

History of Rocketry and Astronautics

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the International Academy of Astronautics**

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Å. Ingemar Skoog, Volume Editor

Rick W. Sturdevant, Series Editor

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Chapter 1

The Silent Revolution: How R. H. Goddard Helped Start the Space Age^{*}

Frank H. Winter[†]

Introduction

Robert H. Goddard is named in a wide variety of sources as the “Father of American Rocketry” or the “Father of Modern Rocketry.”¹ This is because of his practical experiments in rocketry, beginning in 1915 and lasting, almost without interruption, until his death in 1945 (Figure 1–1). He is especially renowned for building and launching, on 16 March 1926, the world’s first liquid fuel rocket. However, the story of Goddard is a complex one and David Cleary, in *Rocket Man—Robert H. Goddard and the Birth of the Space Age* (Hyperion Press, New York, 2003), attempted to correct what he saw as “myths” about Goddard. Cleary argued that Goddard’s secrecy is one of those myths. Cleary and others also have contended that Goddard had no real impact on rocketry. However, this writer maintains that there is ample evidence to show that Goddard was secretive. But the issue of Goddard’s secrecy is not the focus of this chapter, although there are elements of it here. Rather, my focus is on answering the most crucial question about Goddard that is not as well explored or has been, surprisingly, entirely overlooked by many. That is, what was his true role or impact on the history of

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[†] Curator, Rocketry, National Air and Space Museum, Washington, D.C., U.S.A. Currently retired.

spaceflight? In my analysis, I find that Goddard did have an impact internationally as well as nationally in astronautics by planting the seeds of the idea of the space rocket into the public consciousness.



Figure 1–1: Portrait, Robert H. Goddard, ca. 1920s. (Smithsonian photo A620-B).

It is well-known from Goddard’s autobiographical statements that on 19 October 1899 he was first inspired to think about spaceflight at age 17 after reading the serialized version of H. G. Wells’s story *War of the Worlds*, followed by its American sequel, *Edison’s Conquest of Mars* by Garrett P. Serviss, also serialized. Both stories appeared in the newspaper *The Boston Post*. He recalled that not long after, while trimming a cherry tree in his back yard, he experienced a profound daydream in which he envisioned a mechanical device that ascended into space, toward Mars. From then on, he vowed to himself to devote his life toward finding a “method” to make spaceflight possible.²

However, it took more years before he determined that the rocket was the answer. Young Goddard compiled notes on various theoretical possibilities of propulsion. As he became older and more educated, working toward a Ph.D. in physics, Goddard kept more well-thought-out and systematic notes between

January 1906 and August 1912 in his so-called *Journal* followed by his five *Green Notebooks*. These writings were strictly meant for himself—although he dated most of his ideas to establish his priorities for future readers. Save for the barest summaries of certain ideas, none of these notes were published during his lifetime.³

Goddard finally settled on the rocket as the most promising possibility by 31 January 1909, although it was not until 1912 that he began to more fully develop the mathematics involved. This work was largely undertaken from September of that year until September 1913, while serving as a special research fellow at Princeton University. (Goddard had already received his Ph.D. *cum laude* in June 1910 from Clark University in his native Worcester, Massachusetts.) From early February 1915, he began experimenting with rockets, starting with solid fuel types, by determining the efficiency of standard black powder “Coston signal rockets” (named after the inventor, Benjamin Franklin Coston). He soon switched to smokeless powder rockets of his own design. He then developed what he called a “multi-charge” rocket in which individual charges of smokeless powder propellant were automatically fed into the combustion chamber where they burned until the next successive charge was fed. At first, Goddard undertook his experiments funded from his own salary as a physics instructor and later professor at Clark University. Then, from January 1917, his experiments were financed by a \$5,000 grant from the Smithsonian Institution in Washington, D.C.⁴

The Tsiolkovsky Claim

In the meantime, totally unknown to Goddard, about 8,000 miles (12,875 kilometers) away in Kaluga, Russia, a partly deaf school teacher named Konstantin Tsiolkovsky had arrived at his own theories on the attainability of spaceflight by means of the rocket. Moreover, Tsiolkovsky had already published his preliminary findings, as “Issledovanie mirov prostranstv reaktivnymi priborami” (“The Exploration of Universal Space by Means of Reactive [rocket] Propelled Devices”) in the popular scientific journal *Nauchnoe Obozrieniye* (*Scientific Review*) in May 1903. There is no known evidence this journal was then available in the United States, nor in any other country outside Russia. The original version of this article was written in 1895. There was also the manuscript dated 1883, titled “Free Space,” that has been regarded by some Russian historians of spaceflight to have been the first time Tsiolkovsky “definitely calls his spaceship a rocket.” A closer reading of it shows he does not specifically cite the rocket but does suggest reactive propulsion. Nonetheless, this work and Tsiolkovsky’s other space-oriented nonfiction, in addition to fictional works, do not appear to have

been circulated outside Russia during this period (from the 1880s to the early 1900s).⁵

Tsiolkovsky never experimented with rockets as Goddard did later, but like Goddard, was single-mindedly devoted to the cause of spaceflight and continued to produce a steady stream of publications expanding his concepts until his death in 1935. Throughout his life, he faced a constant hardship financially and paid for the limited printings of several of his later tracts out of his own pocket. Thus, his works on the theory of spaceflight were at first little known even in his own country and it was only from the mid-1920s that his fame began to spread. Then from the earliest days of the Space Age, following the launch of *Sputnik 1* in 1957, Tsiolkovsky's compatriots hailed him as the "Father of Cosmonautics" (i.e. spaceflight).⁶

Recently [in 2003], Tanja Jeltnina, one of the leading authorities on Tsiolkovsky, presented the International Astronautical Federation paper "Dissemination of Information on K. E. Tsiolkovsky's Scientific Works on Astronautics in the West (up to the mid-1930s)." In her treatment of the spread of Tsiolkovsky's works in the United States, Jeltnina claimed that Tsiolkovsky's expanded 1911–1912 version of his article "Investigation . . ." [also given as, "Exploration of Universal Space by Reactive Propelled Devices"] "was mentioned in the bibliography of the Smithsonian Institution published in 1921 and that meant that it was available to all American readers." However, with all due respect to my worthy colleague, the latter statement has been characterized by Harold M. Leich, Russian area specialist, European Division, Library of Congress, as "exaggerated." This characterization is explained below.⁷

The Smithsonian bibliography is identified as the *Bibliography of Aeronautics 1909–1916* ([U.S.] Government Printing Office: Washington, [D.C.], 1921). Paul Brockett, Assistant librarian of the Smithsonian Institution from 1914 to 1925, compiled this work, otherwise simply known as "Brockett's," for the National Advisory Committee for Aeronautics (the NACA, predecessor of the National Aeronautics and Space Administration, or NASA). The "mention" of Tsiolkovsky is identified as the bibliographic citation of the multipart article "Issledovanie..." ("Exploration of Universal Space by Reaction Propelled Devices") published in the Russian aviation journal *Viestnik Vozdu-khoplavanii* (*News of Aeronautics*) (St. Petersburg), starting with issue No. 19 for October 1911 and ending with issue No. 9 in 1912.⁸

Further research determined that Brockett's *Bibliography* has a long and complicated history beginning in 1866 with the start of the move of the Smithsonian's library to the Congressional Library (i.e. Library of Congress). The Smithsonian also obtained a separate Langley Aeronautical Collection formed

later and named for the Institution's third Secretary and aviation pioneer Samuel P. Langley. Brockett largely used the Langley portion of the collection to compile his *Bibliography of Aeronautics* for the NACA (i.e. the Smithsonian, in its interest in promoting aviation, was supporting the NACA's bibliographic project that had started in 1915.) Still further research at the Library of Congress produced the *Viestnik Vozdu-khoplavanii*, No. 19 for 1911 and the succeeding numbers and proved revealing.⁹

In the first instance, the volumes were originally housed, not in the Library of Congress, but in the Smithsonian Institution Library as part of the Langley Aeronautical Library (i.e. Collection). Secondly, a date stamp on the lower right-hand corner of issue No. 19 shows that the Smithsonian not only received the issue (on 17 January 1912) not long after it was published in Russia, the Smithsonian also subscribed to the journal. Also, according to the later *Union List of Serials in Libraries of the United States and Canada*, the Smithsonian was the *only* known or documented subscriber in the United States. Furthermore, it was not until the early 1930s that the journal was catalogued with a Library of Congress number. In sum, apparently the earliest known appearance in the United States of Tsiolkovsky's writings on the rocket for spaceflight were the 1911–1912 articles, although they were only available in the Smithsonian Library in Washington. According to Leich, we can only speculate as to how many people had real access to the journal, or knew of it in Washington, even though Brockett's *Bibliography* was available to NACA and presumably all its centers. There was also the language problem, which was probably more severe than in our own times (i.e. far fewer people were conversant in written Russian in those times than today.). In fact, the citation in Brockett is only found in Cyrillic and under Tsiolkovsky's name; it is not cross-referenced subjectively under the subject "Rockets." (The term "astronautics" simply did not exist then, neither did "space travel" nor "spaceflight." Therefore, there were no such headings.) Leich could only conclude that most likely "very few people" knew of this article at the time, much less able to read it. Moreover, it is clear that Tsiolkovsky's original article, "The Exploration of Universal Space with Reaction-Propelled Devices" published in *Nauchnoe Obozriene* in May 1903 was then not available at all in the United States. In sum, Tsiolkovsky's contributions to the astronautics literature were virtually obscure and inaccessible to wider U.S. readership during this early period, contrary to what is stated by Jelkina. Further evidence is presented below that Tsiolkovsky's name as a spaceflight pioneer was not introduced to the West until the mid-1920s and had even been neglected in his own country.¹⁰

Release of Goddard's *Method of Reaching Extreme Altitudes*

After Tsiolkovsky's 1903 article, Goddard's *A Method of Reaching Extreme Altitudes* (Figure 1–2) is widely regarded as the second seminal work in the history of the founding of astronautics. *A Method* appeared as the *Smithsonian Miscellaneous Collections*, Vol. 71, No. 2, with the publication date of 1919 but was released to the public on 11 January 1920. Altogether, 1,750 copies were published.¹¹

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 71, NUMBER 2

A METHOD OF REACHING EXTREME ALTITUDES

(WITH 10 PLATES)

BY
ROBERT H. GODDARD
Clark College, Worcester, Mass.



(PUBLICATION 2540)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
1919

Figure 1–2: Cover, Goddard's treatise, *A Method of Reaching Extreme Altitudes*, published in 1919 by the Smithsonian Institution but released on 12 January 1920. (Smithsonian photo A4135-A).

On the day of its release, the Smithsonian issued, for then, a startling press announcement. Although the original has not been found, all the major U.S. newspapers sensationalized it across the country. Typically, the *Boston Herald* proclaimed in bold headlines on its front page for 12 January that a: “NEW ROCKET DEVISED BY PROF. GODDARD MAY HIT FACE OF THE MOON.” This news was then startling for two reasons. The first was the notion of going into space at a time when, just six months earlier, during 14–15 June 1919, the flight of Britain’s Captain John Alcock and Lieutenant Arthur Whitten Brown—the world’s first non-stop flight across the Atlantic Ocean—in their modified Vickers Vimy biplane bomber at an average speed of 118 miles per hour (190 kilometers per hour) for almost 16 hours was considered a major milestone in aviation. Secondly, the average person only knew the rocket as the simplest kind of firework that could be fired up to just a few hundred meters or feet. “Announcement,” the paper reported,

was authorized by the Smithsonian Institution tonight [11 January] that Prof. . . . Goddard of Clark University had invented and tested a new type of multiple-charge, high-efficiency rocket of entirely new design for exploring the unknown regions of the upper air . . . It will . . . be possible to send it to the highest layers of the air, including those beyond the Earth’s atmosphere . . . possibly . . . so far as the Moon . . . The highest level so far reached with recording instruments is 19 miles [30.5 kilometers] out, accomplished with a free balloon.¹²

The article went on to describe the rocket and its reloading mechanism and how Goddard had raised the efficiency of the rocket to 64 percent compared with two percent with the ordinary ship (i.e. Coston type gunpowder-propelled signal) rocket. Goddard’s rocket promised to be invaluable for studying the chemical composition, temperature, electrical nature, density, and ozone content of the upper atmosphere. Yet the newspapers chose to emphasize only what had been intended by Goddard as a strictly hypothetical exercise in his *Method*—to mathematically demonstrate the possibilities of a multistage robotic rocket that might reach the Moon. But Goddard went further and described how the rocket’s impact on the surface of the dark side of the Moon could be signaled back to Earth with the explosion of “a sufficient amount of the most brilliant flash powder observed by a ‘powerful telescope.’” (He detailed his experiments to test the exact amount of Victor flash powder that would be necessary to be either “just visible” or “strikingly visible” from Earth.) Far more significant than this, and not mentioned in the newspapers, nor perhaps in the Smithsonian press release, was that for the first time in history Goddard had experimentally proven that the rocket could work in vacuum. The significance was that the rocket was able to

operate in the vacuum of space and with further technical development could be made powerful enough to escape Earth's gravitational pull.¹³

As attested by the scrapbooks of Goddard (held in the Goddard Library at Clark University and microfilm copies in the Library of Congress) the "Moon rocket" story lingered for many months and became a popular cultural phenomenon and generated editorials, cartoons, comic strips, and poems, besides articles both in the United States and abroad. Radio was then in its infancy but there were films featuring the "new" idea of the space rocket, as discussed below.¹⁴

The newspaper editorials offer interesting gauges as to the spectrum of public reaction in the United States on the now brand new novelty of the space rocket (Figure 1–3). The most famous of these appeared in *The New York Times* of 13 January 1920 in which the writer took Goddard to task for several perceived errors. Titled "A Severe Strain on Credulity," the editorial judged Goddard's multiple-charge rocket as "practicable, and . . . promising. . . ." Such a rocket "might carry self-recording instruments . . . and parachutes would bring them safely to the ground."¹⁵

The editorial writer then struck his most serious criticism. ". . . Professor Goddard . . ." chided the writer sarcastically, ". . . does not know the relation of action to reaction, and of the need to have something better than a vacuum against which to react . . .". "Of course," the editor continued, "Goddard only seems to lack the knowledge ladled out daily in high schools." Goddard was thus accused of ignorance of what every schoolboy then knew—the rocket can fly because it needs air to "push against." Given this logic, the rocket cannot work in space. Today, the "air-pushing theory" is outmoded. But up to Goddard's day, the notion that air was needed for the rocket to "push against" was well entrenched. For centuries there were actually two basic schools of thought on why the rocket moves. One was the "air-pushing school." The other held that the exhaust gases produce a forward momentum. The latter was closer to the correct explanation of reaction propulsion as expressed by Sir Isaac Newton's Third Law of Motion in his *Principia* of 1687 in which he states: "For every action there is an opposite and equal reaction." Yet Newton never explained that the rocket was an example of this principle. Perhaps for this reason, its application to the rocket was missed down the centuries. But by far, the air-pushing explanation was the most widely accepted theory held by generations of professional rocket makers and lay people alike.¹⁶



Figure 1-3: Montage of typical headlines as a result of the appearance of Goddard's treatise. (Photo, author's collection).

A few days after the criticism of Goddard by the country's leading newspaper, on 16 January, he received support from an unexpected quarter. On the

same editorial page, the *Times* published a letter from Rear Admiral William S. Sims of the Naval War College, Newport, Rhode Island. The admiral wrote that back in his Naval Academy class of 1880, the physics instructor included in one of his examinations the questions: "Will a rocket ascend in [a] vacuum? If so, why? If not, why not?" The instructor, Sims explained, demonstrated the correct principle with a basic experiment using a large water bottle suspended in a horizontal position from the ceiling. On the removal of the cork, the bottle recoiled several inches. This, said Sims, was the same as the recoil of a gun and why a rocket would ascend in a vacuum. Therefore, the editorial article "A Severe Strain on Credulity" was "in error."¹⁷

But the newspaper had to have the last word—or so they thought. On the following day, a shorter editorial appeared, titled "A Conclusion Reached Too Soon." The *Times* again lapsed into sarcasm: "These critics" (like Sims) "won't be content to let the matter go . . . but even the most confident of them will have to admit that a vacuum is not a very good thing for an explosive, or anything else to push against—not, that is, if what one wants is 'reaction'." Almost 50 years later, on 17 July 1969, the *Times* issued "A Correction." It concluded: "Further investigation and experimentation have confirmed the findings of . . . Newton . . . it is now definitely established that a rocket can function in a vacuum as well as in the atmosphere. The *Times* regrets the error." The same issue reported that *Apollo 11* was then heading toward humankind's first landing on the Moon.¹⁸

Back in 1920, Admiral Sims was not the only one who came to Goddard's defense. Garrett P. Serviss also had something to say about rockets working in a vacuum. (It will be remembered that Serviss's serialized story *Edison's Conquest of Mars* helped play a role in setting Goddard on his lifelong course to solve the problem of spaceflight.) In 1920, besides works on fiction, he had authored popular books on astronomy and was a respected syndicated science journalist for the *New York Journal*. He was thus in an ideal position to help correct fallacies about Goddard's rockets. The most common one was whether Goddard's rocket could work in space, that is, whether it would work in a vacuum. Serviss's correct response was carried in the *New York Journal* and in the *New York News*, *Chicago American*, *Boston American*, *Journal* (Dayton, Ohio), *Worcester Post*, and others. Besides this, Serviss was a strong advocate of Goddard's concepts. Goddard's suggestion of reaching the Moon, he wrote in the *New York Evening Journal* for 22 January, "cannot fail to excite the liveliest interest." Serviss thus helped spread the word. There is no evidence the two ever met, but there was some correspondence.¹⁹

However, there remained critical editorials. S. O. Young, writing in the *Chronicle* of Houston, Texas, concluded that the impact of Goddard's rocket on

the Moon “would generate enough heat to vaporize everything connected with the rocket.”²⁰

The *Ledger Dispatch* of Norfolk, Virginia, headed its editorial “Science Goes Too Far” and said that if Einstein’s theory of relativity was right, “. . . things are not really straight, not even light . . .” Therefore, “. . . Goddard thinks he is at the end of that true straight line—but he isn’t.” The Goddard rocket would thus fall “without regard for the frailty of human relativity.” One of the harsher criticisms, simply titled “Futility,” appeared in the *Herald* of Yonkers, New York. The results, it said, would be futile and “altogether devoid of benefit to the human race.”²¹

An otherwise positive editorial in the *Seattle Post Intelligencer* for 19 January observed: “There is a complexity of motion which makes the Moon’s disc an elusive target . . . and . . . will require rather fine shooting to hit a globe 238,000 miles away . . .”²²

On balance, it appears most of the press treatment on Goddard’s alleged Moon rocket was favorable. Other journalists exploited the Goddard story for political or other messages.

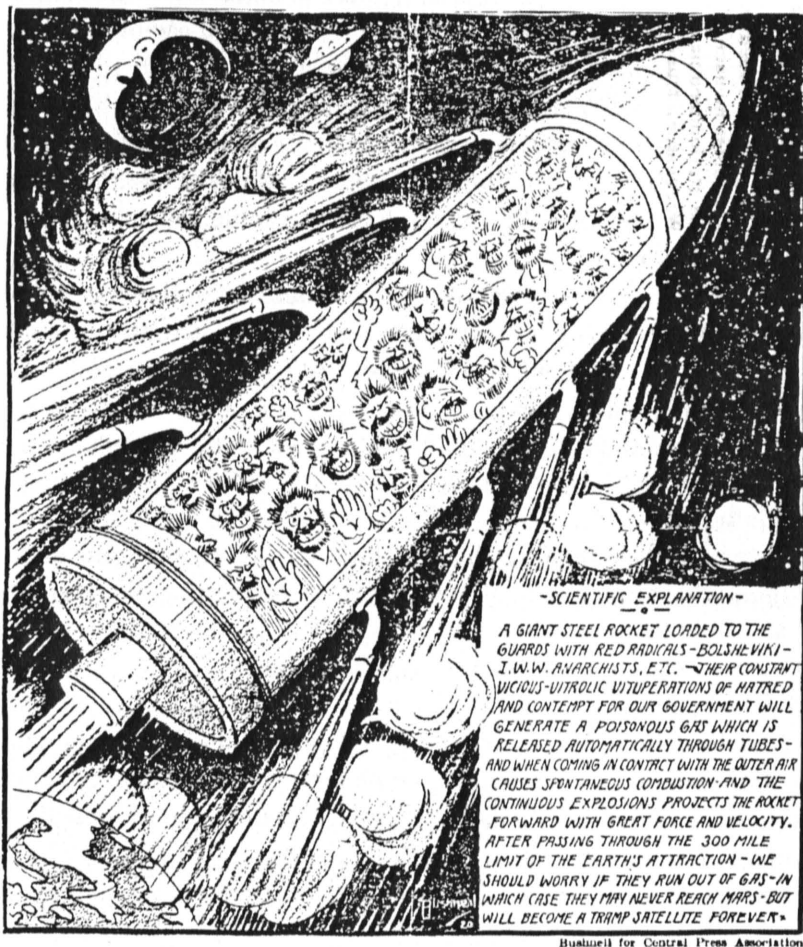
The *Seattle Post Intelligencer* declared that: “The Goddard rocket may bring to the Earth information concerning these stupendous altitudes which will upset all scientific theories . . .”²³

The *Philadelphia Press* for 13 January remarked: “. . . as the rocket is not expected to carry passengers . . . Perhaps, however, it can take to the Moon one of President [Woodrow] Wilson’s urgent invitations [for the U.S.] to come into the League of Nations . . . We do not know how the men in the Moon stand on this subject but we suppose everybody ought to come into the League.”²⁴

Some of the cartoons also had a more pointed political bent. Those in the *New York Evening Journal*, the *Philadelphia Inquirer*, and the Oakland, California, *Tribune*, for instance, depicted Goddard’s rocket taking up the unwanted Reds (i.e. Communists) to the Moon (Figure 1–4); while the *Tribune* added the Kaiser, U.S. radicals, a “few U.S. senators,” and other undesirables as passengers for the rocket.²⁵

The Mars Furor Aspect and the First “Volunteers”

From a 21st century perspective, and with years of explorations of Mars by robotic space probes taken place, it is difficult to imagine the enormous power the “Mars Furor” held on the general public and the astronomical community back in 1920. Indeed, it was still widely held, based on the perceived Martian “canals” as seen by faint lines, that in all probability, life did exist on the planet. Any numbers of schemes were devised to “communicate” with the Martians.



Why not deport our undesirable aliens to Mars—or somewhere—in a giant rocket?

The rocket idea is alright if it can be aimed so that it will get an orbit, for if there's anything your bolshevik likes it is to go round and round in circles.

Figure 1-4: Typical cartoon featuring an allusion of Goddard's alleged Moon rocket. This one has a political message—to use the rocket to send all political “undesirables” to the Moon. From an unknown New York City newspaper, May 1920. (From the author's collection).

Goddard himself was very much a product of the Mars Furor. He had devoted his life to spaceflight, and ultimately to rocketry, as a direct result of his reading the Martian stories by Wells and Serviss in 1898–1899. The Mars Furor figured prominently too in the public reaction to the release of *A Method*. In many of the newspaper and magazine stories on Goddard's Moon rocket, possible voyages to Mars were frequently mentioned in the same context. The *Boston Herald* in its editorial of 18 January, titled "Shooting the Moon," also noted that the "existence of the Martians has been insisted on," but "nobody has yet ventured to say that there are lunarians [i.e. intelligent extraterrestrial life] on the Moon."²⁶

Given the intensity of the Mars Furor, especially because 1920 was a year of close opposition to the Red Planet, it was perhaps inevitable that the sensationalistic stories on Goddard also brought forth its first "volunteer" to go up in the rocket—not the Moon, but to Mars. *The New York Times* of 5 February proclaimed on page one: "First Volunteer For Leap To Mars." The newspaper reprinted, in full, a letter to the editor from Captain Claude R. Collins, New York City Air Police. "Believing the plans of a noted scientist [Goddard] to send a super-rocket from the Earth to Mars," Collins wrote, and "... to aid science ..." he volunteered "to attempt this inter-planet [*sic*] leap and offer to do so gratis ..."²⁷

Collins contended his proposal was written "in full seriousness." Further, he was not making the offer "for monetary gains" but there were stipulations. Among them were that he help plan the construction of the rocket; a "board of ten prominent scientists ... agree to the practicability of the completed rocket"; an insurance policy of \$10,000 be taken out for him; and that he was to make a speech-making "tour of the nation" before the trip.²⁸

Today, this story would be judged as naïve, outrageous, and ludicrous. In Goddard's day, it was regarded seriously. The *Times* was compelled to follow it with an editorial titled "The Leap to the Planet Mars. Is the Great Risk Necessary?" "American aeronautics is certainly in need of stimulation," said the editor sharply, "but does any enthusiast have to go as far as Mars to put America in the van of progress ..."²⁹

The Collins story generated its own share of publicity, along with distortions. According to the *Herald Courier* of Bristol, Virginia, for instance, it was "difficult to say just how he would manage the return trip."³⁰

Ludicrous as they were, these kinds of stories intensified the publicity about Goddard and led to yet more "volunteers." Four days after Collins declared his offer, came an announcement in the *Times* from four more volunteers for Mars "via Professor Goddard's super rocket." They "would impose no conditions." In late March, an offer came from Miss Ruth Phillips of Kansas City,

Missouri, as the first woman volunteer. Captain Charles N. Fitzgerald, also of the New York Air Police, and a “famous . . . daredevil,” likewise volunteered but specified the Moon rather than Mars. By early April, nine had volunteered to go to the Moon (or Mars). By late September 1921, the number had jumped to 20. In all, according to Goddard’s authorized biographer, there were more than 100 volunteers throughout the years. He received such requests as late as 1939.³¹

Goddard’s Reactions

I contend that Goddard was wholly surprised at the unexpected publicity swirl created by the release of *A Method* and that he likely thought that the publication would reach only a small, scholarly audience, not the general public. At the same time, he was so driven by the idea of spaceflight and wished to be as thorough as possible that he compulsively added his “Moon rocket” mathematical exercise. The title of the publication itself was bland and said nothing about spaceflight: *A Method of Reaching Extreme Altitudes* and was really only meant to report on his work thus far toward the development of an upper atmospheric sounding rocket. But now, Goddard was constantly badgered by reporters and he was compelled to say something, if only to correct the gross misinterpretations. He was not averse to delivering public lectures on the rocket. In those talks, and from his own perspective, he could control the level of talk on the rocket and perhaps enlighten his audience, yet refrained from providing too many details. But he was clearly more uncomfortable in speaking with individual reporters compared with students or fellow academics.³²

In sum, said Goddard on 18 January in a signed statement to the press, “Since the announcement by the Smithsonian Institution . . . I have been interviewed a number of times, and on each occasion [I] have been as uncommunicative as possible. The result has consequently been a number of published articles that were not all that could be desired . . . In the first place[,] too much attention has been concentrated on the proposed flash powder experiment, and too little on the exploration of the atmosphere.” But Goddard also shrewdly saw the publicity as a possible way to increase his funding for his experiments and proposed “the raising of from \$50,000 to \$100,000 by popular subscription, to be used . . . in preparing for . . . a preliminary exploration of the atmosphere.” The *Boston Advertiser*, *Philadelphia Record*, and other newspapers eagerly picked up the additional story, but no money was generated from this or subsequent financial appeals.³³

As for the volunteers, Goddard had never mentioned “manned” spaceflight at all in *A Method*. Moreover, his alleged “Moon rocket” was to be propelled by a

solid (smokeless powder), not liquid fuels as given in Tsiolkovsky's works. (Goddard certainly knew of the higher energy content of liquid propellants but very briefly mentioned this in his *A Method* and had never alluded to them in his public writings or pronouncements thus far.) In any case, he characterized the volunteers as more the "adventurous type" rather than "scientific men." They showed, he added, "either ignorance of the conditions they would have to contend with . . . or entire indifference . . . concern[ing] their return to Earth." "The first man who goes to the Moon will have to be an iron man [i.e. a robot]," he also said, since ". . . the construction of these volunteer men was human and therefore too fragile to be acceptable."³⁴

As an interesting contrast, in a talk before the scientific community, as at the Annual Meeting of the National Academy of Sciences, in Washington, held during 26–28 April 1920, Goddard did not discuss humans in space or even the "Moon rocket." Instead, he spoke on "The Possibility of the Rocket in Weather Forecasting." Later, in September, he told a reporter, "The model I plan trying out within a month will weigh not more than six pounds [2.7 kilograms] . . . I could get along a whole lot faster if there was less volunteering and more real support." Then in January, a little more than a year after the release of *A Method*, one newspaper boldly summarized his attitude at this point: "'Moon Rocket' Inventor Deplores Publicity."³⁵

Earliest Known Attempts at Commercialization of the Space Rocket

Among the deluge of mail received by Goddard on his "Moon rocket" were other bizarre requests. Back on 12 January 1920, came an appeal from Bronx Exposition, Incorporated, to use the Starlight Amusement Park at East 177th Street in the Bronx as the "starting point" for the rocket as it was a place where "the greatest number of people could have the opportunity to observe its departure . . ." This represents one of history's first attempts to commercialize the space rocket. The following day came a telegram from the Mary Pickford Studio in Los Angeles: "Would be grateful for opportunity to send message to Moon from Mary Pickford [the famous movie actress] on your torpedo rocket when it starts. Please wire me collect." In April, an ad manager asked Goddard for advertising space on his rocket. In Worcester, the Manager of Massachusetts Motors wrote a strange letter to Goddard's father, Nahum D. Goddard (perhaps by mistake), declaring that: "We are all much interested in that big rocket that is now being built in Worcester to shoot to the Moon . . . That all who are wise are Moon struck . . . We have a sample of the New Moon on our floor, not made of green cheese, but of the best grade of material . . ." Apparently, the manager at-

tempted to sell the senior (or junior) Goddard a new Moon automobile. Clearly, the manager attempted to capitalize on the brand name of the car.³⁶

Magazine Articles

Apart from papers, magazines readily picked up coverage of Goddard's rocket. A cursory survey of *Poole's Index to Periodical Literature* and the *Readers Guide to Periodical Literature* shows that barely a handful of English language articles were written on the rocket from the 19th century and up to 1920. These were either on Congreve type gunpowder war rockets of the 19th century or signal rockets. There are also a couple of articles on Alfred Maul's gunpowder photo rockets, intended for military reconnaissance developed from the 1900s to circa 1915. By contrast, the appearance of *A Method* in 1920 precipitated a steady stream of articles on space rockets and spaceflight from this time. Most were popular pieces. But the *Scientific American* article went into some detail about the phenomena in the upper atmosphere that might be explored. More importantly, it also recognized the significance of Goddard's *in vacuo* experiments. Goddard, it was observed, "confirms what some . . . of us have always suspected . . . [about the rocket being able to operate in a vacuum]."³⁷

Other articles appeared in the *Electrical Experimenter*, *The Monthly Evening Sky Map*, the *Literary Digest*, *Leslie's Weekly*, *Illustrated World*, *The Independent*, and *Popular Science Monthly*. The *Monthly Weather* and *Proceedings of the National Academy of Sciences* only carried pieces on his suggestions of a rocket for weather forecasting. Goddard's own article, "The Rocket Method," appeared in *The Journal of the Worcester Polytechnic Institute* (Worcester, Mass.) as well as his "That Moon Rocket Proposition," in *Scientific American* for 26 February 1921. In both cases he again corrected what he called "popular fallacies." There probably were other U.S. magazine articles.³⁸

International Reaction—The Newspapers

Hitherto, no analysis has been made on the international reaction to the release of Goddard's *A Method*. Hence, the writer conducted a systematic search through all the available foreign newspapers in the Library of Congress for the period of 12–25 January 1920. However, some countries probably picked up the stories much later and were thus missed in the search. There are also gaps in the newspaper collection. But despite such shortcomings, the search did yield results.

The countries that published Goddard stories are as follows: Australia—*Sydney Morning Herald*; Canada—*Daily Colonist* (Victoria, B.C.), *The Gazette* (Montreal), *Montreal Star*, *The Globe* (Toronto), *Halifax Herald* (Halifax, N.S.), and the *Ottawa Citizen*; England—*The Times* (London), *London Daily Mail*, *Leicester Post* (Leicester); France—*Chicago Tribune–Europe Edition* (Paris), *Le Petit Journal* (Paris), and the *New York Herald Tribune–International Edition* (Paris); Netherlands—*Nieuw Amsterdamsche Courant* (Amsterdam); New Zealand—*The Evening Post* (Wellington); South Africa—*Rand Daily Mail* (Johannesburg); and Spain—*El Sol* (Madrid). (Since this paper was written, Goddard Moon rocket stories have also been found in three Czech newspapers of the period.)

Apart from the above, Italy, Germany, Austria, and Russia may be added. Within the Goddard scrapbook is a lengthy article titled “Nel mondo della lune—In America si parla di un viaggio nel nostro satellite” (“In the World of the Moon—In America They Speak of a Voyage to Our Satellite”), appearing in the newspaper *Courriere d'Italia* for 13 June 1920. The city of publication is unknown, although it appears to be Rome. The writer of the article, Pio Emanuelli, had sent a copy to Goddard. Apparently, this same man, from the Vatican Observatory, wrote to Goddard on 25 February 1921 that “Some months ago, the Italian newspapers spoke about some experiments made by you with the aim of sending a rocket to the surface of the Moon . . . Now, the Italian newspapers (e.g. *Epoca*) announce that next summer, the rocket will be sent to the Moon . . . Please tell me what truth there is about this statement . . .”³⁹

In Germany, as mentioned in many histories of rocketry and spaceflight, Oberth in his letter of introduction to Goddard of 3 May 1922 had “. . . learned by the newspaper, that I am not alone in my inquiries [about space travel] . . .” In Austria, the weekly newspaper *Wiener Bilder* (Vienna) of 8 February 1920 repeated, almost verbatim, the Smithsonian press release on *A Method*. (The author of the present chapter is indebted to Bruno Besser of Graz, Austria, for this find). As for Russia, Asif Siddiqi found a mention of Goddard’s name in the short piece, “Novosti nauki i tekhniki: neuzheli ne utopiia? (“Is Utopia Really Possible?) in *Izvestia* (Moscow) for 2 October 1923. However, this is a brief review of Oberth’s *Die Rakete*, published in the spring of that year.⁴⁰

Judging from the later letters Goddard received from overseas from volunteers wishing to ride in his alleged Moon rocket, it appears that news of *A Method* reached several more countries via newspapers, but at later periods than the 12–25 January time frame searched.⁴¹

It was understandable that Canada, being the closest English language-speaking country to the United States should have the most press coverage of the

Goddard story out of all the other non-U.S. papers searched so far. Most of the treatments were positive, although the *Ottawa Citizen* for 20 January reported that Dr. Otto J. Klotz, Director of the Dominion Observatory “indicated that the idea was so foolish as not to be worthy of serious discussion.”⁴²

The Times, of London, published a straightforward report of the release of Goddard’s treatise, but other papers, like the *London Daily Mail*, tended toward more sensationalism. The *Daily Mail* also quoted a member of the respected old firework firm of James Pain and Sons: “The biggest rocket I have ever heard of weighs 11 lbs [5 kilograms] and can rise to 3,000 feet [915 meters]. It would be possible to make one to go a little higher, but to the Moon—!” (As for the Czech articles, these are in the *Národní Politika* (Prague), afternoon issue, for 29 Jan. 1920; the *Československa Republika* (Prague), for 15 April 1920; and the *Lidové Noviny* (Prague), for 7 July 1920.)⁴³

The Esnault-Pelterie Claim

In France, the most outspoken response to the news of the Goddard rocket came from Robert Esnault-Pelterie, also known as REP. Both French and an English translation of his remarks appeared in the European (Paris) edition of the *New York Herald Tribune*. REP, as mentioned, was another of the great early founders of astronautics. Technically speaking, he preceded Goddard in the public presentation of his theories on the possibility of spaceflight by means of rocket propulsion. It is claimed he had delivered his first lecture on this subject in St. Petersburg, Russia, in February 1912, although this still needs corroboration. For certain, he delivered a lecture on this topic before the Société Française de Physique in Paris on 15 November of that year, and then published it in condensed form in the *Journal de Physique* (Paris), Series 5, Vol. 3, for March 1913. But ironically, like Goddard, REP similarly disguised his own work with a bland title so as not to shock his readers with the then outlandish subject of spaceflight. He called it, “Consideration sur les résultats del’allégement indéfini des moteurs” (“Considerations Concerning the Results of the Indefinite Lightening of Motors”).⁴⁴

“Go to the Moon . . . it is not so new . . .” REP declared in the *Tribune* and cited his own 1913 scientific paper on the topic. He also doubted the “American professor” had found a sufficiently powerful “gas” (i.e. propellant) to reach the enormous speed necessary to escape velocity and was skeptical about the rocket surviving these speeds. “The whole [Goddard] story,” he concluded, “is therefore a joke—a Moon hoax!”⁴⁵

REP wrote to Goddard on 31 March, and was far more respectful. Their mutual correspondence continued for 16 years and remained collegial. However, the two never met although had intended to do so. Goddard later explained that REP initially believed that “no chemical energy was sufficient and that radioactive energy would be needed for a solution to the problem.” Then, “I sent him a copy of the Smithsonian publication [*A Method*], and . . . explained the multiple-rocket principle, by which empty casings were discarded, thereby maintain a large, and sensibly constant, ratio of propellant to casing or rocket proper.” Goddard should have added that *A Method*, backed up by experimental results, also introduced the de Laval nozzle as applied to the rocket to REP. Goddard’s *A Method* may thus be credited with contributing toward the development of REP’s own concepts of spaceflight. REP, added Goddard, (later) wrote “a book much along the lines of my 1919 publication.” This was his *L’Astronautique (Astronautics)* (1930, with revisions up to 1935). In fact, it was through the REP–Hirsch Astronautical Prize, founded in 1928 by REP and his friend André-Louis Hirsch, that the word “astronautics” was created.⁴⁶

In a more subtle sense, it may be said that through REP’s subsequent works, the impact of *A Method* was extended much further than when it appeared in 1920.⁴⁷

The remainder of the Goddard articles found so far in non-U.S. newspapers—in Australia, Holland, New Zealand, South Africa, and Spain—presented straightforward accounts. Undoubtedly there was further Goddard newspaper coverage that has not yet been discovered and examined.⁴⁸

International Reaction—Magazines

As with U.S. magazines, it did not take too long for overseas magazines to seize on the Goddard Moon rocket story. Among these were the *Bulletin de la Société Astronomique de France*, *Je Sais Tout* (Paris), *Nature* (London), *Flight* (London), *La Nature* (Paris), and *The Graphic* (London). There was also mention in the academic journal *Physikalische Berichte* (Braunschweig, Germany). (I am likewise indebted to Bruno Besser for this find.)⁴⁹

Additional notices on Goddard’s alleged Moon rocket also appeared in a later issue of the *Bulletin de la Société Astronomique*. “If the information [on the Moon rocket] is not pure fantasy,” they said, “we are very curious of the results of his experiments.” The *Bulletin de la Société Astronomique* of the Paris Observatory for 1920 also listed *A Method* in its bibliography of recent works of astronomical interest.⁵⁰

The widely circulated French popular magazine *Je Sais Tout* (Paris) for June 1920 was one of the first European publications of this type to feature the Goddard story, although the writer mainly sketched a hypothetical trip for two or three persons to the Moon in the Goddard rocket. The article also contained a number of serious mistakes including printing a photo of the multiple-charge rocket upside down with the nozzle away from Earth!⁵¹

In August, the British popular science journal *Nature* (London) ran Goddard's article, "A Method of Reaching Extreme Altitudes." This was essentially a condensed version of the treatise itself and his article in *Scientific American Monthly* for February 1920 and was obviously meant to broaden the circulation of his basic ideas to an educated European readership.⁵²

But in November, the article "Bombing the Moon by Rocket" by George F. Morrell in *The Graphic* (London) was full of errors and distortions. First, he got off on the wrong footing when he reported that Goddard was undertaking his experiments with a \$50,000 grant. (The actual sum was \$5,000.) Morrell also wrongly believed it was Goddard's plan that after the robotic Moon rocket was successfully fired and set off its flash powder on the dark side of the Moon, Captains Collins and Fitzgerald, along with Ruth Phillips, would ride in a manned version. This phase of "the venture," he thought, would be "an absurdity." The escape velocity itself of more than six miles (9.6 kilometers) per second would cause the rocket to "vanish in an incandescent wisp of flame and smoke" due to extreme friction, he added. For these and other reasons, Morrell was wholly convinced that "... to get to the Moon must be regarded as an absolute impossibility."⁵³

Goddard evidently thought the article outrageous and needed to be answered. The end result was a flurry of more newsprint on the Moon rocket on both sides of the Atlantic. This included a cartoon or two and a couple of follow-up pieces in *The Graphic* and Goddard's article in *Scientific American* for 26 February 1921, "That Moon Rocket Proposition—Refutation of Some Popular Fallacies." In the end, neither Goddard nor Morrell altered their basic positions with the exception of the latter, who thought it practicable to explore the upper atmosphere but reaching the Moon was still impossible. "However," he admired "... the patience, courage and ingenuity of Professor Goddard in tackling so stupendous a venture..."⁵⁴

In the meantime, on 1 December 1920, the *Physikalische Berichte* (*Physics Report*) (Braunschweig) presented a brief abstract of Goddard's article "A Method of Reaching Extreme Altitudes" that had appeared in the August issue of the British science magazine *Nature*. This was perhaps the first mention of Goddard and the space rocket concept in a German magazine.⁵⁵

In May 1921, another European magazine published an article on Goddard's concepts. This was the popular science journal *La Nature* (Paris) that included an analysis of Goddard's first two rocket patents, U.S. Patent No. 1,102,653 of 7 July 1914 for "Rocket Apparatus," and U.S. Patent No. 1,103,503 of 14 July 1914, also titled "Rocket Apparatus." The publication of these patents, along with a summation of *A Method*, was a significant milestone as it provided the public—albeit the scientifically minded, French-reading public—the first overall picture of Goddard's developments thus far. The patents were especially important in establishing Goddard's concepts of the multistage rocket (potentially for spaceflight) and the use of the de Laval nozzle for achieving maximum efficiency of the rocket. Additionally, one of the patents covered the use of a gyroscope for achieving stability. However, it is difficult to judge the circulation of this journal in the early 1920s.⁵⁶

Finally, in the January 1922 issue of another popular science magazine, *La Science et la Vie*, was the article "De la Terre à la Lune: l' 'Obus-fusée' du docteur Américain Goddard" ("From the Earth to the Moon: The 'Shell Rocket' of the American Doctor Goddard"). Here, the most significant feature was not the text of the article, which was a largely inaccurate analogy to Verne's space novels, but the front cover picture of the supposed Moon rocket (Figure 1–5). In actuality, the rocket came directly from the film *All Aboard for the Moon*. On closer inspection, *All Aboard for the Moon* was another spin-off from the release of *A Method*.⁵⁷

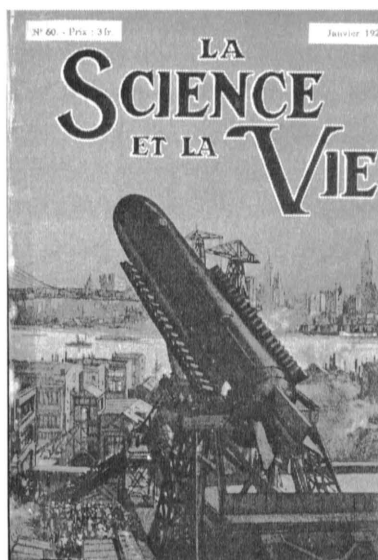


Figure 1–5: Cover of the French popular science magazine, *Science et Vie*, for February 1922, showing a scene from the movie *All Aboard for the Moon*, perhaps the earliest film featuring a space rocket. (Photo, courtesy, *Science et Vie*).

The Film Connection and Goddard

Georges Méliès's *Voyage dans la Lune* (*A Trip to the Moon*) (1902) is usually regarded as the first "space film," or more correctly, the first film depicting spaceflight. Based on the Jules Verne novel by the same title, *Voyage* depicts a giant cannon sending a group of travelers to the Moon. Surprisingly, there were many more early space films following the Méliès classic. A survey of these movies was conducted by the author over several years, primarily in the Division of Motion Pictures in the Library of Congress, and reveals more than 50 titles up to 1920, the year *A Method* was released. Of these, about 40 show some sort of spaceflight.⁵⁸

Typical of the period, all these films were black and white, very short (usually two–three minutes, or, only a few seconds), and very primitive technologically, in story line, and other cinemagraphic elements. (Méliès' *Voyage* was exceptionally long and ran for 21 minutes.) Due to the high nitrate content of the chemical makeup of all early films, the vast majority from the period were totally deteriorated over time, or burned, and only a small fraction are extant. Furthermore, few details were published on these earliest films when they were released. The titles of the "space movies" given here come largely from movie copyright directories, science fiction film histories, and early film magazines found in the Library of Congress.

The first list covers the period 1902–1919 and is in order by methods of propulsion:

1. Giant guns (cannons or mortars)—*Voyage dans la Lune*, Méliès, France, 1902; *A Trip to Mars*, but probably a pirated version of the above, Sigismond Lubin, United States, 1903; *Un Matrimonio Interplanetario*, Italy, 1910.
2. Dreams—*Moonstruck*, Pathé, 1909; *Jones Nightmare*, Pathé, Acme Films, United Kingdom, 1911; *A Windy Dream*, Pathé, United States, 1912; *Smith Visits the Moon*, Gaumont, France, 1914; *Voyage à la Planète Jupiter*, Segundo de Chomon, France, 1907 or 1908; and *Dreamy Dud. He Resolves Not to Smoke*, Bray, United States, 1915 [A dream of smoke taking him to the Moon.]
3. Runaway Train—*Voyage à Travers l'Impossible*, also known as *An Impossible Voyage*, also known as *Whirling the Worlds*, also known as *Voyage across the Impossible*, Méliès, France, 1904.
4. Super fast car—*'Q' Motorist*, R. W. Paul, United Kingdom, 1906.
5. Rope ladder—*A Trip to Jupiter*, Pathé, France, 1907.

6. Wind carries lady with large hat—*Lady Luna(tic's) Hat*, R. W. Paul, United Kingdom, 1908.
7. Hot air balloon—*Man in the Moon*, Gaumont, France, 1909.
8. Floating in inflated dressing gown—*McNab Visits the Comet*, Lux, France, 1910.
9. Anti-gravity (powder, et cetera)—*A Trip to Mars*, Edison, United States, 1910; *First Man in the Moon*, Gaumont, United Kingdom, 1919; *When the Man in the Moon Seeks a Wife*, Clarendon, United Kingdom, 1908.
10. Airplane or propeller-driven—*Les Mysteres du Ciel (The Mysteries of the Sky)*, France, 1912; a color poster, at least, depicts a propeller-driven airplane flying among the planets; however, this poster, produced by a “Consortium des galas cinematographiques,” is all that is known about this film but see list below; *A Trip to the Moon*, Lubin, United States, 1914; *Himmelskibet*, also known as *Heaven Ship*, also known as *Fourteen Million Leagues from Earth*, also known as *A Trip to Mars*, also known as *The Ship of Heaven*, Nordisk, Denmark, 1919, released in the United States in 1920 as *A Trip to Mars*.
11. Floating in giant soap bubble—*Le Voyage Autour d'une Étoile*, also known as *The Voyage around a Star*, Gaston Veile, France, 1906.
12. Airship, dirigible—*Le Dirigible Fantastique*, Méliès, France, 1906; *Claire de Lune Espagnol*, Gaumont, France, 1909; *Exploring Ephraim's Exploit*, Bray, United States, 1915.
13. Propulsion unspecified or unknown—*A Trip to the Sun*, Andrews Pictures, Ltd., United Kingdom, 1904, but film of same title also advertised in 1911 (two different films?); *Viaggio al Centro della Luna*, or *Voyage to the Center of the Moon*, Mario Caserini, Italy, 1905; *Voyage dans la Lune*, possibly another version of Méliès' 1902 film, Pathé, France, 1905; *Rêve a La Lune*, or *Dream of the Moon*, also known as *Amant de la Lune*, or, *The Lover of the Moon*, Pathé, France, 1905; *Il Viaggio di una Stela*, or *The Voyage to a Star*, Cines, Italy, 1906; *Excursion to the Moon*, also known as *Excursion to Moon*, Pathé Freres, France, 1908; *New Voyage to the Moon*, also known as *New Trip to the Moon*, also known as *Voyage dans la Lune*, Pathé, France, 1909; *A Trip to Jupiter*, Pathé, France, 1909; *Voyage dans La Lune*, also known as *Nuevo Viaje a la Luna*, Segundo de Chomon, director, Pathé, France, 1909; *Pa's Trip to Mars*, Cine Arts Productions, United States, 1917; *Professor Wiseguy's Trip to the Moon*, Powers Picture Plays, United States, 1915; *MoToy Comedies—A Trip to the Moon*, Peter Pan Film Corp., United States, 1917; *Happy Hooligan in a Trip to the Moon*, International Film Service Inc., United States, 1917.

The above may now be contrasted to the films on the second list, covering space films from 1920 to 1930. (For our purposes, there is no need to go beyond 1930):

1. Reaction propulsion or rocket—*All Aboard for the Moon*, also known as *A Trip to the Moon*, Bray, United States, 1920; *If We Went to the Moon*, Bray, United States, 1920 [may have also featured a rocket]; *The First Man to the Moon* [and] *Lampoons* [two films on one reel, the first about Happy Hooligan taking a trip to the Moon by a rocket], Goldwyn-Bray, 1920; *The Sky Ranger*, serial, 15 episodes, Pathe, United States, 1921 [features reaction-propelled aircraft suggesting rockets]; *The Sky Splitter*, Bray, United States, 1922; *Aelita*, Mezharabom-Russ, Union of Soviet Socialist Republics (USSR), 1924 [very quick fire and smoke from the vehicle, vaguely suggesting the rocket]; *Trip to Mars* (Max Fleisher, Out-of-the-Inkwell cartoon, with sound), United States, 1924; *Bull and Sand* (Mack Sennett comedy, burlesque of *Blood and Sand*, 1922, United States, 1924 [contains the scene of the scientist Prof. Marsupp going to Mars via a rocket]; *Frau im Mond*, also known as *The Girl in the Moon*, Ufa, Germany, 1929; *Just Imagine*, Fox Film Corp., United States, 1930; *Bimbo-Up to Mars* (Max Fleisher cartoon, with sound), United States, 1930.
2. Miscellaneous propulsion—*A Trip to Mars* [about a “new type of aircraft” flying to the planet], W. H. Productions, a U.S. company but possibly produced in Italy since it had Italian actors, 1920; *Dream of a Rarebit Fiend: The Flying House*, Winsor McCay, United States, animated, 1921, [A giant gasoline engine attached to attic of house and giant propeller turns house into a spacecraft that goes to Moon.]; *Mezhplanetnaya revolutsiya*, GTK (State Film Technicum), USSR, [an animated parody of *Aelita*, but the space ship does not clearly show rocket propulsion, or at least there is no exhaust visible from it]; *Felix the Cat in Astronomeous*, animated, M. J. Winkler, United States, 1928, [shot into space with a rope on an arrow].
3. Propulsion unspecified or unknown—*Münchhausen, the Famous Tall-Teller*, Institute für Kulturforschung, Germany, 1920, possibly includes segment of the story about Baron Münchhausen’s flying to the Moon; *A Trip to Mars*, animated, Bud Fisher (a Mutt and Jeff cartoon), United States, 1920; *Les Mystères du Ciel* (produced by Serge Sandberg, France, 1920) [perhaps a different film than same title above and may have included an “imaginary voyage” to the Moon]; *Păculă în lună* (*Pacala on the Moon*), Romania, premiered 4 April 1920 and produced by Aurel Petrescu as the first animated film in his country; *Ein Tag auf dem Mars* (*One Day on Mars*), Cserépy Film Co., GmbH, Germany, 1920 [unknown if this de-

picted a flight to Mars]; *The Ship that was Sent Off to Mars* (Raymond Griffith, director), United States, 1921 [unknown if it depicted spaceflight]; *First Man to the Moon*, animated by Dave Fleischer (with Koko the Clown), Out-of-the-Inkwell Films, Inc., United States, 1921; *Pa's Trip to Mars*, produced by C. C. Barr [Charles C. Barr], United States, 1923 [could be same film with this title credited to Cine Arts Productions and believed to have been produced in the 1910s. In any case, a viewing of the Cine Arts film of this title shows a projectile with conical cap sent into space when two boys plant and ignite fireworks next to, but not underneath the projectile.]; *From Mars to Munich*, Fox Film Corp., United States, 1925; *Montanul în lună (A Cat on the Moon)*, Petrescu, Romania, 1926; *The Adventures of Baron Munchausen*, also known as *Nothing but the Truth*, Paul Peroff, France, 1927, perhaps including Münchhausen's trip to the Moon; *Puteshestvie na Mars (A Voyage to Mars)*, USSR, 1926 [A poster of the movie suggests a rocket]; *Cosmic Journey*, USSR, 1928 [possibly the same Russian film made in 1926]; *Peter and the Moon Man*, Educational, Health, and Cleanliness Council, United Kingdom, 1929; *Up to Mars*, Paramount Publix Corp., United States, 1930.

Unfortunately, because many of the above films no longer exist or are inaccessible, the writer has only been able to view a small number. But it is clear that the rocket or reaction propulsion was introduced to films for mass audiences from 1920. A closer look shows this trend was due directly to the appearance of *A Method*. However, since Oberth's *Die Rakete* was published in June 1923, by no means does the second list above suggest that *A Method* was responsible for films with space rockets after 1923.

The first movie to have depicted a space rocket thus appears to be *All Aboard for the Moon*, also known as *A Trip to the Moon*, produced by John R. Bray for the Goldwyn Bray Company and released in mid-February 1920, about a month after the release of Goddard's treatise (Figure 1–6). It premiered at the Strand Theatre, New York, and was a 697-foot long, 35-millimeter educational animated film. The director was David Fleischer. His brother, the pioneer animator Max Fleischer, did the animation. According to *Motion Picture News*, the film "... demonstrates how a giant rocket airship might be hurled to the Moon by ... radium engines. You see the projectile start ... and watch its journey through space with a landing on the Moon. You are then given a view of the Moon's surface ... with trick photography this has never been excelled."⁵⁹

An earlier notice in *The Moving Picture World*, before the film was released, seems to suggest that the magazine *Popular Science Monthly* was a partner in the venture. According to this source, "Max Fleischer of the Bray Studios,

in conjunction with the *Popular Science Monthly* has staged an imaginary trip to the Moon aboard a newly completed sky rocket.” Most likely, this partnership amounted to more of Fleischer consulting the latter magazine for technical inputs or illustration ideas, especially on radium. The use of radium in the film was, of course, a departure from Goddard’s *A Method* and the term “sky rocket” was inaccurate but it seems certain the film was a direct result of the publicity from the release of *A Method*, if not from Goddard directly. Years later, in 1932, Bray wrote to Goddard mentioning *All Aboard for the Moon* and said, “As I remember it, we obtained much of the information from you.” However, there is no indication Goddard helped Bray personally.⁶⁰

Nonetheless, it is very likely Goddard saw the film—and used it to supplement one of his talks. In his article, “The Rocket Method,” in *The Journal of the Worcester Polytechnic Institute* for April 1920, he wrote:

At about the same time as the Smithsonian announcement of the writer’s work [*A Method*], public attention was called to a motion picture on *A Trip to the Moon*, in which a rocket was imagined as propelled by the energy (and matter, of course) from radium . . . when the writer was a youngster—a senior at Tech thirteen years ago [in 1907]—he “wrote up” the idea [of radium as a propellant] as a speculation . . .

It is also interesting to note that in his copy of the *Program of The Eighty-Fifth Meeting of the Eastern Association of Physics Teachers*, held at the High School of Commerce at Boston on 20 March 1920, Goddard had added after his talk—“Measurement of Efficiency of Rockets”—the words, “Scientific Films—Bray Pictures Corporation.” Furthermore, in his diary for this date, he mentions the talk and adds, “Bray Pictures Corp. gave movies on . . . a bald headed man, signaling to Mars (by light) [probably the film *Hello Mars*] and *Trip to the Moon*.” Very likely, the latter was really *All Aboard for the Moon*.⁶¹

The potential power of radium was much in the news up to these years. It therefore seems that either John Bray or Max Fleischer, or both, discovered the then startling idea of Goddard’s Moon rocket and decided to make the film. They adapted—via an earlier article on radium in *Popular Science Monthly*—the notion that radium could be the propellant. According to *The Moving Picture World*, “The Bray press agent tells us that . . . No other form of energy will give us this power. Flash! We are off with a roar . . . This remarkable illustration of a trip to the Moon is made possible by a series of animated drawings. Goldwyn has it.” The film also showed a special inclined launch ramp for the rocket, set on the roof of a skyscraper, with a sign nearby reading “Skyrocket to the Moon.” The rocket attained a speed of 60 miles (96.5 kilometers per minute) on leaving Earth. At 213,000 miles (342,780 kilometers), on its approach to the Moon, it reversed

itself for a slow descent on the lunar surface. On touchdown in a crater, the space pilot emerged, peered skyward, wondering whether he would return.⁶²

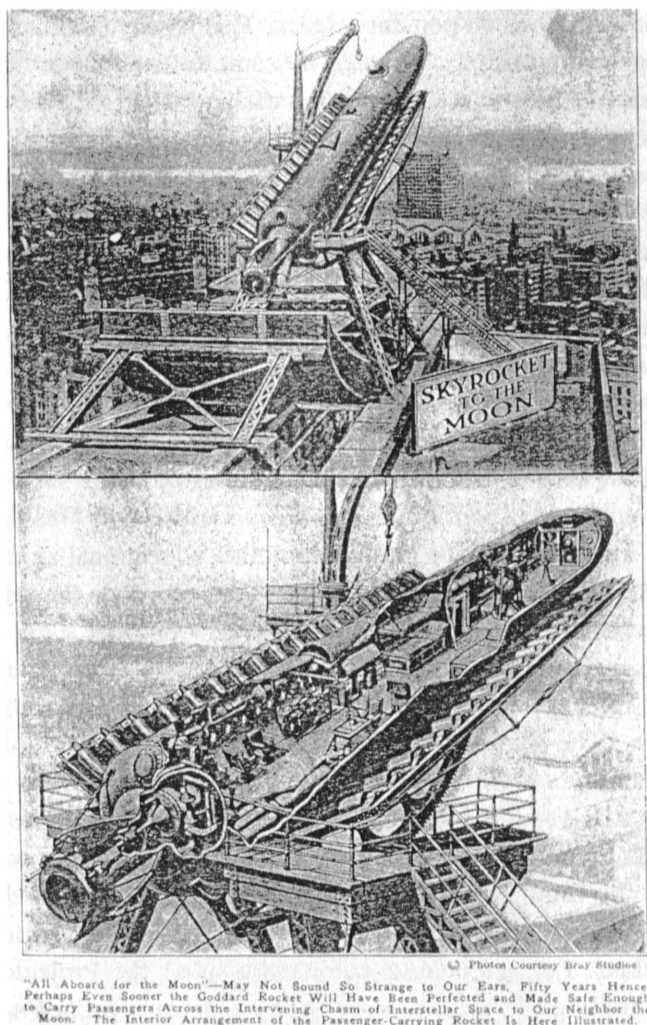


Figure 1–6: Scenes from the very first film depicting a space rocket, *All Aboard for the Moon* (Bray, 1920), although distorted Goddard’s concept, for instance, considering the vehicle as a giant “skyrocket.” Compare this with Figure 1–5 (From *Science & Invention*, April 1921).

“*All Aboard*,” Bray later told Goddard, was a great success “and we obtained an immense amount of publicity on it from newspapers, magazines and other publications, the articles of which were extensively illustrated by scenes from the film.” This was true. In fact, many of the early newspaper and magazine articles on Goddard’s rockets were illustrated with the most famous scene from the film, the rocket on its ramp poised for launch.”⁶³

Bray himself was a pioneer in the American motion picture industry, especially in the production of animated cartoons and educational films and patented several important techniques that speeded up the production of cartoons. Primarily, he specialized in films on popular science. This is why Goddard's rocket was tremendously appealing to him although he came to use this device in both his science and comedy films. (We saw that as early as 1915, he had already made two short fantasy spaceflight films, *Dreamy Dud* and *Exploring Ephraim's Exploit*, and there is some evidence he may have made the science film *Signalling to Mars* by 1919. His educational film, *Hello Mars*, may have been a similar, or retitled version of the latter, since it was also about communications with Mars and not spaceflight *per se*. *Hello Mars* was released on 25 Jan. 1920. Thus, another of Bray's favorite topics was space. But, it took Goddard to introduce him to the space rocket.)⁶⁴

Very soon after *All Aboard*, Bray copyrighted (on 24 April 1920), the comedy *First Man to the Moon* [and] *Lampoons*, featured on the same reel. (*Lampoons* is described in the copyright as "A series of clever sayings . . ." while *First Man to the Moon* is about Happy Hooligan and Gloomy Gus taking a rocket to the Moon.). Then, in Sept., he produced another educational animated short, *If We Lived on the Moon*, about the habitability of the Moon. In the same month, he copyrighted the short comedy, *If We Went to the Moon*, that suggests that it too featured a rocket. By late 1922, he produced *The Sky Splitter*, centering on an incredibly fast radium-powered flying machine called the Projectocar that flew into deep space. (The film was copyrighted by Bray on 14 December 1922, advertised that month, but released on 7 January 1923.) The reviews did not mention that the machine was a rocket, but there is no question it was an upgraded version of the radium-powered one in *All Aboard*. Max Fleischer was the animator. This time, the film had a more developed plot and effects and was another success. It saw numerous depictions of this vehicle likewise gracing articles on Goddard's rockets. For example, a color painting of the Projectocar, with its rocket exhaust trailing behind it, was featured on the cover of *Science and Invention* for February 1923. Goddard's article, "The Rocket to the Moon," in *The Washington Post* and other newspapers also featured a picture of the radium-powered, teardrop-shaped vehicle from *Sky Splitter*. It should finally be mentioned that when Bray wrote to Goddard on 22 January 1932, he proposed a "new picture of this type" and asked for Goddard's assistance. The earlier film, Bray added, was done with "carefully made drawings . . . We double-exposed them over the city of New York in passing through the clouds, etc. in such a way as to give a very realistic effect." Now, however, Bray was seeking the use of a real Goddard rocket, with added effects to show it leaving Earth and landing on the

Moon, et cetera. But characteristically, Goddard responded cordially but negatively to this request. “It is possible,” he told Bray, “that at a later time a popular presentation might be undertaken, but for the present . . . I must confine myself to the work . . .”⁶⁵

Another remarkable piece of evidence of the role of silent movies in introducing the idea of the space rocket into the public consciousness concerned the film *Chasing the Moon*, produced by William Fox in 1922. This major feature-length, internationally shown film, starring Tom Mix, then one of film’s top cowboy stars, was an action-love story that had nothing to do with the Moon, nor space, nor rockets. However, the widely distributed press kit for the film depicted the hero straddling a rocket, using a horse saddle, and flying toward a smiling Moon (Figure 1–7). Thus, this image of Tom Mix shows that the Moon rocket (the space rocket) had become an accepted idea and, moreover, was used commercially to sell a film. It is not known how widely this press kit was distributed, but in an article in *Moving Picture World* on the 18th anniversary celebration week of Fox in the movie industry, during January and February 1922, it is stated that Fox films were distributed to more than 20,000 exhibitors in a dozen countries.⁶⁶



Figure 1–7: Publicity still for the 1922 Fox film, *Chasing the Moon*, showing the then internationally acclaimed star, Tom Mix, riding a Moon rocket. Even though the film had nothing to do with spaceflight, this image shows that by this time, Goddard’s “Moon rocket” idea—if not a clear idea of the technology—had now “arrived” into the public consciousness and that the space rocket idea was born, in the West. (Photo, author’s collection).

The Goddard Space Rocket in Music

Another, though lesser measure that Goddard's Moon, or space rocket, had entered into popular culture was the appearance of several pieces of music with space travel, and rocket themes, after the release of *A Method*. There were actually several space-oriented songs before this time. For example, "A Trip to the Moon" by Clifford V. Baker, was copyrighted on 17 July 1907 in which the music sheet depicts a fanciful airship with propellers flying to the Moon. Later, on 21 March 1921, there was copyrighted another song titled "A Trip to the Moon," words by R. G. Hanley and melody by R. A. Brown. It is not known if the words included references to Goddard or his rocket. But for certain, "A Moon Goddard Rocket Ride" did, and was copyrighted 21 May 1924. The words were by Mrs. L. P. Shrefler of Burbank, Oklahoma, the music by George Graff Jr. (Figure 1–8).

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A Moon Goddard Rocket Ride

Words by
Mrs. L. P. SHREFFLER

Music by
GEORGE GRAFF, Jr.

Moderato

Piano

Oh! now - a - day - a - n - k how fast a guy is, Has he a speedster? How fast is it? What?
I will take a big ra - di - o set with me too, So the powder can really run - ry me to you.

I'll plant my pen - n - u - s in - til they grow big, Then I will buy me a Moon God - dard rig.
We'll have our hon - ey moon on the moon, We'll go to - va - ma when we want to spoon.

Now I can catch a - w - w of a hit And they will all want to - ride with me, But
When we get - hun - gry green cheese we can eat And a - long with us take some star fish for meat Frother

K 410 Copyright 1924 by Mrs. L. P. Shrefler, Box 253, Burbank, Okla.

Figure 1–8: Music sheet for the song "A Moon Goddard Rocket" by Mrs. L. P. Shrefler, Burbank, Oklahoma, 1924. The appearance of the Goddard rocket theme in music was another manifestation of the introduction of the space rocket concept into the public consciousness. (Robert H. Goddard scrapbook, Library of Congress).

Also in 1924, there was “The Moon Rocket March for the Pianoforte” (without lyrics) by Walter Rolfe and published by the Theodore Presser Co., Philadelphia. Earlier, in 1922, John Henry Boyle sent the words to his song, “Oh, They’re Going to Shoot a Rocket to the Moon, Love,” directly to Goddard. In this instance, Boyle wished to use the proceeds of the sale of the song sheets to help Goddard finance his Moon rocket. Thus, as with films, it appears the space rocket was *not* an element in music prior to the appearance of *A Method*. As with the films, and articles, et cetera, there may have been other pieces of music of this period with space rocket themes.⁶⁷

The Rocket in Early Science Fiction

Lastly, it has been found useful to examine the perception of the rocket in science fiction before and after Goddard’s *A Method*.

Throughout the long history of what we may call “space fiction,” a branch of science fiction, a wide variety of imaginative devices has been used to transport fictional space travelers. Rockets first appeared in this role in Savinien Cyrano de Bergerac’s *Comical History . . . of the Moon* (1656), and *Comical History . . . of the Sun* (1662). But it is immediately self-evident from the word “*Comical*” in both titles that the rocket was only meant to be interpreted as a humorous device for literary effect and not to be taken in a serious, scientific way. It is indeed, laughable, in any age, as Cyrano’s fictional rocket was a mere handmade firework and far too feeble to produce any kind of power, let alone lift a manned vehicle into space.⁶⁸

Not until three centuries later does the rocket in space first start to appear in a more scientific vein in the science fiction literature. This is in the classic novels of Jules Verne, *From the Earth to the Moon* (1865) and its sequel, *A Trip Around the Moon* (1870). However, the giant *Columbiad* cannon served as the primary propulsion for shooting the shell type space capsule. Rockets, still of the firework variety, were relegated the lesser but important role of breaking the fall of the capsule when it landed on the Moon. But when his space capsule was not able to land, the rockets were used for a different application. They were to alter “the direction of the capsule back to Earth.” Therefore, it is implicit Verne understood that the rocket can work in a vacuum but did not develop this idea further.⁶⁹

From another survey made by the writer, based largely on Everett F. Bleiler’s *Science Fiction—The Early Years*, a compendium of more than 3,000 science fiction stories from the earliest times to 1930, the rocket is indeed seen as a rarity in early science fiction. Examples of these fictional space rockets may be mentioned.

In 1852, in his novel *Gulliver Joi—His Three Voyages . . . Marvelous Adventures in Kailoo, Hydrogenia, and Ejario*, Elbert Perce described what Miller calls the first “unambiguous” use of the rocket as the primary means of space propulsion although Perce does not specifically call it a rocket. The propellant was a new type of “pyrotechnic” red powder of “great power” and the “steady blast,” or “malleable flame,” could be controlled by a stopcock. A better-known example is found in the novel *Voyage à Venus* of 1865 by the Frenchman Achille Eyraud. In this case, however, Eyraud misunderstood the reaction principle. His “moteur à reaction” ejected water that was then recycled in a container towed behind the spacecraft and used again, thereby negating the reactive effect.⁷⁰

In 1864, the book *Eve and the Evangelist—A Romance of A.D. 2108* by Harry E. Rice featured gigantic rocket-like vehicles using the new explosive “pulva” as a propellant. But the vehicles were for long-distance terrestrial travel, not spaceflight. Similarly, the Canadian author writing under the pseudonym of Ralph Centennius, described intercontinental rocket airships in his 1883 novel *The Dominion in 1893* about Canada in the future. The fictional rockets used gas from propellants of solid oxygen and carbonic acid. There was also the serialized short story “The Outlaws of the Air” by George Griffiths appearing in the 8 September 1894 to 23 March 1895 issues of the British magazine *Short Stories*. In this case, the rocket-propelled terrestrial rocket ship used a solid fuel. In 1897, John Munro, British engineer and professor of mechanical engineering at Bristol University, did mention the possibility of the rocket as a method of propulsion for his fictional spacecraft in his novel *A Trip to Venus*. But he dismissed this method and opted for an anti-gravity technique. In 1910 there appeared the novel *By Aeroplane to the Sun* by British astronomer Donald Horner. Horner’s spacecraft used radium motors that, according to Bleiler, suggested ionic (rocket) propulsion. A more sophisticated uranium-powered fictional spacecraft was described in “The Moon Maker” by Arthur Train, a lawyer by profession, and Robert W. Wood, a professor of physics at the Johns Hopkins University of Baltimore, Maryland. Their story was published in *Cosmopolitan* from October 1916 to February 1917. Great attention was paid to technical details, although the uranium-powered “Flying Ring” spacecraft worked by a mysterious “lavender ray” serving as the means of safely disintegrating the radium, which was ejected rocket-fashion as an exhaust of super-heated helium. A bona fide rocket-propelled spaceship was described in the short story “Bagley’s Inter-Planet Sky-rocket” by Howard Dwight Smiley in the U.S. magazine *Blue Book* for March 1908. In this story, the rocket stood 20 feet (6 meters) high, was 4 feet (1.2 meters) in diameter, and propelled by nine separate charges (evidently solid fuel).⁷¹

Finally, and most importantly, Bleiler's compendium briefly describes the novel of Konstantin E. Tsiolkovsky, *Vne zemli* (*Out of Earth*), written during 1896–1920 and published in the latter year in which Tsiolkovsky's fictional hero proposed a multistage liquid-fuel space rocket. At the same time, Bleiler notes that, "While Tsiolkovsky's scientific work was important in the history of rocketry . . . and astronautics, his fiction does not seem to have been known outside Russia until the modern interest in non-English science-fiction traditions."⁷²

Hence, before 1920 the rocket, or reaction propulsion as a main means of propulsion for a spacecraft, appeared in only five stories (de Bergerac, Perce, Eyraud, Tsiolkovsky, and Smiley). Of these, Tsiolkovsky's alone stood out as a workable propulsion concept but was not published until 1920 and was unknown in the West until later.⁷³

The survey further shows that besides the five spaceflight stories before 1920 using rocket propulsion, 13 stories used balloons to get into space, five used birds, 12 used forms of electromagnetism, 13 using meteors or comets (the heroes of the stories riding on passing meteors or comets), and 18 used miscellaneous methods (giant whirlwinds, magic carpet, super natural power, and so forth). Bleiler's compendium further reveals that by far, anti-gravity was the most popular form of fictional propulsion in space with some 44 stories choosing this technique.⁷⁴

The picture changed dramatically from 1920, but the situation is a lot more complicated. From Bleiler's compendium, we find that from 1920 to 1930, 16 books featured the rocket as the main form of space propulsion. However, it is difficult to attribute the noticeable rise in science fiction stories with space rockets *after* 1923. In that year, as mentioned, Oberth's *Die Rakete* appeared and opened up yet another and more dynamic phase in the history of rocketry and astronautics that is beyond the scope of this chapter. Indeed, following Oberth's own groundbreaking book there appeared other pioneering works by such authors as Max Valier, Walter Hohmann, Willy Ley, Hermann Noordung, Robert Esnault-Pelterie, Eugen Sänger, et al. Moreover, the world's first science fiction magazine, *Amazing Stories*, was inaugurated in April 1926. Bleiler thus wrote another compendium, his *Science Fiction—The Gernsback Years—A Complete Coverage of the Genre Magazines, Amazing, Astounding, Wonder, and Others from 1926 through 1936*. This source shows there were an additional 33 spaceflight stories from 1926 to 1930 with rockets as the main form of space propulsion, or 49 total, carried forward from the earlier compendium. But from 1931 to 1936—far beyond the *Method of Reaching Extreme Altitudes* period and when the international spaceflight movement had fully taken hold—some 169 interplanetary rocket stories appeared in the science fiction "pulp," as the magazines

were called. For this reason, Bleiler was compelled to annotate in his index, under the category “Space Travel, Rockets” the following: “. . . this is by far the most important method of space travel . . .”⁷⁵

At most, therefore, we can only speculate that Goddard’s *A Method*, followed by general news in the press about progress with his rocket experiments, undoubtedly contributed toward this trend. It may also be asserted that the science fiction magazine, starting with *Amazing Stories*, was an American phenomenon. It was created after Oberth’s book and other works by Valier, et al. that had more impact in Europe (especially in Germany) than in the United States. In this respect, it is possible the progress of *Amazing Stories* and other magazines of its ilk with their interplanetary stories may owe more to the legacy of Goddard’s *A Method* than is generally realized. For certain, the arrival of this new genre of literature that appeared only six years after the release of *A Method* and was another part of the spaceflight revolution and came into full flower by the 1930s. Thus, the concept of the space rocket had left its novelty phase and became firmly established by the mid-to-late 1920s and Goddard was part of this equation.⁷⁶

Conclusion

Goddard, as we saw at the outset, was technically not the first to suggest the rocket as a means to escape Earth’s gravitational pull and serve as a vehicle for flight into space. He was preceded by Tsiolkovsky and there were also early science fiction stories that roughly suggested rocket propulsion for spaceflight. Esnault-Pelterie was another early proponent of the rocket-propulsion solution for reaching space. It is documented, at least, that his talk on this topic before the Société Française de Physique was made in November 1912, several years before the public release of Goddard’s treatise, *A Method of Reaching Extreme Altitudes*. (It is also possible to find early newspaper and magazine articles on REP’s first spaceflight ideas that included the rocket.) But what set Goddard apart from Tsiolkovsky, REP, and others was the enormity of the publicity he received on the release of *A Method*. It was a deluge of publicity that even entered into films and music of the times—that is, into the popular culture and therefore into the popular consciousness. By comparison, the pre-Goddard works of Tsiolkovsky, REP, and others were obscure. Goddard’s Smithsonian connection and the Smithsonian’s press release to *The New York Times* and other leading papers overseas made the difference. Beyond this, although completely unintended, the Goddard publicity created a kind of revolution in introducing the idea of the space rocket into the public consciousness.⁷⁷

Goddard's monumental breakthrough *in vacuo* experiment, which was not generally picked up by all the newspapers and magazines covering the release of *A Method*, may be considered revolutionary by itself as the true inception of the Space Age, West or East. For if Tsiolkovsky technically preceded Goddard in theorizing that the rocket could potentially break the bonds of Earth's gravitational pull, then Goddard undeniably completed the first necessary experiments that established its feasibility. His concepts of the multistage approach to spaceflight and the de Laval nozzle—the latter, also proven by experiment—were likewise major breakthroughs.

Lay people who devoured the sensationalistic stories on *A Method* were evidently oblivious to the technical landmarks, however. (These were usually entirely lacking in the popular articles.) Yet, arguably, the concept of the space rocket was revolutionary to them. In those simpler times, the average person took it at face value that a scientist, backed up by a foremost scholarly institution, the Smithsonian, had declared that spaceflight was possible and this made it so. Goddard's experiments gave further credence that he was already preparing for the great leap. And to the 1920 lay person's mindset, humankind appeared to be at the juncture dreamt about for thousands of years in fables, religion, art, song, and poetry—a leap into space to the Moon and beyond. Moreover, this was to be accomplished with a glorified skyrocket firework.

The latter notion itself was astounding. On closer examination, this element alone was "revolutionary" since for 1,000 years the rocket was merely a pasteboard amusement device, a signal, or occasionally, a primitive gunpowder weapon. Now, it was suddenly transformed into a way to penetrate space. Finally, it was revolutionary how rapidly the general public became aware, literally overnight, on 11 January 1920 to be specific, of the prospect of spaceflight.

As with many revolutions, sociological, historical, or scientific, the space rocket or spaceflight revolution underwent another phase, or post-revolution. If Goddard opened the first, the post or second revolution was the appearance of Oberth's *Die Rakete* in 1923. Unquestionably, Oberth's book, with its detailed plans of a *manned, liquid-propellant staged rocket* contrasted with Goddard's *unmanned, solid-propellant staged rocket* placed the state-of-the-art of astronautics on a whole new level with far wider possibilities. Oberth proposed, for instance, a manned space station, self-contained space suits, space missions that included the exploration of the planets, and stressed the then at hand technological feasibility of spaceflight. Consequently, worldwide interest in spaceflight arose anew. This time, an international space movement took root and came into full flower by 1930.

Oberth was not entirely responsible for this development himself. His acclaim was further spread by Max Valier who served as a popularizer or publicizer of Oberth's work with his own book, *Der Vorstoss in den Weltenraum* (*The Thrust into Space*), appearing in 1924. Valier's work was enormously popular and went through five printings from 1925 to 1929 and an enlarged edition in 1930, *Raketenfahrt* (*Rocket Travel*). In addition, he wrote a prolific number of articles and lectured widely. Ironically, reviewers of Oberth's *Die Rakete* used *A Method* as a basis of comparison, to show that his book was a superior treatment of the subject. Following Valier, appeared books on spaceflight and rocketry by others, like Hohmann, who may be considered among Oberth's disciples.

Meanwhile, in Russia, Tsiolkovsky's supporters felt compelled to reintroduce the name of their own great pioneer. He became "rediscovered," though in the West he was virtually unknown. Early in 1924, just a few months after Oberth's book was published, there appeared the enlarged, so-called "Second Edition" of Tsiolkovsky's 1903 paper, now called *Raketa v kosmicheskoe prostranstvo* (*The Rocket into Cosmic Space*) published in Kaluga by the 1st State Printing Press (1-ya Gosudarstvennaya Tipo-litografiya). It began with a curious but historically important "Introductory Note" in German by one of Tsiolkovsky's students named Alexander L. Chizhevskiy (or Tchiyevesky), dated 14 November 1923. The student lamented that while Oberth's *Die Rakete* was the first work on the subject to appear in Germany, Tsiolkovsky had already written on this topic 30 years before. (He meant 20 years.) Tchiyevesky then cited Tsiolkovsky's major publications on spaceflight but observed that "All these works remained nearly unnoticed [in Russia] and the invention of K. E. Tsiolkovsky did not find general acknowledgement." "The above . . . is not meant to establish . . . Tsiolkovsky's priority," he continued, but showed "the almost criminal indifference of our countrymen toward intellectuals . . . Do we always have to get from foreigners what originated in our boundless homeland and died in loneliness from neglect." The message was unmistakable. It also helps corroborate an assertion made earlier in this chapter. That is, Tsiolkovsky technically preceded both Goddard and Oberth in formulating theories of spaceflight by rocket but by one of his compatriot's own admissions, suffered from obscurity, even in Russia. Because of neglect of Tsiolkovsky, Goddard was clearly the first to win wide acclaim for his work on astronautics, and on an international basis.⁷⁸

Later, in Germany, in the mid-1920s, events moved faster and more dynamically and saw the second revolution set by Oberth. The first space travel or rocket societies soon emerged. The most important of these was the Verein für Raumschiffahrt (VfR), or German Rocket Society, founded in 1927 and began its first experiments in 1930. The first full-length spaceflight film, *Frau im Mond*,

featuring a large liquid fuel manned rocket designed by Oberth as the film's technical director, was produced in 1929. In the same year, the German Army's secret rocket program was initiated and ultimately led to the creation of the A-4 (V-2), the world's first large-scale, liquid fuel rocket.⁷⁹

As for Goddard, his name was still brought up in the Sunday supplements from the post-Oberth years up to the 1940s on anything to do with space rockets. His work continued to be compared with Oberth's, although only in the most general terms, because he never offered details due to his secrecy. Indeed, from 1930, he was, except for his few assistants, a lone rocket experimenter at his isolated research station near Roswell, New Mexico. He remained aloof from an ever more crowded field of rocket experimenters and exponents of spaceflight. His 1920 legacy became all but forgotten and indeed, was a silent revolution. Yet he had surely implanted the basic idea of the space rocket into the public consciousness of countless people internationally and had inadvertently led the way.

Notes

¹ For example, the well-known aviation and space writer Craig Covault, writing in *Aviation Week*, for 15 December 2003, as part of the celebration of the centenary of flight, called Goddard the "Father of Modern Rocketry." He added the oft repeated modern American myth that Goddard's 1926 50-ft (15 m) [should be 41 ft or 12.4 m] flight was "epochal in the history of rocketry as the Wright brothers' first 120-ft [36.5 m] flight was to aircraft." A similar claim was expressed by Harry F. Guggenheim in an address on the opening of the first public showing of Goddard rockets at The American Museum of Natural History in New York on 21 April 1948. Goddard, said Guggenheim "was just as surely the father of modern rockets as the Wright Brothers [sic] were of the airplane." Likewise, Dr. Eugene M. Emme, NASA Historian, in his *Robert H. Goddard World Rocket Pioneer* fact booklet (NASA Historical Report No. 1) of July 1960 "in response to many requests" on Goddard, called him the "father of modern rocket propulsion" and said "the flight of Goddard's rocket on March 16, 1926 [sic]...was a feat as epochal in history as that of the Wright brothers at Kitty Hawk." The authorized biography of Goddard, *The High Man*, echoes the identical sentiments. The same source quoted Smithsonian Secretary Charles G. Abbot in saying that the 1926 flight "compared favorably with the Wrights first airplane flight...and...was just as significant." What is never mentioned in these claims is that whereas the Wright brothers first flight on 17 Dec. 1903 was soon made known to the public, Goddard never publicly made known his 1926 flight until a full decade later, with the appearance of his second Smithsonian Institution treatise, *Liquid-propellant Rocket Development*. This work was published in the *Smithsonian Miscellaneous Collections*, Vol. 95, No. 5, 16 March 1936. It was either merely coincidental or deliberate that the publication was on the exact tenth year anniversary of the 1926 flight. (By contrast, Orville Wright telegraphed his father at the end of the day of the first flights to "...inform press..." See Marvin W. McFarland, ed., *The Papers of Wilbur and Orville Wright*, Vol. I, pp. 395–412; James Tobin, *To Conquer the Air*, pp. 189–190, 205, 207, and similar sources, as well as contemporary accounts as Orville and Wilbur Wright, "Our Aeroplane Tests at Kitty Hawk," *Scientific American*, Vol. 98, 13 June 1908, p.423.).

Craig Covault, "Aviation Week's The Next Century of Flight—Higher and Faster," *Aviation Week*, 15 Dec. 2003, p. 36; Pamphlet, *The Future of Rocket Power—Address Delivered by Harry F. Guggenheim and J.H. Doolittle at the Preview Opening of The Robert H. Goddard Exhibit Sponsored by The Daniel and Florence Guggenheim Foundation* (Daniel and Florence Guggenheim Foundation: New York, 1948), p. 3. Dr. Eugene M. Emme, *Robert H. Goddard World Rocket Pioneer* (Technical Information and Education Programs, NASA: Washington, DC, NASA Historical Report No. 1, Revised July 1960), p. 1; Milton Lehman, *This High Man* (Farrar, Straus and Co.: New York, 1963), pp. 3, 66, 144; Marvin W. McFarland, ed., *The Papers of Wilbur and Orville Wright* (McGraw-Hill: New York, 1953), Vol. I, p. 397.

² Lehman, pp. 22–23, 25–27; Esther C. Goddard and G. Edward Pendray, eds., *The Notebooks of Robert H. Goddard* (McGraw-Hill Book Co.: New York, 1970), Vol. I, pp. 7, 9, hereafter cited as RHG, *The Notebooks*.

³ The original *Journal* and *Green Notebooks*, and other original Goddard papers, are in the Special Collections of the Robert H. Goddard Library, Clark University, Worcester, Mass.

⁴ Goddard's primary research at Princeton was on the "positive result of force on a material dielectric carrying a displacement current," which, in Goddard's words, was not related to "space navigation." Working out the theory of rocket propulsion in space was his after hours avocation. RHG, *The Notebooks*, Vol. I, pp. 17–18, 159; Lehman, p. 84.

⁵ Similar to Goddard, Tsiolkovsky was inspired by a childhood dreams as well as science fiction, specifically Jules Verne. In his autobiographical article, appearing in *Komsomolskaya Pravda* (Moscow) for 23 July 1935, Tsiolkovsky said that he "first dreamed of the possibility of travelling beyond our own planet" when he was 17. This would have been in 1874, or, 25 years before Goddard.

Consult N. A. Rynin, *Interplanetary Flight and Communication—Vol. III, No. 7—K.E. Tsiolkovsky Life, Writings, and Rockets* (Israeli Program for Scientific Translations: Jerusalem, 1971), translated from the Russian as NASA Technical Translation, TT-646, pp. 3, 9–10; K.E. Tsiolkovsky, *Works on Rocket Technology* (National Aeronautics and Space Administration: Washington, DC, Nov. 1965), NASA TT-243, pp. 3, 24, 28–29, 59; K. E. Tsiolkovsky, *The Call of the Cosmos* (Foreign Language Publishing House: Moscow, n.d.), pp. 454, 459, 470.

⁶ Tsiolkovsky later became a Soviet icon, as Goddard became a U.S. icon in the history of American rocketry. See the M.A. thesis by Rita De Domenico, "The Official Image of Konstantin Tsiolkovsky in the Soviet Union, 1959–1970," Harvard University, 1986.

⁷ Tanja Jeltnina, "Dissemination of Information on K. E. Tsiolkovsky's Scientific Works on Astronautics in the West (up to the mid-1930s)," paper, IAA-03-IAA.2.1.01, in *History of Rocketry and Astronautics*, Otfried Liepack, Editor (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 2011), AAS History Series, Vol. 34, 2011, pp. 467–500, especially p. 472 (paper presented at the 54th International Astronautical Congress, Bremen, Germany, 29 September – 3 October 2003); Discussion with Harold M. Leich, Russian area specialist, European Division, Library, of Congress, with author, 2 July 2004. The wording in Jeltnina's paper has since been changed in the published version to read: "... available to American readers ..."

⁸ Paul Brockett, *Bibliography of Aeronautics 1909–1916—National Advisory Committee for Aeronautics* ([U.S.] Government Printing Office: Washington, [DC], 1921), p. 1346; Leich discussion.

⁹ National Advisory Committee for Aeronautics, *First Annual Report of the National Advisory Committee for Aeronautics—1915* ([U.S.] Government Printing Office: Washington, [DC],

1917), p. 16; *Union List of Serials in Libraries of the United States and Canada* (H. W. Wilson Co.: New York, 1965), 3rd ed., Vol. 5, p. 4385.

- ¹⁰ Neither Goddard nor Hermann Oberth, the next name among the triumvirate of the great founders of modern astronautics, knew Russian, apart from being unaware of Tsiolkovsky's work. The Library of Congress did *not* subscribe to *Nauchnoe Obozrieniye* at the time and obtained copies later that were catalogued only in 1936 but even so, only volumes from 1895–1900 were acquired.

Willy Ley, *Rockets, Missiles, and Space Travel* (The Viking Press: New York, 1959), p. 112, and subsequent editions.

- ¹¹ RHG, *The Papers*, I, pp. 406–407.

- ¹² RHG, *The Papers*, I, pp. 406–407. The writer of the press release appears to have been Webster P. True, the Smithsonian's editor who had evidently edited *A Method*.

- ¹³ Goddard's magnesium flash powder experimental box is on exhibit at the Smithsonian Institution's National Air and Space Museum. This modest object is generally overlooked but it is undoubtedly the world's oldest existing space oriented artifact and dates to December 1915, when this phase of his experiments were carried out. *A Method of Reaching Extreme Altitudes* itself originated in August 1914, then revised in late 1916 based on Goddard's experiments undertaken during 1915–1916, with some editorial changes made in 1919. There is evidence Goddard had *not* intended to publish anything at all on his rocketry but was pressured to do so. His former teacher at Clark, Dr. Arthur G. Webster, according to Lehmann, told Goddard earlier in 1919, if Goddard did not publish, he (Webster) "would handle the matter..."

Goddard's momentous vacuum experiments were carried out in June to July of 1916. But the apparatus in these experiments may no longer exist.

RHG, *The Papers*, I, pp. 165–166, 168–169, 173–174, 393–305, 337, 407–408; Lehmann, p. 102.

- ¹⁴ Radio, radio news broadcasting may be said to have begun just a few months after the Goddard Moon rocket story broke, on 4 Nov. 1920, when station KDKA in Pittsburgh, Pa., broadcast the U.S. presidential election. It was not until 1926, with the formation of NBC, the U.S. first permanent national network, that regular national, then later international news broadcasts were possible. There are many works on early radio broadcasting. See, for example, Tom Lewis, *Empire of the Air The Men Who Made Radio* (Harper Perennial: N.Y., 1991), pp. 152–155, 160–164.

- ¹⁵ *New York Times*, 13 January 1920, p. 12, col. 5.

- ¹⁶ The early literature on rocket motion is more extensive than is generally believed. Some journals, like the *British Mechanics' Magazine* for 7 and 14 August 1847, included lively correspondence among readers, debating—by inductive reasoning alone—the merits of whether a rocket could or could not work in a vacuum. For a Civil War vintage American counterpart to this kind of debate, see *Scientific American*, Vol. VI, 18 Jan. 1862, p. 38, 8 Feb. 1862, p. 84, and 22 March 1862, p. 179. An example of the endurance of the "air pushing" school is found in *A System of Natural Philosophy* by J. L. Comstock, M.D. (Robinson, Pratt, & Co.: New York, 1843), pp. 39–40. The air-pushing theory found here appeared in the original edition of 1833 and in later editions up to 1856. Even long after the appearance of Goddard's *A Method*, in which his experiments completely disproved the "air pushers," there were still individuals who clung on to this school. See, for example, a letter Goddard wrote in 1932 on this topic, in RHG, *The Papers*, Vol. II, p. 820. In the same letter, he pointed out that his experiments showed that thrust ("the force of recoil") was actually 22 percent "greater in a vacuum than in the air" (because air friction hinders motion).

Ibid; Frank H. Winter, *Rockets into Space* (Harvard University Press: Cambridge, Mass., and London, 1990), pp. 1, 5–6, 10; Frank H. Winter, *First Golden Age of Rocketry: Con-*

greve and Hale Rockets of the Nineteenth Century (Smithsonian Institution Press: Washington, DC, 1990), p. 226; *Mechanics' Magazine* (London), Vol. XLVII, 7 Aug. 1847, pp. 136–137 and 14 Aug. 1847, pp. 148–149; RHG, *The Papers*, III, p. 820.

¹⁷ “The Moon Rocket,” letter by William S. Sims, *The New York Times*, 16 Jan. 1920, p. 8, col. 6.

¹⁸ This famous 69-year later retraction was news itself. See “Times Corrects A 1920 Error,” in *The Washington Post* (Washington, DC), 18 July 1969.

“A Conclusion Reached Too Soon,” *The New York Times*, 17 Jan. 1920, p. 10, col. 5; “A Correction,” *The New York Times*, 17 July 1969, p. 43.

¹⁹ For more on Serviss and his “Edison’s Conquest of Mars,” not published as a book until 1947, see Sam Moscovitz, “Edison’s Conquest of Mars,” in Frank N. Magill, ed., *Survey of Science Fiction Literature* (Salem Press: Englewood Cliffs, N.J., 1979), pp. 698–702. See also, Frank H. Winter, “Garrett Serviss, the Would-be-astronaut Who Helped Start the Space Age,” *Griffith Observer* (Griffith Observatory, Los Angeles), Vol. 74, July 2010, pp. 3–17.

RHG, *The Papers*, Vol. I, pp. 7, 165; Garrett Serviss, “Why Rocket Can Be Driven Through a Vacuum,” *Chicago American*, 12 May 1920; Garrett Serviss, “Rocket-to-Moon Theory Has Scientific Basis, Says Serviss,” *New York Evening Journal*, 22 Jan. 1920; Everett F. Bleiler, *Science Fiction—The Gernsback Years* (The Kent State University Press: Kent, Ohio, and London, England, 1998), p. 375.

²⁰ S. O. Young, “Getting Data on Higher Atmospheres Is Difficult Task For Scientists,” *Chronicle* (Houston, Texas), 10 March 1920.

²¹ “Science Goes Too Far,” *Ledger Dispatch* (Norfolk, Va.), 13 Jan. 1920; “Futility,” *Herald* (Yonkers, N.Y.), 1 Oct. 1920.

²² “Shooting At The Moon,” *Seattle Post Intelligencer*, 13 January 1920.

²³ “Shooting At The Moon,” *Seattle Post Intelligencer*, 13 January 1920.

²⁴ *Philadelphia Press*, 13 January 1920.

²⁵ Cartoons found on the Goddard story are in the following: *Philadelphia Inquirer*, 13 Jan. 1920; *New York Evening Journal*, 13 Jan. 1920, p. 20; *Tribune* (Oakland, Calif.), 14 Jan. 1920; *San Francisco Chronicle*, 15 Jan. 1920; *Herald* (Birmingham, Ala.), 16 Jan. 1920; *Virginian* (Norfolk, Va.), 18 Jan. 1920; *Worcester Post* (Worcester, Mass.), Feb. 1920; *Savannah News* (Savannah, Ga.), 20 June 1920; *The Evening Star* (Washington, DC), 22 Oct. 1920; and *New York Times*, 17 Feb. 1921. There was also the “Boob McNutt” comic strip, adapting the Goddard story, in the *Boston Daily Advertiser*, 18 April 1920; a specially created strip by T. E. Powers, and titled “If It Hits the Moon We’ll Get Moonshine Back,” in an undated *Evening Journal* (New York) issue; and a cartoon in the British journal, *Judge* (London), for 1 Oct. 1921. At the foot of the cartoon in the *News* (Savannah, Ga.), for 20 June 1920, is also a brief poem by Norman E. Brown, on the Goddard rocket.

Later, in 1930, Goddard himself was depicted, thinly disguised, in a *Buck Rogers* comic strip as “Professor Stoddard, the rocket expert,” in the Buck Rogers episode, “Tiger Men of Mars.”

²⁶ “Shooting The Moon,” *Boston Herald*, 18 Jan. 1920; Lehman, p. 104.

There were also stories speculating about life on Mars, then inserting Goddard’s name, like the piece in *The Journal* (Springfield, Mass.), 25 April 1920, also found in *The Missoulian* (Missoula, Missouri) titled, “Mars With Celestial Stone’s Throw of Earth—Worcester Professor’s Rocket Would Have the Best Chance to Reach Planet Today.” Besides Mars, another popular theme used by the newspapers to relate the Goddard Moon rocket story was Jules Verne’s novels, *A Trip to the Moon* (1865) and *Around the Moon* (1870). The *Christian Science Monitor*, for example, compared Goddard’s Moon rocket to the fictional Moon

trip in the Verne novels and the *Boston American* titled its story, "Modern Jules Verne Invents Rocket To Reach Moon."

²⁷ "First Volunteer for Leap to Mars," *New York Times*, 5 Feb. 1920.

²⁸ "First Volunteer for Leap to Mars," *New York Times*, 5 Feb. 1920; Letter Fannie Collins to Frank H. Winter, 15 June 1982, copy in "Claude R. Collins" file, NASM Library; Obituary Claude R. Collins, *NYT*, 18 Aug. 1958, p. 4.

Collins lived to see the opening of the Space Age and died in Aug. 1958, age 63. He was a newsman throughout his career and became editor of Pathe newsreels. According to his widow and corroborated by other sources, Collins was sincerely devoted to the cause of aviation but volunteered to go to the Moon as a "publicity stunt."

²⁹ Editorial, *NYT*, 6 Feb. 1920, p. 12.

³⁰ "Current Comment," *Herald Courier* (Bristol, Va.), 2 May 1920; "Who Can Answer This?" *Scientific American*, 6 March 1920.

Among other papers that picked up the Collins story were: the *Boston Herald*, *Boston American*, *Newark News* (Newark, N.J.), the *Pittsburgh Press*, *Pittsburgh Gazette*, all of 5 Feb. 1920, and the *Spokane Spokesman* (Spokane, Washington), for 29 Feb. 1920. The Collins story also produced a laudatory poem titled "To Captain Collins." See *NYT*, 7 Feb. 1920, p. 10.

³¹ Fitzgerald informed the entertainment magazine *Billboard* that either he or Collins would be "willing to make almost any kind of trip that would promise something new [novel] along the thrill lines." Fitzgerald also claimed he went to Washington several times, to the Smithsonian, to personally see Goddard, "but they wouldn't let me get to him."

"Four Seek Trip To Mars," *NYT*, 9 Feb. 1920, p. 2; "Woman Asks To Rocket With Capt. Collins To The Moon," *New York Journal American*, 21 March 1920, and *Pittsburgh Press*, 21 March 1920; "Flier Tells Plan For Rocket Trip," *Boston Sunday Advertiser*, 21 March 1920; "Asks For First Ride On Rocket To Moon," *New York World*, 21 Sept. 1920; "Capt. Fitzgerald," *Billboard* (New York), Vol. 1, May 1920, p. 63; "Nine Eager To Ride On Rocket To Moon," *Boston Globe*, 4 April 1920; "Want Ride On Rocket Up To Moon," *Boston Post*, 26 Sept. 1921; Lehman, p. 110; "N.Y. Air Cop Wants First Trip To Moon In Rocket," *Times* (Washington, DC), 21 Sept. 1920.

³² An insight into Goddard's relations with the press at the time is found in the *Boston Herald* of 14 Jan. 1920. "In self-defense," said Goddard, "I have to fight shy of the newspaper men." There was not only a great danger of "being misunderstood," he explained, "but my inventions are being perfected under the supervision of the Smithsonian Institution..." The latter, however, was not entirely true but the rationale served Goddard's purpose. In truth, the Smithsonian did expect and received regular reports of his technical progress but otherwise Goddard was under free reign to undertake the work and received no *direct* Smithsonian technical assistance. Similarly, throughout his career he had assistants but never revealed his overall plans and had them sign oaths, if they left, never to reveal details.

"Prof. Goddard Talks of Device To Hit The Moon," *Boston Herald*, 14 Jan. 1920.

³³ "Moon Pictures Not Yet Certain, Goddard Says," *Philadelphia Record*, 19 Jan. 1920; "Goddard Plans Rocket To Snap 'Sky High' Views," *Boston Traveler*, 19 Jan. 1920; "Wishes To Explore Sky," *Boston Advertiser*, 19 Jan. 1920; RHG, *The Papers*, Vol. I, pp. 409-410.

³⁴ "Live Ad Manager Seeks Space on Moon Rocket; More Volunteers For Ride," unknown newspaper, ca. April 1920, in Scrapbook of Robert H. Goddard, Manuscript Reading Room Library of Congress; RHG, *The Papers*, Vol. I, p. 433; "Want Ride On Rocket Up To Moon," *Boston Post*, 26 Sept. 1921; "Nine Willing To Go To Moon In Rocket," *Gazette* (Little Rock, Arkansas), 4 April 1920; "Moon's Beams Would Cremate Human Rocket," *Milwaukee Journal*, 4 April 1920; "1st Man To Moon Must Be Of Iron," *St. Paul News* (St. Paul,

Minn.), 4 April 1920, and other papers including the *Milwaukee Sentinel*, *Springfield Register*, *Minneapolis Journal*, and the *Star* (Lincoln, Neb.); "Seek Moon Trip Fund In Chicago," *Chicago Herald and Examiner*, 3 April 1920.

³⁵ Program, National Academy of Sciences, Annual Meeting, April 26, 27, 28, 1920," in Scrapbook, op. cit.; RHG, *The Papers*, Vol. I, pp. 437–438; "Captain Barred From Flight to Moon," *Boston American*, 22 Sept. 1920; "Can't Visit Moon Now," *New York World*, 22 Sept. 1920; "Moon Rocket" Inventor Deplores Publicity," *New York Evening Telegraph*, 27 Jan. 1921 and *Brooklyn Times*, 27 Jan. 1921.

³⁶ The foregoing ad proposal was apparently the one from the outdoor advertising firm of Hurd and Reidy of Elgin, Illinois, cited by Macinnis, who had asked Goddard "to secure space for a suitable ad." The Moon automobile company was started by Joseph W. Moon in 1905 and Moon cars were still being made in 1920 but by 1931 had gone out of business. In 1921, there was apparently an insurance company that used a Goddard-inspired rocket cartoon in its advertising. The author also examined *Toys and Playthings*, a leading U.S. toy business trade journal, for 1920 to see if there were any toy "spin-offs" from the Goddard phenomenon, but without results. All the above is not to say that there were no later efforts to commercialize Goddard. One notable example was the pack of cigarettes allegedly made by a German company in the late 1920s that contained collectors' cards, one of which depicted Goddard by a test or launching stand. This card was discovered at that time by Arthur Rudolph, then a young student and avid rocket enthusiast. The card, recalled Rudolph, "...was most interesting, and this even enthused me more to try to get into the rocket field than...before..." Years later, Rudolph became manager of the Saturn V program that took men to the Moon.

Copy, telegram, Mark Larkin, Mary Pickford Studio, 13 Jan. 1920, in R.H. Goddard Scrapbook, loc. cit.; "Live Ad Manager," op. cit.; Letter, Bronx Exposition, Inc. to R. H. Goddard, 12 Jan. 1920, in R. H. Goddard Collection, Clark University, Worcester, Mass.; Letter, H. R. Beale, Manager, Massachusetts Motors, Inc, to Nahum D. Goddard, 13 April 1920, in Robert H. Goddard Collection, op. cit.; <http://www.ktsmotorsportsgarage.com/quiz/quiz8.html>; Insurance company cartoon, unnamed, R. H. Goddard Scrapbook; Macinnis, *Rockets*, p. 173; Interview, Arthur Rudolph by Dr. Michael Neufeld, 4 Aug. 1989, copy of partial transcription in "Arthur Rudolph" file, National Air and Space Museum, Washington, DC.

³⁷ Both *Poole's* and *Reader's Guide* are standard references available in city or university libraries.

Goddard already had a letter published in *Science* for 6 Feb. 1920 in their Discussion in Correspondence section, under the title, "On High-Altitude Research," in which he expressed his exasperation with the press, especially with their incessant distortions. "I am beginning to appreciate the difficulty of making oneself understood....," he began. "...The present statement is written for the purpose of correcting any misconceptions that may have arisen from my recent press statement..."

"To Reach the Moon!" *Leslie's Weekly*, (New York), Vol. CXXX, 14 Feb. 1920, p. 184; "The Exploring Rocket—The Missile That Could Be Shot to the Moon, and Its True Purpose," *Scientific American*, Vol. 122, 14 Feb. 1920, p. 161; "A Rocket That Will Carry To The Moon," *Scientific American Monthly* (New York), Vol. I, Feb. 1920, pp. 99–107; R. H. Goddard, "On High-Altitude Research," *Science* (Lancaster, Pa.), Vol. LI, 6 Feb. 1920, pp. 141–142, reprinted in RHG, *The Papers*, Vol. I, pp. 412–413.

³⁸ The article "Can We Visit the Planets?" by Hugo Gernsback, in *Electrical Experimenter* (New York), Vol. VIII, April 1921, pp. 1290–1292, 1355, is a survey of several proposed methods (including one by Gernsback himself) for accomplishing "space flying," as Gernsback phrased it. Goddard was included as the "latest newcomer in space flying" with "his now famous Moon rocket." Included in the article are scenes (sketches) from the film "All Aboard for the Moon," discussed below. It is significant that the rocket has a sign by it

reading "Skyrocket to the Moon." Clearly, the concept of a space rocket was so novel that the terminology "skyrocket" was adapted directly from the centuries-old firework usage. The second picture shows the interior of the rocket, with passenger chairs.

Science and Invention in its issue of Aug. 1920, included a photo of Goddard, titled "From the Inventor of the Moon Rocket," in which he made a brief testimonial on the name change of the magazine from *Electrical Experimenter* to *Science and Invention*. This was one of several testimonials that included Thomas Edison and Lee D. Forest, in answer to the enquiry, "What Prominent Men Think of Our New Name." It is interesting to note that the article "The Goddard Moon Rocket" in the *Electrical Experimenter* for Feb. 1920 echoed what had been observed in the articles in *Leslie's* and *Scientific American*, that "Dr. Goddard did NOT [*sic*] start out to build a machine to fly to the Moon...The idea of the Professor's rocket landing on the Moon was only incidental..."

"The Goddard Moon Rocket—Special Authorized Interview with the Inventor," *Electrical Experimenter* (New York), Vol. 7, Feb. 1920, pp. 986–988, 1048; "A Rocket That May Reach The Moon," *The Monthly Evening Sky Map* (New York), Vol. XIV, Feb. 1920; H. Gernsback, Editorial, "The Moon Rocket," *Electrical Experimenter* (New York), Vol. VII, March 1920; "Rockets To Explorer Space," *Literary Digest* (New York), Vol. 64, March 1920, pp. 28–29; "Goddard Rockets To Take Pictures," *The Monthly Evening Sky Map*, Vol. XIV, March 1920; "Passengers For The Rocket To The Moon or Mars?" *The Monthly Evening Sky Map*, Vol. XIV, March 1920; "Rockets May Explore Ether," *Popular Mechanics*, Vol. 33, March 1920, pp. 324–327; Robert H. Goddard, "The Rocket Method," *The Journal of the Worcester Polytechnic Institute* (Worcester, Mass.), Vol. XXIII, April 1920, pp. 211–224; "Skyrocketing to the Moon," *Illustrated World* (Chicago), Vol. 33, April 1920, p. 236; "Meteorological Apparatus for Use with the Goddard Rocket" in *Monthly Weather Review* (U.S. Dept. of Agriculture, Washington, DC), Vol. 48, June 1920, pp. 321–322; E. F. Richards, "Hitting the Moon with a Rocket," *Popular Science Monthly* (New York), Vol. 96, April 1920, pp. 84–85; "First Test in July in Plan to Shoot Rocket at the Moon," *The Monthly Evening Sky Map*, Vol. XIV, June 1920, Robert F. Moulton, "Let's Go to the Moon," *Independent* (New York), 5 June 1920, p. 330; Robert H. Goddard, "The Possibilities of the Rocket in Weather Forecasting," *Proceedings of the National Academy of Sciences* (Washington, DC), Vol. 6, Aug. 1920, pp. 493–495; R. H. Goddard, "That Moon Rocket Proposition," *Scientific American* (New York), Vol. 124, 26 Feb. 1921, p. 166; "From the Inventor of the Moon Rocket," *Science and Invention*, Vol. VIII, Aug. 1920, p. 385.

³⁹ The foreign articles include: "New Rocket Invented," *Sydney Morning Herald* (Sydney), 14 Jan. 1920, p. 11; "A Rocket To Explore The Upper Air," *Halifax Chronicle Herald* (Halifax, N.S., Canada), 13 Jan. 1920, p. 11; "Weather Forecast Will Be Aided By Air Exploration," *The Gazette* (Montreal), 16 Jan. 1920, p. 13; "Plan To Fire Rocket At Moon Interests Weather Bureau Men," *Ottawa Citizen* (Ottawa), 17 Jan. 1920, p. 1; "Invents A Rocket That May Hit Moon," *Toronto Globe* (Toronto), 13 Jan. 1920, p. 11; "Rocket To Ascend Far Above Earth," *Daily Colonist* (Victoria, British Columbia, Canada), 13 Jan. 1920, p. 2; "Says Rocket Cannot Be Shot To Moon," *Ottawa Citizen* (Ottawa), 20 Jan. 1920, p. 2; [caption, above photo of Goddard, "Professor Who Says His Rocket Can Hit The Moon After Four Days' Flight," more text below picture], *Montreal Star* (Montreal), 21 Jan. 1920, p. 1; "A Rocket To The Moon" ["From our correspondent," in New York], *The Times* (London), 13 Jan. 1920, p. 11; "Rocket, High Power, Inventor Demonstration Announced," *The Times* (London), 8 April 1921, p. 10; "Prof. Goddard's Proposed Attempt to Reach Moon by Means of Gigantic Rocket, Postponed," *The Times* (London), 8 April 1921, p. 10; "Hitting The Man In The Moon," *London Daily Mail* (London), 14 Jan. 1920; "Rocket To Pierce Upper Air Layers May Reach Moon," *New York Herald Tribune* (Paris, European edition), 13 Jan. 1920, p. 1; "De la Terre à la Lune—M. Esnault-Pelterie croit qu'il n'est pas aisé d'aller dans la Lune," *The New York Herald Tribune* (Paris, European edition), 17 Jan. 1920; "French Savant Doubtful About Rocket To Moon," *New York Herald Tribune*, Paris,

European edition), p. 5; "U.S. Professor Will Take A Long Shot At The Moon," *Chicago Tribune* (Paris edition), 14 Jan. 1920, p. 4; "Eon vuurpij naar da maan," *Neue Amsterdamse Courant* (Amsterdam), 15 Jan. 1920, p. 2; "A Professor's Rocket," *The Evening Post* (Wellington, New Zealand), 13 Jan. 1920, p. 7; "Rocket To Reach The Moon?" *Rand Daily Mail* (Johannesburg, South Africa), 17 Jan. 1920, p. 9; "De la Tierra a la Luna-Nuevo aparato explorador del aire," *El Sol* (Madrid), 16 Jan. 1920, p. 9; Pio Emanuelli, "Nel mondo della luna-In America si parla di un viaggio nel nostro satellite," *Corriere d'Italia* (Rome?), 13 June 1920; *RHG Papers*, Vol. I, p. 460.

⁴⁰ See, for example, back note 79.

RHG, *The Papers*, Vol. I, p. 485; "Eine Rakete nach dem Monde," *Wiener Bilder* (Vienna), 8 Feb. 1920, p. 9; Asif Siddiqi, "Deep Impact: Robert Goddard and the Soviet 'Space Fad' of the 1920s," *History and Technology*, Vol. 20, June 2004, pp. 98–99, 109.

⁴¹ The writer would be extremely grateful for finds of any additional articles on Goddard from non-U.S. newspapers and magazines, especially dating to the early 1920s and on *A Method* and/or his supposed Moon or Mars rocket. For a translation of a letter sent to Goddard from Khartoum, Sudan, in 1922 from a volunteer who wished to go to the Moon, see Macinnis, *Rockets*, pp. 173–174. In the Goddard scrapbooks are overseas clippings from a later period. Among these are: the *Imparcial* (Montevideo, Uruguay), 21 Nov. 1925; *Lokal Anzeiger* (Berlin), 21 Nov. 1925; *The Standard* (Bridgetown, Barbados), 25 Nov. 1925; *Panama Gazette Straits*, 8 July 1926; *The Leader* (Peking [Beijing], China), 18 July 1926; *Neue Freie Presse* (Vienna), 28 Aug. 1926; *Cork Examiner* (Cork, Ireland), 18 Aug. 1926; *The Pioneer* (Alahamabad, India), 13 Sept. 1926; *Prager Abendblatt* (Prague), 11 Nov. 1926; *South Pacific Mail* (Valpariso, Chile), 11 Nov. 1928; *Vart Hem* (Stockholm), 20 Nov. 1929; *Stockholms-Tidningen* (Stockholm), 9 March 1930; *North China Star* (Peking), 9 July 1930; and *Pester Lloyd* (Budapest), 22 Aug. 1930. Among the overseas letters Goddard received over the years, many, although not all of them from "volunteers," were those from Czechoslovakia, Finland, Switzerland, The Netherlands, The Philippines, Italy, Austria, Russia, and Australia.

News of Goddard's "Moon rocket" continued to generate enormous interest in Russia. Goddard even received letters from volunteers from that country. An unprecedented, heated three-day lecture on interplanetary flight was also held in Moscow in Oct. 1924 that included the Russian "cosmonautics" pioneer Friedrich Tsander, following a rumor that Goddard had already launched a rocket to the Moon. Later, Goddard was prominently featured, by models and other materials, as part of the First World Exhibition of Interplanetary Machines and Mechanisms held in Moscow from April-June 1927. For Goddard's overall effect on the space movement in Russia, consult, Asif Siddiqi, "Deep Impact: Robert Goddard and the Soviet 'Space Fad' of the 1920s," in *Technology and History*, Vol. 20, June 2004, pp. 97–113. For the 1924 lecture above, see also, Frank H. Winter, *Prelude to the Space Age—The Rocket Societies: 1924–1940* (Smithsonian Institution Press: Washington, DC, 1983), p. 28.

⁴² "Says Rocket Cannot Be Shot," op. cit.; "Plan To Fire Rocket," op. cit.

⁴³ "Hitting The Man In The Moon," op. cit.; *Národní Politika* (Prague), afternoon issue, 29 Jan. 1920, p. 3; *Československa Republika* (Prague), for 15 April 1920, p. 10; *Lidove Noviny* (Prague), 7 July 1920, p. 2.

⁴⁴ For an account of REP's contributions to astronautics and later rocketry see, "Robert Esnault-Pelterie: Space Pioneer," by Lise Blosset, in Frederick C. Durant III and George S. James, eds., *First Steps Toward Space* (Smithsonian Institution Press: Washington, DC, 1974), pp. 5–31 [republished as *First Steps Toward Space* (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 1986), AAS History Series, Vol. 6]. A more recent, full-length biography of REP has also appeared, Félix Torres and Jacques Vilain, *Robert Esnault-Pelterie du ciel aux étoiles, le génie solitaire* (Éditions Confluences;

[Bordeaux], 2007). REP had been carrying out his theoretical researches on “intersidereal navigation” (literally, “interstellar flight”) since 1908, although this term was forgivably inaccurate. As for his activities in Russia, he had been in the country earlier and was presenting lectures (presumably on aviation) in St. Petersburg at least from 1909 before the Army and Navy Club and also the Academy of Military Engineers. For these lectures, he was decorated by the Tsar. See “Esnault-Pelterie Teaching in Russia,” *Flight* (London), Vol. 1, 3 April 1909, p. 198.

Blosset, p. 9; Robert Esnault-Pelterie, “La Navigation intersidérale or astronautique,” *L’Aérophile* (Paris), Année 36, 1–15 March 1928, p. 67.

⁴⁵ The story on REP’s response in the *Herald* was picked up and repeated in the respected *Bulletin de la Société Astronomique de France*. “French Savant,” op. cit.; “De la Terre à la Lune, op. cit.; “Pour aller dans la Lune,” *Bulletin de la Société Astronomique de France* (Paris), 34 Année (1920), pp. 42–43.

⁴⁶ For details on the history of the creation of the word “astronautics,” see Frank H. Winter, *Prelude to the Space Age The Rocket Societies: 1924–1940* (Smithsonian Institution Press: Washington, DC, 1983), pp. 13, 25.

RHG, *The Papers*, Vol. I, pp. 24, 432, 436–437, 442, 445, 448–450, 642–647, 651, 686, 706–707, 737, 780, 863–864, 931, 938, 940, 947, 999; Blosset, pp. 11, 19.

⁴⁷ REP’s 1912 lecture on spaceflight and his 1913 published paper did not receive any wide public attention as did Goddard’s *A Method*, even though REP himself was internationally known in the world of aviation. His fame in astronautics was really started with his lecture on 8 June 1927, “L’exploration par fusées de la très haute atmosphère et la possibilité des voyages interplanétaires” (“The Exploration of the Very High Atmosphere by Rockets and the Possibility of Interplanetary Voyages”). This was followed by other lectures and articles like “La Navigation intersidérale or astronautique,” cited above, and his “Astronautique et relativité,” *L’Aérophile* (Paris), 37e année, 1–5 May 1929, p. 135. For examples of U.S. coverage of REP from ca. 1927, see *NYT* 25 Nov. 1928; *New York American*, 2 Dec. 1928; *NYT*, 18 May 1930; *Newark Ledger* (Newark, N.J.), 12 Jan. 1931; *Herald Tribune* (N.Y.), 16 Jan. 1931; *New York Sun* 16 Jan. 1931; *Newark Star-Bugle*, 26 Jan. 1931; and *NYT*, 28 Jan. 1931. Mostly, from the early 1920s, Brockett’s *Bibliography of Aeronautics*, cited above, are articles about his drawn-out legal suit for claims on his airplane “joy stick” invention. See, for example, “The R.E.P. Litigation in France,” *Flight* (London), Vol. 12, 12 Aug. 1920, p. 878, and “L’affaire Esnault-Pelterie en Cour d’Appel,” *L’Aérophile* 30e année, 1–15 Nov. 1922, p. 339.

Blosset, p. 19.

⁴⁸ For the negative remarks on Goddard’s “shooting at the Moon” that Prof. A. W. Bickerton of Canterbury College, New Zealand, allegedly made in 1926, see Macinnis, *Rockets*, pp. 161–162, and Cerf and Navasky, *The Experts Speak*, p. 258. As pointed out by Macinnis, an examination of Prof. Bickerton’s career makes the remarks “a little suspect.” (Bickerton, he contends, retired in 1902, left New Zealand in 1914, and was 84 in 1926.) However, Bickerton may have made his negative statement earlier, in ca. 1920–1921—even if he had left New Zealand.

Macinnis, *Rockets*, pp. 161–162; Christopher Cerf and Victor Navasky. *The Experts Speak The Definitive Compendium of Authoritative Misinformation* (Pantheon Books: New York, 1984), p. 258.

⁴⁹ It should also be noted that according to a “Publisher’s Announcement” in the *Electrical Experimenter*, for July 1920, that journal had a circulation of 200,000 copies per month and the magazine also “reaches every land of the globe...Our articles are being translated constantly into French, German, Italian, Spanish, Japanese, Dutch and even Arabian [Arabic].”

Flight (London), Vol. 12, 15 Jan. 1920, p. 80; *Flight*, Vol. 12, 19 Feb. 1920, p. 214; "Publisher's Announcement," *Electrical Experimenter*, Vol. VIII, July 1920, p. 279.

⁵⁰ *Bulletin de la Société Astronomique de France*, 35 Année (1921), p. 84; *Bulletin de la Société Astronomique de France*, 36 Année (1922), pp. 203–204; *Bulletin Astronomique* (Paris), 2nd Series, 2nd Pt., T. II, Jan.–March 1920, p. 117.

⁵¹ Georges Houard, "De la Terre a la Lune," *Je Sais Tout* (Paris), 16 Année, June 1920, pp. 654–657; RHG, *The Papers*, Vol. I, pp. 233–295, et. seq.; Ley, *Rockets, Missiles*, pp. 406–407.

⁵² Robert H. Goddard, "A Method of Reaching Extreme Altitudes," *Nature* (London), Vol. 105, 26 Aug. 1920, pp. 809–811; RHG, *The Papers*, Vol. III, p. 1649.

⁵³ George F. Morrell, "Bombing The Moon By Rocket," *The Graphic* (London), Vol. 102, 20 Nov. 1920, p.

⁵⁴ RHG, *The Papers*, Vol. I, pp. 461–463; "Says Goddard Rocket Has No Chance to Reach Moon," *New York World*, 28 Dec. 1920; and also in *Worcester Gazette*, 28 Dec. 1921, *Courier Journal* (Louisville, Ky.), 2 Jan. 1921, and *Globe* (New York), 11 Feb. 1921; "Goddard's Rocket Is Not Practical," *Worcester Post*, about the same date; "Prof. Goddard Answers the London Graphic, Says His Moon Rocket Would Not Explode on Way," with accompanying cartoon, *Worcester Telegram*, 30 Dec. 1920; G. F. Morrell, "Can We Reach The Moon?" *The Graphic*, Vol. 103, 5 March 1921, p. 281; [Robert H. Goddard], "Can The Moon Be Reached by Rocket," *The Graphic*, Vol. 103, 5 March 1921, p. 282.

⁵⁵ "Robert H. Goddard. A Method of Reaching Extreme Altitudes," *Physikalische Berichte* (Braunschweig), 1. Jahrg., 1 Dec. 1920, pp. 1479–1480.

⁵⁶ *La Nature* was established in 1873 and this was the first time any article had appeared in the journal conveying the idea of the space rocket. The article alluded to an earlier, excellent article on rockets in the same journal, titled "Les Fusées Lumineuses et les Artifices de Guerre" by R. Levatel, in the issue for 18 May 1918, pp. 305–308, and covered the application of gunpowder rockets as signaling devices used during World War I. Signaling was then, the most prominent application of the rocket besides fireworks.

Goddard was not the first to conceive the multistage rocket. Examples of this arrangement, although strictly for amusement purposes, may be found in the firework literature back to the 16th and 17th centuries. See Elie Carafoli and Mihai Nita, "Romanian Rocketry in the 16th century," in R. Cargill Hall, ed., *Essays on the History of Rocketry and Astronautics: Proceedings of the Third Through the Sixth History Symposia of the International Academy of Astronautics* (Scientific and Technical Information Office, NASA: Washington, DC, 1977), NASA Conference Publication 2014, pp. 3–8 [republished as *History of Rocketry and Astronautics* (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 1986), AAS History Series, Vol. 7]. Even so, the Frenchman, Dr. André Bing, took out a Belgian patent on 10 June 1911 for a multistage rocket for upper atmospheric and possibly space exploration purposes, although this fact was quite unknown at the time and was only later discovered by REP. See, Blosset, pp. 8–9. It remained unknown to Goddard. The gyroscope in a rocket was not new either and was used in the camera rockets of the German Alfred Maul in the early 1900s. See, Ley, *Rockets, Missiles*, pp. 106–106. Goddard may certainly be credited with the idea of adapting the de Laval nozzle to the space rocket—in the West—as Tsiolkovsky appears to have preceded him with a form of nozzle, although a non de Laval type, in his 1903 paper. See K. E. Tsiolkovsky, *Works on Rocket technology* (National Aeronautics and Space Administration: Washington, DC, 1965), NASA TT F-243, p. 29. Also, Goddard clearly was the first to work out the mathematics of the rocket nozzle and was unquestionably the first to experiment with and regularly use rocket nozzles.

R. Villers, "Vers les Confins de l'Atmosphere—La fusée Goddard," *La Nature* (Paris), 49 Année, 14 May 1921, pp. 310–313.

⁵⁷ To the European coverage may be added an article by A. M. Repetto in the Italian popular scientific journal *Scienze per Tutti* for Oct. 1921, as cited by Luigi Gussalli in his *Si può già tentare un viaggio dalla terra all Luna?* (Società Editrice Libreria: Milan, 1923), p. 4, but this journal is not available to the author.

"De la Terre la Lune: L' 'Obus-fusée' du Docteur Américain Goddard," *Le Science et Vie* (Paris), Jan. 1922, p. 58.

⁵⁸ The sources used to find the titles listed here were many. The main ones include Howard Lamarr Walls, *Motion Pictures 1894–1912—Identified from the Records of [the] United States Copyright Office* (Copyright Office, Library of Congress: Washington, DC, 1953; *Catalog of Copyright Entries—Motion Pictures 1912–1939* ([U.S.] Copyright Office, Library of Congress: Washington, DC, 1951); Ronald S. Magliozzi, *Treasures from the Film Archives: a Catalog of Short Silent Fiction Films Held by FIAF Archives* (The Scarecrow Press, Inc.: Metuchen, N.J. and London, 1988); Walt Lee, compiler, *Reference Guide to Fantastic Films* (Chelsea—Lee Books: Los Angeles, 1972, 3 vols., and similar directories; as well as histories of science fiction and other films; and volumes of the earliest film magazines like *Moving Picture World*, *Motion Picture News*, and *Bioscope*. See also, "L'Astronomie au Cinema," in *La Nature* (Paris), Année 48, 16 Oct. 1920, for some coverage on the educational film, *Les Mystères du Ciel* (1920). For a lengthy review of *A Trip to Mars* (W. H. Productions, 1920), see *Moving Picture World*, Vol. 44, 29 May 1920, p. 1236. Through the collections of the Library of Congress, available films were viewed by the author. Other early "space" films have been discovered but lack details. For example, the German film "*Fahrt in den Weltraum*" ("*Travel into Space*") played in Austria by Oct. 1925, as briefly described in *Dokumentation zur Österreichischen Zeitgeschichte 1918–1928* (Jugend und Volk—Wien München: Vienna [and] Munich, 1984), p. 395. Thus far, this is all that has been found on this film. For this find, the author once more thanks Bruno Besser. For another unknown early German space film, set in the year A.D. 3929, and produced in 1929, see *Popular Science Monthly*, Vol. 115, Aug. 1929, p. 68. For mention of a brief scene of a scientist flying to Mars via a rocket, in *Bull and Sand*, a Mack Sennett comedy of 1924, see the *Los Angeles Times*, 8 Oct. 1924, p. C13.

The earliest known film about a rocket is titled "*The Effects of a Rocket*" and was produced in 1911 by Italia of Italy. However, it did not involve spaceflight. It was about mischievous boys placing a skyrocket (firework) in the coattails of a man reading a newspaper on a park bench. The rocket made the man jump up and demolish everything in his path while the rocket landed on a roof. This basic plot is found in *The Bioscope* (London), Vol. XIII, 26 Oct. 1911, p. xi.

Some of the early films that do exist, such as "*Rêve a la Lune*," Pathé, 1905, are extreme rarities and found in the National Film and Television Archive, London, and the Österreichisches Filmmuseum, Vienna, and similar special film archives and are therefore not readily accessible to the author.

⁵⁹ "A Trip to the Moon," *Motion Picture News*, Vol. XXI, 14 Feb. 1920, p. 1667; "New York—Strand Theatre," *Motion Picture News*, p. 1673; "The High Lights of Broadway," *Motion Picture News*, p. 1667.

⁶⁰ The magazine *Popular Science Monthly* did publish an article on Goddard rockets, "Hitting the Moon with a Rocket," in the April 1920 issue, cited above, but it did not contain any scenes from the film "*All Aboard for the Moon*" nor any reference to the film.

"Bray Has a New Theory of Getting to the Moon," *The Moving Picture World*, Vol. 43, 7 Feb. 1920, p. 909; RHG, *The Papers*, Vol. II, pp. 819–820; Terry A. Bragg, compiler, *Register to the Papers of Robert H. and Esther C. Goddard* (Special Collections, Robert H. Goddard Library: Worcester, Mass., [1980], n.p.

- ⁶¹ Goddard, "The Rocket Method," p. 212; *Program of The Eighty-Fifth Meeting of the Eastern Association of Physics Teachers at the High School of Commerce Boston, Massachusetts Saturday, March 20, 1920*, [p. 2], in R. H. Goddard, Scrapbook; RHG, *The Papers*, Vol. I, p. 431; R. H. Goddard, Diary, entry for 20 March 1920, Special Collections, Robert H. Goddard Library, Clark University, Worcester, Mass.
- ⁶² The use of radium, the calculated necessary horsepower, and other details did come from *Popular Science Monthly*, from the article titled "Hurling a Man to the Moon," in the issue of April 1919, from information furnished by REP (see back note 80). However, this does not detract from the fact that the film was still produced as a result of the release of *A Method* and played a strong role in publicizing Goddard as described below.
- "Bray Has a New Theory."
- ⁶³ Despite the success, the film was not copyrighted until 1 June 1924, leading some to infer that it was released until that year. A copy of this rare film can be found in the National Film and Television Archive, London. Examples of scenes from "*All Aboard*," from the "Bray Pictograph Studios" appearing in articles on Goddard's rockets are: "A Trip to the Moon," in *The Independent*, 31 Jan. 1920; "Skyrocketing to the Moon," repeated in the *Tribune* (Providence, R.I.), 25 April 1920, *Herald* (Rochester, N.Y.), same date, and the *News* (St. Paul, Minn.), same date; and "A Long Shot to the Moon," *New York Times*, 3 Feb. 1921.
- RHG, *The Papers*, Vol. I, p. 819; Ronald S. Magliozzi, *Treasures from the Film Archives: A Catalog of Short Silent Fiction Films Held by FIAF Archives* (The Scarecrow Press, Inc.: Metuchen, NJ, and London, 1988), p. 452; A. W. Strickland and Forrest J. Ackerman, *Reference Guide to American Science Fiction Films* (T.I.S. Publications: Bloomington, Indiana, 1981), Vol. I, p. 271; Notes, on interview with Paul Bray, Jr., by Frank H. Winter, 20 Oct. 1980, in author's private collection.
- ⁶⁴ For coverage of Bray's career and contributions to the motion picture industry, see Anthony Slide, *The American Film Industry* (Greenwood Press: New York, 1986), p. 48; David Craf-ton, *Before Mickey—The Animated Film 1898–1928* (The University of Chicago Press: Chicago and London), 1982, 1993), pp. 139, 160–161; and "Grandfather of the Film Cartoon Is Honored Here at 96," *New York Times*, 26 Aug. 1975. In Aug. 1919, Samuel Goldwyn took over the distribution of Goldwyn–Bray Pictograph films, which included "*All Aboard*." See, "Goldwyn Has Controlling Interest in the Bray Pictures Corporation," *Moving Picture World*, Vol. 43, 7 Feb. 1920, p. 867. For mention of the film *Signalling to Mars*, see ad in *Motion Picture Age*, Oct. 1919, n.p., in Scrapbook, 1919–1922, Bray Studios, L-050, Library of Congress [in Division of Motion Pictures and Recorded Sound]. Besides *Hello Mars* possibly being a re-make or re-titled version of *Signalling to Mars*, some of Bray's other "space" or astronomy films may have also had title changes.
- ⁶⁵ Film copyright description, *First Man to the Moon* [and] *Lampoons*, Registration No. MP 1580, Library of Congress; Charles Frederick Carter, "Navigating Interstellar Space," *Science and Invention*, Vol. 10, Feb. 1923, p. 952; Robert H. Goddard, "That Rocket To The Moon," *The Washington Post* (Washington, DC), 24 Nov. 1929; *Motion Picture News*, Vol. XXVI, 2 Dec. 1922, p. 2810, and 23 Dec. 1922, op. p. 719; *Motion Picture News Booking Guide* (Los Angeles, New York, and Chicago), Vol. IV, April 1923, p. 129; Letter, John R. Bray to R. H. Goddard, 22 Jan. 1932, Box 7, Robert H. Goddard Papers, Special Collections, Robert H. Goddard Library, Clark University, Worcester, Mass.; RHG, *The Papers*, Vol. II, pp. 819–820.
- ⁶⁶ It is of great interest that an earlier version of the same Tom Mix publicity picture shows Mix, using the same saddle, but riding a horse to the Moon. Obviously, an alert and brilliant film publicist seized on the rocket idea and quickly *substituted* the horse for the rocket!
- Press Kit, "*Chasing the Moon*," (William Fox [Studios], 1922), in Theatre Collection, Lincoln Center for the Performing Arts, New York Public Library; "*Chasing the Moon*," *Mo-*

tion *Picture News*, Vol. 25, 18 Feb. 1922, p. 1157; *Motion Picture News Booking Guide*, Vol. II, April 1922, p. 19; "Fox Anniversary Week Success," *Moving Picture World*, Vol. 25, 18 Feb. 1922, p. 1143.

⁶⁷ Titles of songs and other data derived from card catalog of the U.S. Copyright Office, Library of Congress, Washington, DC; RHG Scrapbook, op. cit.; Music sheet, Walter Rolfe, *The Moon Rocket March for the Pianoforte* (Theodore Presser Co.: Philadelphia, copyright 1924, published 1925), copy courtesy University of Houston Libraries. See also, Frank H. Winter, "Ye Olde Space Music," in *Starlog* (New York), No. 36, July 1980, pp. 84–87.

⁶⁸ Ron Miller, "Speculative Spacecraft—1610–1957," paper, IAA-87-667, in *History of Rocketry and Astronautics*, Lloyd H. Cornett, Jr., Editor (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 1993), AAS History Series, Vol. 15, pp. 115–136 (paper presented at the 38th International Astronautical Congress, Brighton, United Kingdom, 10–17 October 1987, p. 2); Ron Miller, *The Dream Machines A Pictorial History of the Spaceship in Art, Science and Literature* (Krieger Publishing Co.: Malabar, Florida, 1993), pp. 12–14, 82; Everett F. Bleiler, *Science Fiction The Early Years* (Kent State University Press: Kent, Ohio, and London, England, 1990), p. 179.

⁶⁹ It is well known that Verne's spaceflight and other novels were considered the true beginnings of modern science fiction because of their realism and were another great influence on Goddard. Throughout his life, Goddard read the space novels several times. But he did not immediately grasp the significance of the use of rockets probably because they had not advanced at all technologically and were exactly in the same class as they were in Cyrano's time—simple fireworks. It took Goddard years of theorizing and calculating before it dawned on him that the rocket could also serve as the *main* propulsion, but required greater technological development, which he would give it.

Jules Verne, *From the Earth to the Moon...And A Trip Round It* (Scribner, Armstrong and Co.: New York, 1874), pp. 223, 293–294.

⁷⁰ Bleiler's compendium is ideal for conducting a survey since it includes multiple indexes including an invaluable subjective one that classifies many elements of the 3,000 + stories such as "Propulsion." This category is further broken down into subcategories as "Rockets." Originally, it was believed by rocketry and spaceflight historians that Eyraud's *Voyage à Venus* of 1865 was the first novel to feature the rocket (or rather, reaction propulsion) as the principle mode of propulsion for spaceflight—even if Eyraud's understanding of reaction propulsion was faulty. But Miller since discovered that the American Elbert Perce's *Gulliver Joi* of 1852 preceded him.

Miller, *The Dream Machines*, pp. 43, 54; Miller, "Speculative Spacecraft," p. 3; Bleiler, pp. 591–592; Ley, *Rockets, Missiles*, pp. 39, 99; Wernher von Braun and Frederick I. Ordway, III, *History of Rocketry and Space Travel* (Thomas Y. Crowell Co.: New York, 1966, 1969), p. 17; Elbert Perce, *Gulliver Joi* (Charles Scribner: New York, 1852), p. 32.

⁷¹ To the rocket-propelled terrestrial flying machines may possibly be added one featured in a so-called "dime novel," a form of early American comic magazine, notably the *Pluck and Luck* issue titled *The Rocket; or Adventures in the Air*, by Allyn Draper (a pseudonym), No. 76 for 15 Nov. 1899. However, the front page caption reads: "The Rocket mounted up in the air, and soared away. 'Good-bye,' cried Harry. 'Tell the justice I'll report next year for sentence. I live in the Moon.' The three men [on the ground] were dumfounded." On the other hand, the picture of the craft does not show a rocket propulsion but a multi-propeller driven machine.

Like John Munro, Train and Woods, in their story of 1916–1917, also mention the rocket for spaceflight, but then dismiss it. See, *Cosmopolitan*, Vol. 62, Feb. 1917, p. 160.

⁷² Bleiler, pp. 128, 304, 371, 623, 641, 670, 746, 748–749; Miller, *The Dream Machines*, pp. 83, 117–118; Miller, “Speculative,” p. 6; John Clute and Peter Nicholls, eds. *The Encyclopedia of Science Fiction* (St. Martin’s Press: New York, 1993), p. 838.

⁷³ Tsiolkovsky’s unpublished (at the time) fiction, appearing only as manuscripts at this stage, is not included in this survey. Bleiler, pp. 747–749.

⁷⁴ The first part of *Vne zemli* also appeared earlier, in the journal *Piroda i lyudi* in 1916, according to Miller. Miller, *Dream Machines*, p. 115.

⁷⁵ The figures given here are only for those stories found in Bleiler’s compendium and could be expanded. Another example of the popularity of the anti-gravity technique for conveying the idea of interplanetary flight in popular culture is found in early spaceflight simulation shows like the Trip to the Moon attraction at the Pan-American Exposition in 1901. This show was later transplanted as a long-time attraction at New York City’s Coney Island amusement parks. See Frank H. Winter, “The ‘Trip to the Moon’ and Other Early Spaceflight Simulation Shows ca. 1901–1915,” in Donald C. Elder, ed., *History of Rocketry and Astronautics*, AAS History Series, Vol. 23, IAA History Symposia, Vol. 15 (Published for the American Astronautical Society by Univelt, Inc.: San Diego, California, 2001), pp. 133–161. It may be argued that the anti-gravity approach was the simplest literary or show device to use since it really required no technical explanation nor depiction nor presentation of complicated machinery, and was magic-like and could be readily appreciated by all ages.

At least one science fiction story of this period, “Die Geschichte einer Mars-Expedition” by the engineer H. Langner of Berlin-Steglitz, Germany, in *Der Luftweg* (Berlin), Jahrg. 1921, 6 Oct. 1921, pp. 287–290, 20 Oct. 1921, pp. 298–300, and 3 Nov. 1921, pp. 309–312, does not specifically use the word “rocket” but strongly suggests it. This story says the fictional spacecraft used the “reaction principle” and accompanying pictures (drawings) show a rocket exhausts although depicts the additional aid of a propeller. It may be that at this early date, the potential power of the rocket for spaceflight was still not fully understood, but was just beginning to be appreciated.

There are any number of histories of the American science fiction magazine. See, for example, Sam Moskowitz, “The Growth of Science Fiction from 1900 to the Early 1950s,” in Frederick I. Ordway III and Randy Liebermann, eds., *Blueprint for Space Science Fiction to Science Fact* (Smithsonian Institution Press: Washington [DC] and London, 1992), pp. 69–82.

Bleiler, *passim*.

⁷⁶ As one piece of evidence that the influence of REP on early science fiction cannot be entirely discounted, even during *A Method* period, his radium-powered rocket is mentioned by name in the 1922 science fiction novel *Number 87* by Harrington Hext, a pseudonym for Eden Phillpotts. Nonetheless, more research is required into the science fiction literature of, say, the 1920–1923 period, to better detect Goddard’s own influence.

Bleiler, *passim*; Everett F. Bleiler, *Science Fiction—The Gernsback Years—A Complete Coverage of The Genre Magazines Amazing, Astounding, Wonder, and Others from 1926 Through 1936* (The Kent State University Press: Kent, Ohio, and London, England, 1998), *passim*, especially p. 684; Harrington Hext (Eden Phillpotts), *Number 87* (The MacMillan Co.: New York, 1922), pp. 232–233.

⁷⁷ As regards the sad early neglect of Tsiolkovsky, in his own country and elsewhere, Thomas in her *Men of Space*, similarly says there was a “marked dissimilarity [for Tsiolkovsky’s 1903 seminal article] to the furor caused by Dr. Robert H. Goddard’s first published report which touched on the possibility of lunar travel, *A Method of Reaching Extreme Altitudes*.”

Shirley Thomas, *Men of Space* (Philadelphia and New York: Chilton Co.), Vol. I, p. 106.

⁷⁸ The “Oberth Revolution” may be treated in a later IAF or other paper. As a kind of “preview” of the Oberth revolution, already on the release and circulation of his book to the United States by the latter part of 1923, Oberth’s name joined Goddard’s in U.S. press reports on rockets and space. In fact, from then on, Oberth assumed greater importance. According to one syndicated Associated Press report from Berlin that December, for example, “The suggestion of Professor Robert H. Goddard...for shooting a rocket to the Moon, attracted much attention in Germany some time ago. But a German engineer, Herr Oberth, has gone Dr. Goddard one better by discussing...actual plans for the construction of rockets he thinks would be capable of reaching the planets...Oberth would use either alcohol or hydrogen in a fluid state to be burned with [liquid] oxygen ...” Similarly, an earlier review in the British scientific journal *Nature*, for 23 Aug. 1924, observed: “Herr Oberth is more ambitious than Prof. Goddard; his object is to... send off a rocket large enough to hold human beings. For fuel he suggests liquid hydrogen and a mixture of water and alcohol...The author discusses...even physiological aspects of such a venture...” There thus became a pattern of comparison between Goddard and Oberth’s approaches.

Oberth was not an engineer, but a mathematics teacher. Technically, he was also not a German but was born in 1894 in Sibiu, Transylvania, then a part of the Austro-Hungarian Empire but by 1923 was part of Romania. Oberth’s parents were German and the family lived in a German enclave of Sibiu, known in German as Hermannstadt. He therefore considered himself German and eventually became a German citizen.

It was also in Dec. 1923 that the German journal *Himmelswelt* reviewed Oberth’s book. Goddard is mentioned too, but only because Oberth mentioned Goddard in his own book. In his postscript in *Die Rakete*, he had written that only after his work had been typeset did he become aware of Goddard’s *A Method*. Goddard, he noted, “was able to experiment...whereas I attempted mainly a theoretical treatment...For this reason, our works compliment each other.” Goddard, however, hardly saw Oberth’s book as complimentary and severely criticized Oberth at every available opportunity, mainly on perceived technical priorities. See, for example, RHG, *The Papers*, Vol. I, pp. 485–486, 497, 513–523, 545, 549–550, Vol. II, pp. 585, 616, 645, 702–703, 736, 798, 966, 1002, Vol. III, pp. 1534, 1549; and *Nature* (London), Vol. 114, 23 Aug. 1924, p. 270, a review of Oberth’s book, followed by Goddard’s criticism of it, 18 Oct. 1924, pp. 574–575. In essence, Goddard became extremely bitter on Oberth’s entry into the field of rocketry (and spaceflight) and his apparent encroachment on his territory.

K. E. Tsiolkovsky, *Raketa v kosmicheskoe prostranstvo* (1-ya Gosudarstvennaya Tipolitografiya: Kaluga [USSR]: 1924), forward; Thomas, *loc. cit.*

“German Engineer Would Shoot Rockets to Star,” *Times Advertiser* (Trenton, N.J.), 9 Dec. 1923, with same story under other titles in *Baltimore Sun*, *Republican* (Springfield, Mass.), *Washington Post* (Washington, DC), *Vindicator* (Youngstown, Ohio), *Commercial Tribune* (Cincinnati, Ohio), and other papers for the same date; “Rockets to reach Planetary Space,” *Nature* (London), Vol. 114, 23 Aug. 1924, p. 270; Robert H. Goddard, [Letter to the editor], “Rockets and High Altitude Research,” *Nature* (London), Vol. 114, 18 Oct. 1924, pp. 574–575.

⁷⁹ For the rocket societies, consult, Frank H. Winter, *Prelude to the Space Age—The Rocket Societies: 1924–1940* (Smithsonian Institution Press: Washington, DC, 1983). The publicity on Goddard did not cease after *A Method* had run its course in the papers. Rather, there were occasional stories on Goddard “about” to allegedly prepare his Moon rocket. Stories especially flared up following his 17 July 1929, or fourth liquid fuel rocket flight, that generated its own considerable publicity. From then on, publicity on Goddard continued until his death in 1945, although after he moved to the remote site of Roswell, New Mexico, from 1930 he was far more inaccessible to newsmen and the general public. Both these factors, besides the year around good launching weather, were entirely suitable to him. For more on the significance of Goddard’s 1929 flight and its aftermath see, Frederick C. Durant, III and

Frank H. Winter, "Goddard and Lindbergh: The Role of Charles A. Lindbergh in the Rocketry Career of Robert H. Goddard," paper, IAC-02-IAA.2.1.02, in *History of Rocketry and Astronautics*, Michael L. Ciancone, Editor (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 2010), AAS History Series, Vol. 33, pp. 31–59 (paper presented at the 53rd International Astronautical Congress, Houston, Texas, U.S.A., 10–19 October 2002).

Both the Goddard and Oberth revolutions are not to deny the earlier spaceflight proposal of the German Hermann Ganswindt in the 1890s although he had a very faulty and unworkable concept for his reaction-propelled space ship. He also delivered well-publicized lectures on the topic. See, Willy Ley, *Rockets, Missiles*, pp. 91–100, 135, and Heinz Gartmann, *The Men Behind the Space Rockets* (David McKay Co., Inc., New York, 1956), pp. 11–25. As in the cases of Tsiolkovsky and REP, the amount of publicity on Ganswindt did not come into play anywhere near to the extent that Goddard encountered. Nor did REP, or any other earlier astronautics pioneer, obtain anything like the kind of publicity Goddard did. One notable example of early publicity in REP's case is found in Waldemar Kaempffert, editor of *Popular Science Monthly*, and A. J. Loraine, "Hurling a Man to the Moon," *Popular Science Monthly* (New York), Vol. 94, April 1919, pp. 69–72. This article surprisingly mentioned REP's suggestion that the "sky-rocket" might be considered for entering planetary space because the reaction principle works in a vacuum. He envisioned an enormous skyrocket of many tons to produce the necessary horsepower to reach escape velocity. This article appeared only nine months before the release of Goddard's *A Method* yet REP's suggestion caused no stir whatsoever. For an even earlier article, but in a newspaper, see "Two Days to Reach Moon from Earth: French Engineer Says It May Be Done..." *NYT*, 9 March 1913, p. A. See also the following for similar articles on REP: *Chicago Daily Tribune*, 9 March 1913, p. A1; and *Boston Daily Globe*, 13 April 1913, p. SM10. Undoubtedly there were similar articles in France and elsewhere. But again, Goddard's findings were backed up with experiments funded by the Smithsonian besides the fact that he was a professor of physics and therefore had the far greater—and lasting—impact in the minds of the general public and scientists alike. Moreover, *A Method* itself was published by the Smithsonian and was a cornerstone in the technical literature of spaceflight.

Among the "other" early pioneers in astronautics, that included the rocket, but did not receive publicity at the time were Friedrikh Tsander, Yuriy V. Kondratyuk (Aleksandr Sharгей), and Franz von Hoefft. The Italian Luigi Gussalli published his *Si può già tentare un viaggio dall terra alla Lune? (Is it now Possible to Attempt a Voyage from Earth to the Moon?)* as early as 1923. Gussalli was greatly influenced by Goddard and cites *A Method* extensively although REP was critical of Gussalli's own recycling type of "double-reaction" rocket turbine rocket engine. In any case, Gussalli did not achieve major stature in the space travel movement of the 1920s to 30s. See Michael L. Ciancone and Diana Motta Rubagotti, "Luigi Gussalli—Italian Spaceflight Visionary," paper, IAC-02-IAA.2.P.01, in *History of Rocketry and Astronautics*, Michael L. Ciancone, Editor (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 2010), AAS History Series, Vol. 33, pp. 519–530 (paper presented at the 53rd International Astronautical Congress, Houston, Texas, U.S.A., 10–19 October 2002), and consult Giovanni Caprara, ed., *Luigi Gussalli pioniere dello spazio* (Fondazione Cività Besciana for the Agenzia Spaziale Italiana: Brescia, 2002). Nikolai I. Kibalchich is often cited in histories of astronautics, although his reaction-propelled aircraft design of the 1880s was only for terrestrial use.