

Technology and Culture
31 (Oct. 1990), 725-52

*Weimar Culture and
Futuristic Technology:
The Rocketry and Spaceflight Fad
in Germany, 1923-1933*

MICHAEL J. NEUFELD

In 1923 the Transylvanian German Hermann Oberth published in Munich a slim theoretical volume on rocketry and spaceflight, *Die Rakete zu den Planetenräumen* ('The rocket into interplanetary space').¹ (See fig. 1.) Over the next few years Oberth's book was followed in the German-speaking lands by a number of other works, both popular and technical, which attempted to demonstrate the feasibility and desirability of spaceflight—at the time a rather utopian and bizarre concept. One of the world's first spaceflight societies and the world's first journal devoted exclusively to rocketry and space exploration were also founded, and a significant popular fad was unleashed, peaking in 1928-29 with a number of spectacular rocket stunts and a major science-fiction movie, directed by Fritz Lang, about a moon-flight. Rocket experiments extended the life of this fad into the early 1930s, but the political and economic troubles of the Great Depression gradually overwhelmed it, and public experimentation with and discussion of rocketry were largely eliminated by the Nazis in 1933-34.

DR. NEUFELD is a curator in the Department of Aeronautics of the National Air and Space Museum, Smithsonian Institution. He is the author of *The Skilled Metalworkers of Nuremberg* and is currently working on an institutional history of the German army rocket center at Peenemünde during the Third Reich. This article was originally presented at the 1988 Society for the History of Technology annual meeting in Wilmington, Delaware. The research was made possible by the generous support of the Verville Fellowship of the National Air and Space Museum and a Smithsonian Postdoctoral Fellowship. The author wishes to express his appreciation for the many helpful comments made by colleagues currently or formerly at the Smithsonian, especially Frank Winter and Paul Forman, but also Gary Kulik, Robert Smith, John Mauer, Michael Dennis, David DeVorkin, Paul Ceruzzi, Allan Needell, and Cathy Lewis. Adam Gruen of the NASA Space Station History Project also deserves thanks.

¹Hermann Oberth, *Die Rakete zu den Planetenräumen* (1923; reprint, Nuremberg, 1960). Oberth outlived virtually all of his contemporaries, dying in late December 1989 at the age of ninety-five.

© 1990 by the Society for the History of Technology. All rights reserved.
0040-165X/90/3104-0004\$01.00

COPYRIGHT POLICY

The code on the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made beyond those permitted by Section 107 or 108 of the U.S. Copyright Law provided that copies are made only for personal or internal use or for the personal or internal use of specific clients and provided that the copier pays the stated per-copy fee through the Copyright Clearance Center, Inc. Operations Center, 27 Congress Street, Salem, Massachusetts 01970. To request permission for copying for general distribution, for classroom use, for advertising or promotional purposes, for creating new collective works, or for resale, kindly write to Permissions Department, The University of Chicago Press, 5801 South Ellis Avenue, Chicago, Illinois 60637. If no code appears on the first page of an article, permission to reprint may be obtained only from the author.

While it is our policy to require the assignment of copyright on most journal articles, we do not usually request assignment of copyright for other contributions such as book reviews and communications. Although the copyright to such a contribution may remain with the author, it is understood that, in return for publication, the journal has the nonexclusive right to publish the contribution and the continuing right, without limit, to include the contribution as part of any reprinting of the issue and/or volume of the journal in which the contribution first appeared by any means and in any format, including computer assisted storage and readout, in which the issue and/or volume may be reproduced by the publisher or by its licensed agencies.



FIG. 1.—Hermann Oberth's 1923 book, along with Robert Goddard's "A Method of Reaching Extreme Altitudes" (1919/20), can be said to have launched the modern spaceflight movement. (All illustrations except fig. 6 courtesy of the National Air and Space Museum.)

Oberth was not, of course, the first to discuss the feasibility of spaceflight through rocket propulsion. The priority of Konstantin Tsiolkovsky in Russia and Robert Goddard in the United States has long been recognized.² Germany was also not the only location where rocketry and spaceflight were energetically discussed in the 1920s and 1930s—German-speakers were involved in a larger international movement that included Russians, Frenchmen, Americans, and Britons. What was unique about Germany in this era was the spectacular nature of the rocket stunts, the extent of the theoretical discussion, and the level of response in the news media and popular culture to the spaceflight idea. While this fact has often been noted, no one has offered an adequate explanation that takes into account the character of Weimar culture and society. In large part this is due to the scholarly neglect of the history of technology in German popular culture as well as the inadequacy of the literature in space history—a field that has only recently become respectable among academic historians. Not only do we lack comparable treatments of, say, the zeppelins or aviation in Weimar culture; there is little scholarly literature on the Weimar spaceflight fad itself. Popular histories aside, only Frank Winter's very useful books and articles on the early rocket societies have covered this ground, and they do not focus on the cultural factors that might explain Weimar Germany's openness to radical technological ideas.³

Such explanations as have been offered in the popular literature have emphasized nationalism and escapism among the German populace, which was burdened by the defeat in World War I, and the ensuing

²In this article the adjective "German" will be used loosely to include Austrians and other German-speakers like Oberth, a Rumanian citizen in the 1920s, who were heavily involved in the German movement. A peculiar footnote to Oberth's role in the German-speaking world is that even there he was not first. The well-known eccentric inventor Hermann Ganswindt gave a public lecture in May 1891 proposing a form of reaction propulsion for spaceflight based on a faulty understanding of physics. His idea was fairly rapidly dismissed and forgotten, however, and was remembered only as a result of the fad unleashed by Oberth's book. Frank H. Winter, *Prelude to the Space Age: The Rocket Societies, 1924–1940* (Washington, D.C., 1983), p. 24.

³Winter, *Prelude*; "Birth of the VFR: The Start of Modern Astronautics," *Spaceflight* 19 (1977): 243–56; "1928–1929 Forerunners of the Shuttle: The 'Von Opel' Flights," *Spaceflight* 21 (1979): 75–83, 92. For the state of the history of technology in German, see Karl-Heinz Ludwig, "Entwicklung, Stand und Aufgaben der Technikgeschichte," *Archiv für Sozialgeschichte* 18 (1978): 502–23, and Ulrich Troitzsch, "Deutschsprachige Veröffentlichungen zur Geschichte der Technik 1978–1985. Ein Literaturbericht," *Archiv für Sozialgeschichte* 27 (1987): 361–438. A rare exception to the neglect of technology and popular culture in Germany is the stimulating if rather impressionistic history of the imperial German zeppelin fad (1908–17) by Karl Clausberg, *Zeppelin: Die Geschichte eines unwahrscheinlichen Erfolgs* (Munich, 1979). This book also has a brief

postwar chaos of revolution, inflation, and foreign occupation.⁴ Frank Winter has placed more weight on the influence of individuals, in particular on how Oberth's book provoked a strong reaction because it opened whole new vistas for manned spaceflight through its many ingenious technical proposals.⁵ One might add that, since Oberth's book was available only in German for some years, this may help explain the strong reaction in Germany and Austria. But Winter has also suggested that "the space travel movement had a special appeal to the Germans as an extension of the romantic *Lebensphilosophie* (Philosophy of Life) which pervaded the Weimar Republic. The *Lebensphilosophie*, at its height, glorified technology in reaction to Germany's defeat in World War I and its subsequent economic woes." In Winter's view, the romantic aspects of the German spaceflight movement and Fritz Lang's movie *Frau im Mond* (The woman in the moon, 1929) are examples of the influence of *Lebensphilosophie*.⁶

There are many problems with this. If right-wing idealist philosophy was very prominent in the universities and among some intellectuals, it hardly "pervaded" the ideologically diverse and divided Weimar Republic, and the advocates of this amorphous philosophy were far from uniformly protechnology.⁷ In any case, *Lebensphilosophie* was almost absent in the mainstream media's treatment of the rocket fad, as I will show, and a vague romanticism in the movement or in the movie hardly demonstrates the influence of reactionary idealist philosophers. Winter is certainly correct in emphasizing the role of personalities as the most important cause of Germany's prominence in the early space travel movement, but I will examine in more depth the cultural factors leading to this prominence. These include nationalism, a widespread belief in technological progress, and the growth of a very modern "consumer culture" that was indeed in some aspects escapist.

section on the renewed enthusiasm for these airships that followed the transatlantic crossing of the LZ 126 (taken over by the United States as the *Los Angeles*) in October 1924.

⁴For a particularly sensationalistic version of this argument see Helen B. Walters, *Hermann Oberth* (New York, 1962), p. 60. The more competent popularizations of Willy Ley and Wernher von Braun do not appear to address the question at all. Willy Ley, *Rockets, Missiles, and Space Travel*, rev. and enlarged ed. (New York, 1957); Wernher von Braun, Frederick I. Ordway III, and Dave Dooling, *Space Travel: A History* (New York, 1985).

⁵This argument is more implicit than explicit in Winter, *Prelude* (n. 2 above), p. 15, but is more clearly stated in his forthcoming *The Rocket into Space* (Cambridge, Mass., 1990), chap. 1.

⁶Winter, *Prelude* (n. 2 above), p. 15.

⁷Jeffrey Herf, *Reactionary Modernism: Technology, Culture, and Politics in Weimar and the Third Reich* (Cambridge, 1984).

Before examining these factors in more detail, however, it is useful to look at the trajectory and nature of the Weimar rocket fad, in order to gauge its extent, the personalities involved, and the forces at work. This fad went through three phases: the preliminary period from the publication of Oberth's book in mid-1923 to the first rocket stunt in April 1928; the fad proper from the spring of 1928 to the premiere of *Frau im Mond* in late 1929; and the declining phase from 1930 to the Nazi seizure of power in 1933.

Oberth's work was indeed crucial in the first phase, in part because his heavily mathematical treatise forthrightly discussed not just rocketry but also manned spaceflight. The little book opened with four startling propositions: (1) "With the present state of science and technology it is possible to construct machines that can climb higher than the Earth's atmosphere"; (2) "With further development" it would be feasible to reach escape velocity; (3) These machines could carry humans, probably without unhealthy side effects; and (4) "Under certain economic conditions the construction of such machines would pay for itself" and this could happen "within a few decades."⁸ Oberth then proceeded not only to derive the theory of rocket engines and trajectories mathematically but also to make many constructive suggestions for the design of liquid oxygen/alcohol and liquid oxygen/liquid hydrogen multistage vehicles, and showed how the hazards of manned spaceflight, such as acceleration and weightlessness, could be overcome. Although many of these ideas had been developed independently by others, they were nowhere accessible to the public. Tsiolkovsky's work remained buried in very obscure Russian journals until Oberth's book appeared, and Goddard was quite circumspect in his 1919 paper "A Method of Reaching Extreme Altitudes."⁹ After the paper's publication by the Smithsonian in January 1920, the shy American became completely secretive when newspapers sensationalized and distorted his discussion of a simple staged powder rocket to hit the moon.

Fueled by this secrecy, wild rumors about Goddard's plans circulated in the German popular press in the 1920s, especially in 1924–25, when the American scientist was allegedly going to launch himself to the moon.¹⁰ But only the reaction to Oberth produced any

⁸Oberth, *Die Rakete* (n. 1 above), p. 7. All translations are mine.

⁹Robert H. Goddard, "A Method of Reaching Extreme Altitudes," in Esther C. Goddard and G. Edward Pendray, eds., *The Papers of Robert H. Goddard* (New York, 1970), 1:337–406.

¹⁰Otto Willi Gail, *Mit Raketenkraft ins Weltall* (Stuttgart, 1928), pp. 58–60; Desiderius Papp, *Was lebt auf den Sternen?* (Vienna, 1931), pp. 317–18; Willy Ley, *Die Fahrt ins Weltall*, 2d ed. (Leipzig, 1929), p. 50; Max Valier, *Raketenfahrt* (Munich and Berlin, 1930), p. 188.

long-lasting movement in Germany. At first scarcely anyone noticed Oberth's book, which appeared in a very small edition at the author's cost and in the middle of the disastrous hyperinflation/Ruhr-occupation crisis of 1923. Oberth's initial problem was academic opposition. The book was rejected as a Heidelberg doctoral thesis in 1922 because it was too unorthodox, and in early 1924 it was attacked by a Prof. Dr. Riem in a popular science magazine with the old and oft-repeated canard that a rocket cannot work in a vacuum because its exhaust had nothing to push against.¹¹ While others with academic titles wrote to defend Oberth, the German-Rumanian pioneer was often to suffer from narrow-minded and sometimes silly attacks by members of the university establishment.

The whole discussion might have remained obscure at this point but for the intervention of Max Valier, a popular writer of Austrian birth resident in Munich. Valier lived by his wits and writing talent, churning out books on a bizarre heterodox cosmology and on the occult, among other topics. He devoted his inexhaustible energies to a crusade for Oberth's ideas, beginning with a popular book, *Der Vorstoss in den Weltenraum* (The advance into outer space) in 1924. This sold well enough to go into a second printing by 1925 and greatly aided the sales of Oberth's book, which sold out and was reprinted in 1925 as well.¹² Valier also published a number of illustrated articles on spaceflight in popular newspapers and magazines, some with very large circulations. Although it may be significant that German editors were already open-minded enough to publish articles on such a futuristic and often ridiculed topic, perhaps they were motivated only by a desire to increase their readership. Valier also set out on endless lecture tours in Germany and Austria; some were well received, others drew ridicule and cost him money.¹³

Although he had drawn some attention to the spaceflight idea, by 1926 Valier was disillusioned by the lack of a broader response, partly

¹¹Hans Barth, *Hermann Oberth: Leben, Werk und Auswirkung auf die spätere Raumfahrt-entwicklung* (Feucht, 1985), pp. 75–76, 93; Prof. Dr. Riem, "Die Fahrt in den Weltenraum," *Die Umschau* 28 (February 2, 1924): 71–75.

¹²Max Valier, *Der Vorstoss in den Weltenraum: Eine wissenschaftlich-gemeinverständliche Betrachtung* (Munich, 1924); Barth, *Hermann Oberth* (n. 11 above), p. 106; Ilse Essers, *Max Valier—Pioneer of Space Travel* (NASA Technical Translation TTF-664) (Washington, D.C., 1976), pp. 94–95. Ley, *Rockets* (n. 4 above), p. 109, incorrectly states that Oberth's *Die Rakete* sold out in both editions very quickly, thus giving the impression that the fad got off the ground much more quickly than it did.

¹³Essers, *Max Valier* (n. 12 above), pp. 62, 123; Max Valier, "Der Vorstoss in den Weltenraum—eine technische Möglichkeit?" *Scherls Magazin* 1 (February 1925): 221–28, 246–47.

because he and Oberth had a naive view of the technological and financial difficulties involved in building a space vehicle. With the theoretical problems largely solved, they both felt that some millionaire or corporation would come along to finance rocket experiments leading to spaceflight in a few years. In retrospect this seems ludicrous, but their image of the lone inventor creating a great breakthrough was typical of this era and appears to derive from the examples of the electrical and aviation pioneers, among others. It also shows that, like all the spaceflight pioneers, they failed to anticipate that advanced rocketry would be an enormously expensive technology that could only be developed by large state-financed military-industrial complexes.¹⁴

Departing from Oberth's concept of vertically launched rockets, Valier set out to popularize his own approach, which postulated a gradual transition from rocket planes to spaceships, with the aim of attracting money to solve an important contemporary technological challenge: transatlantic air transport. The weather-plagued attempts to cross the ocean in these years gave Valier's advocacy of travel at stratospheric altitudes a certain currency. The Austrian pioneer even dimly perceived the possibility of some kind of air-breathing reaction propulsion, but the turbojet concept had not yet been clearly perceived by him or virtually anyone else.¹⁵ To launch his campaign, Valier enlisted the support of two well-known technical illustrators in Munich, the von Römer twins, and published a whole series of articles with sensationalistic drawings of rocket planes beginning in 1926 (fig. 2). In part because these drawings and proposals were often technically absurd, Oberth broke with him.¹⁶ Meanwhile, other spaceflight theorists

¹⁴For an influential interpretation of the relationship between rocketry and the military-industrial complex, see Walter A. McDougall, . . . *the Heavens and the Earth: A Political History of the Space Age* (New York, 1985). On Valier's and Oberth's expectations, and Valier's disillusionment, see their correspondence, and Oberth's correspondence with C. Barthel, a wealthy banker, in Hans Barth, ed., *Hermann Oberth: Briefwechsel* (Bucharest, 1979), 1:20–41, 75–77. Hermann Oberth, "Ist die Weltraumfahrt möglich?" pt. 2, *Die Rakete* 1 (December 1927): 165–66, and the anonymous article, probably by Winkler, "Was kostet das Weltraumschiff," pp. 170–71 of the same issue, offer extremely unrealistic cost estimates for constructing a spaceship. There is no adequate social history of the image of inventors and scientists in Germany in this period. My impressions were gathered in part from reading the press and the spaceflight pioneers' publications. Some useful impressions of the image of engineers in German popular novels are to be found in Harro Segeberg, *Literarische Technik-Bilder: Studien zum Verhältnis von Technik und Literaturgeschichte im 19. und frühen 20. Jahrhundert* (Tübingen, 1987).

¹⁵Essers, *Max Valier* (n. 12 above), pp. 132–33; Edward W. Constant II, *The Origins of the Turbojet Revolution* (Baltimore, 1980).

¹⁶Essers, *Max Valier* (n. 12 above), pp. 125–26, 237, 244–45; Oberth to Valier, January 8, 1927, in Barth, *Oberth: Briefwechsel* (n. 14 above), pp. 89–92; Max Valier,

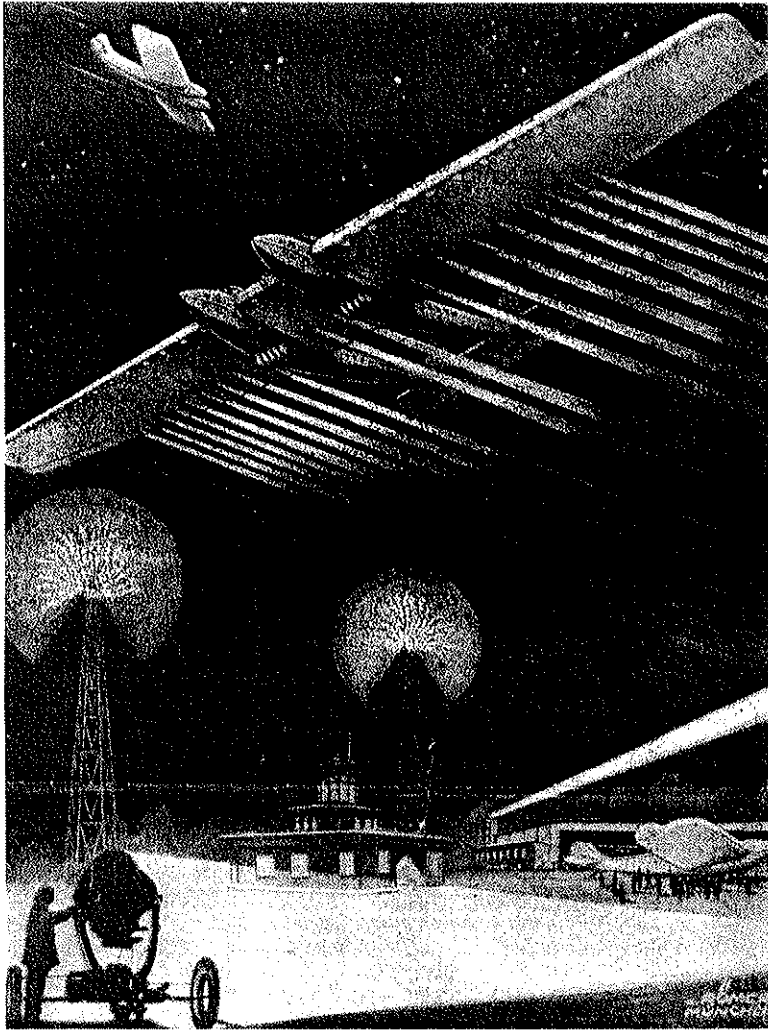


FIG. 2.—This Valier/von Römer illustration conveys their romantic and fanciful vision of future passenger travel by rocket plane.

came forward in Germany and Austria in 1925–26, a number of influential science-fiction novels about spaceflight were published, such as Otto Willi Gail's *Der Schuss ins All* (The shot into space), and a society was formed in Vienna in late 1926. Johannes Winkler, a church administrator in Breslau, Silesia, started the first spaceflight journal, *Die Rakete* (The rocket), in the spring of 1927, and partly because of Valier's intervention, the Verein für Raumschiffahrt (Society for space travel or VfR) was founded in Breslau in July 1927, with *Die Rakete* as its organ.¹⁷ (See fig. 3.)

Although the years 1923 to 1927 had generated a level of activity in Germany and Austria that rivaled or exceeded that of the lively but internationally isolated spaceflight movement in the USSR,¹⁸ the popular fad began in earnest with the first rocket car stunts in April–May 1928. In his search for financial support, the restless Valier had finally succeeded in enlisting the cooperation of the media-conscious playboy and heir to the Opel car manufacturing fortune, Fritz von Opel. Jettisoning the scientific approach of Oberth, who advocated the development of liquid-fuel rocket engines, Valier and Opel chose to use traditional black powder lifesaving rockets to popularize the often misunderstood principle of reaction propulsion and to win adherents for the rocket plane. In this they succeeded. The first rocket car experiments at the Opel headquarters of Rüsselsheim on April 11–12, 1928, were followed by Opel's spectacular run at the Avus racetrack in Berlin on May 23 before 2,000 invited guests from the pinnacle of Weimar government and society (figs. 4 and 5). Before the run, Opel's speech and that of the head of the Scientific Society for Aviation were carried live on Berlin radio, and the newspapers gave considerably more space to the rocket car than they had in April.¹⁹

lecture program, "Der Vorstoss in den Weltenraum," in National Air and Space Museum (NASM) file "Max Valier"; Valier, "Der Flug in den Weltenraum: Die Rakete als Motor," *Wissen und Fortschritt* 1 (July 1927): 6–11; Valier, "Ueber die Ozeanflüge," *Die Rakete* 1 (October 1927): 136–38; Karl-Heinz Ingehaag, "Die Raketenflugzeug-Entwürfe von Max Valier," *Luftfahrt International* 5 (1980): 211–17.

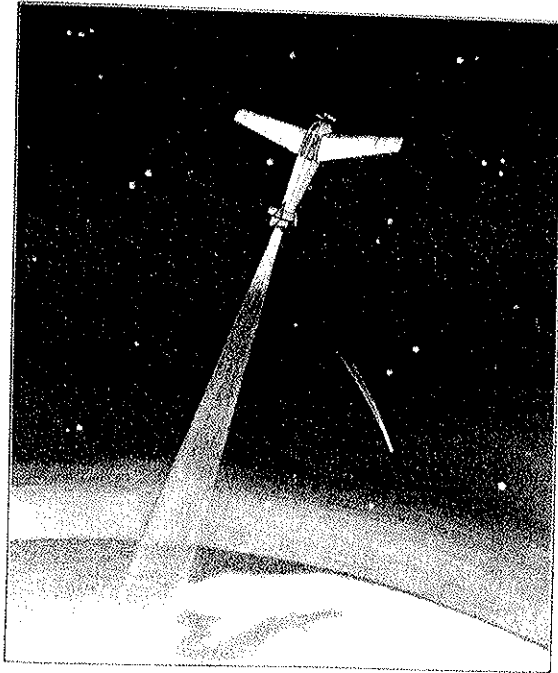
¹⁷Walter Hohmann, *Die Erreichbarkeit der Himmelskörper* (Munich, 1925); Otto Willi Gail, *Der Schuss ins All* (1925; repr., Munich, 1979); Winter, *Prelude* (n. 2 above), pp. 30–36; "Verein für Raumschiffahrt E. V.," *Die Rakete* 1 (July 1927): 82–84; letter of F. I. Ordway III, in *Spaceflight* 20 (February 1978): 78–79.

¹⁸Winter, *Prelude* (n. 2 above), pp. 27–30.

¹⁹Essers, *Max Valier* (n. 12 above), pp. 140–56; Gail, *Mit Raketenkraft* (n. 10 above), p. 9; Valier, *Raketenfahrt* (n. 10 above), pp. 209–16; *Vorwärts* (Berlin), Morgenausgabe, April 14, 1928; *Völkischer Beobachter* (Munich), Bayernausgabe, April 15/16, 1928; *Berliner Tageblatt*, Abendausgabe, May 23, 1928; *Berliner Morgenpost*, May 24, 1928; Joachim Fischer, "Der Raketenwagen auf der Avus," *Die Umschau* 32 (June 9, 1928): 487–88.

Die Rakete

Zeitschrift des Vereins für Raumschiffahrt E.V., Breslau



Breslau 15. August 1927

FIG. 3.—The cover of one of the early issues of *Die Rakete* also shows Max Valier's influence: the conventional propeller aircraft with rocket assistance is reaching for the edge of space.

Certainly there were German technological feats that produced much more media attention in the Weimar Republic—notably the construction and flights of the passenger zeppelins and the first east-to-west, nonstop transatlantic flight, carried out by a German crew in April 1928. The Opel-Valier experiments nonetheless unleashed what one journal disparagingly called the *Raketenrummel* (“rocket row” or “rocket racket”—the term *Rummel* was often applied

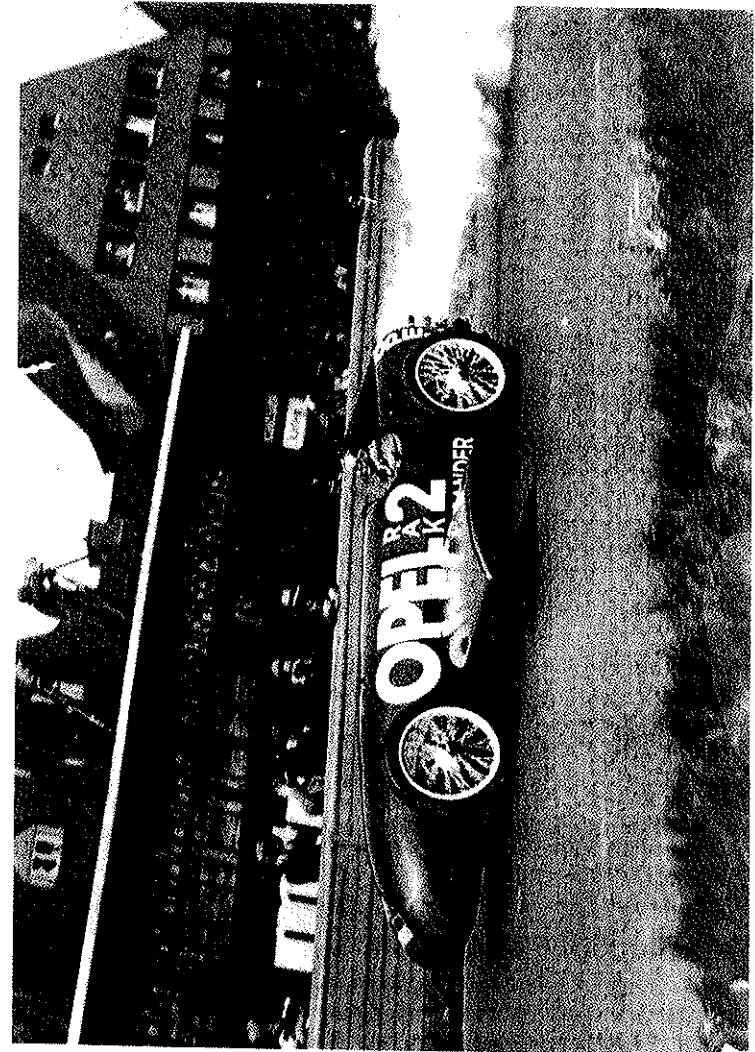


FIG. 4.—Fritz von Opel shown during his famous run at the Avus racetrack in western Berlin on May 23, 1928. The car was powered by Sander black powder rockets.

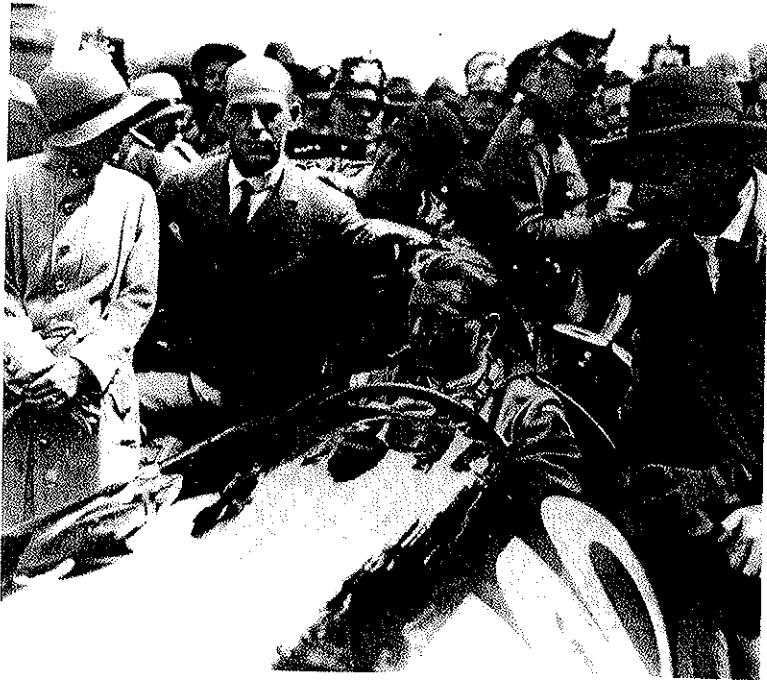


FIG. 5.—Fritz von Opel sitting in his car after the May 23, 1928, stunt. To his right is the bald-headed Max Valier, who was already being pushed to the side by Opel. Note that Valier's name is missing from the car in fig. 4.

to public controversies or fads in this period). Powder rocket experiments multiplied: the first flight of an aircraft with rocket power on June 11; separate experiments by Opel and Valier with unmanned rocket railcars during the summer (the two split up owing to Opel's desire to keep all the credit); even rocket bicycles and a Valier rocket ice sled in 1929 (fig. 6). Other rocket car imitators followed.²⁰ In addition to the print media, radio and newsreels often popularized these exploits, and space launches appeared in a Berlin cigarette advertisement (fig. 7), a Munich fireworks display, a parade float, and on the cover of the sheet music for the "Raketenflug-Marsch" (Rocket

²⁰*Raketenrummel* is found in the editors' introduction to Fritz Stamer, "Rakete—weniger reden—mehr arbeiten," *Flugsport* 20 (June 20, 1928): 232–35. On other experiments, see Valier, *Raketenfahrt* (n. 10 above), pp. 216–30; *Deutsche Allgemeine Zeitung* (Berlin), June 26, 1928; *Berliner Tageblatt*, June 13, June 23, August 4, 1928; Max Valier, "Meine Versuche mit dem Raketenschlitten," *Die Rakete* 3 (February 1929): 23–27; *Berliner Morgenpost*, October 23, 1929. Frank Winter ably sorts out the confusion surrounding the rocket plane flights in "1928–1929 Forerunners" (n. 3 above).

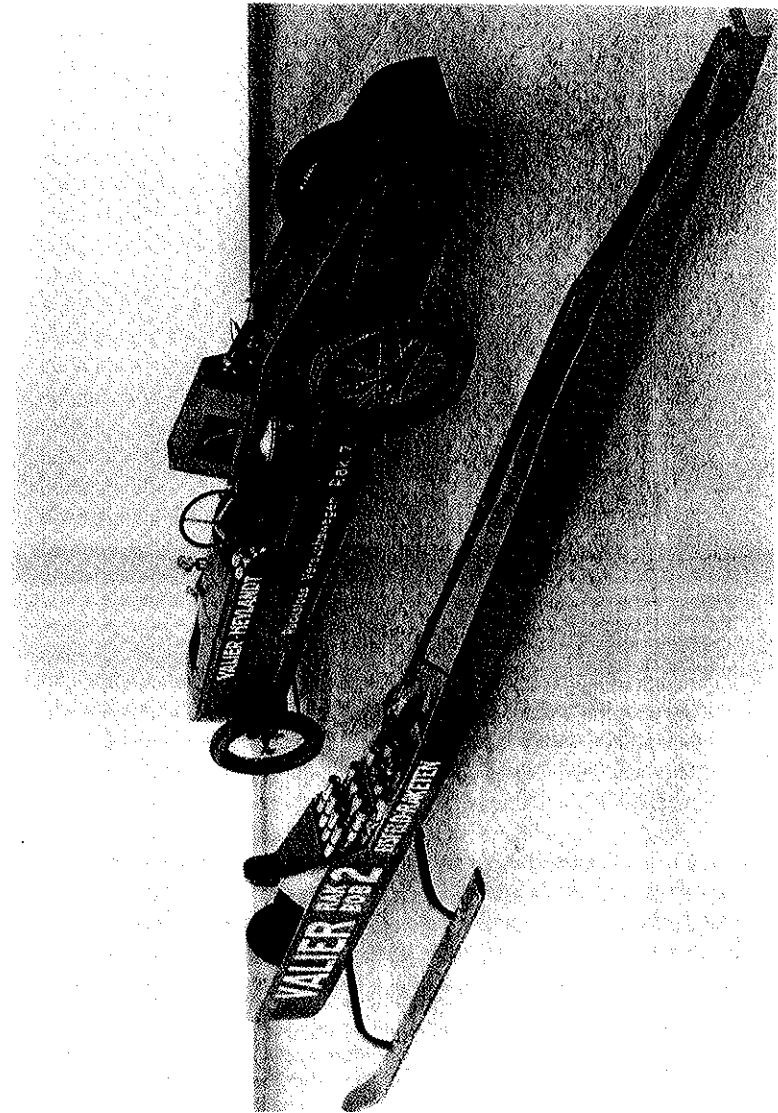


FIG. 6.—Two of Max Valier's vehicles: his rocket ice sled from early 1929, and the rocket car completed at the Heylandt Co. in Berlin after his accidental death in May 1930. (Courtesy of the Deutsches Museum, Munich.)

Flight March).²¹ (See fig. 8.) German children played with model rocket cars and planes, and a number of future engineers at Peenemünde, notably Wernher von Braun, had their interest in rocketry sparked or increased by the publicity. On a more serious level, the number of books and articles about rocketry and spaceflight markedly increased after 1928. Commercial publishers brought out both quick popularizations and new theoretical works.²²

This fad was showing signs of petering out in 1929 when two events gave it new impetus. On September 30, 1929, Fritz von Opel flew in a rocket-powered glider, which he dishonestly advertised as the first-ever such flight, and about two weeks later Fritz Lang staged the spectacular Berlin premiere of his film *Frau im Mond*. Lang had first conceived of a moonflight movie while working on the futuristic drama *Metropolis*. But it was the *Raketenrummel* that really impelled him and his novelist-screenwriter wife, Thea von Harbou, to publish a novel and turn it into a film. Oberth was brought on board as scientific adviser, and then financed to build a liquid fuel rocket to be launched for publicity at the time of the premiere. This latter project turned into a comic disaster when the technologically inexperienced professor from Rumania tried to build a rocket together with a con-artist engineer, Rudolf Nebel, and a fugitive Bolshevik aviation writer, Alexander Scherchewsky (described by Oberth as “the second laziest man I ever met”). The rocket never flew, but the film company

²¹Advertisement for Josetti Juno cigarettes in *Die Rote Fahne* (Berlin), June 23, 1928; advertisement in the *Völkischer Beobachter* (Munich), Bayernausgabe, July 12, 1928; photograph “Das Weltraumschiff auf Volksfesten,” *Die Rakete* 3 (February 1929): 30; and sheet music of the “Raketenflug-Marsch” by Johann Schädler (Zurich, ca. late 1920s) in the Bella Landauer Collection, Ramsey Room, NASM Library. Rocket pioneer and von Braun team member Arthur Rudolph also remembers a photograph of Goddard on a pack of cigarettes about 1928. Rudolph oral history interview by Michael Neufeld, August 4, 1989, available in the Department of Space History, NASM, Smithsonian Institution.

²²Among the important theoretical or serious semipopular works published in this period were Hermann Oberth, *Wage zur Raumschiffahrt* (Munich, 1929); Hermann Noordung (pseud. of Hermann Potočnik), *Das Problem der Befahrung des Weltraums* (Berlin, 1928); Willy Ley, ed., *Die Möglichkeit der Weltraumfahrt* (Leipzig, 1928); and numerous articles in *Die Rakete*. One cheap popularization was Felix Linke, *Das Raketen-Weltraumschiff: Wanderung zum Monde und zu anderen Planeten* (Hamburg, 1928). A later imitator was Gerd Biermann, *Weltraumschiffahrt? Eine kurze Studie des Problems* (Bremen, 1931). For German rocket toys, see the pictures in Reinhold Otte, “Die Schnellfahrversuche des Opel-Raketenwagens auf der Reichsbahnstrecke Burgwedel-Celle. Bericht eines Augenzeugen,” *Ikarus* 4 (August 1928): 65–68, and in *Science and Invention* 16 (November 1928): 602. They were also shown in a newsreel available in the Bundesarchiv Koblenz. Erik Bergaust, *Wernher von Braun* (Washington, D.C., 1976), pp. 34–35, and Dieter Huzel, *Peenemünde to Canaveral* (Englewood Cliffs, N.J., 1962), pp. 18–19, testify to the influence of this period on future Peenemünders.

Was sagt der Bär?

Im Zeichen von
hochfliegenden Plänen steht
unsere Zeit. Locken im
Weltraum den Forscher neue
Ziele, dem Raucher gilt als erstre-
benswert immer nur das Eine:

Josetti Juno
Berlins meistgerauchte 4 Pf. Cigarette

FIG. 7.—A cigarette advertisement from *Die Rote Fahne* in June 1928 reflects the *Raketenrummel*. The text reads: “What does the bear [the symbol of Berlin] say? Our age is marked by high-flying plans. If new goals in outer space entice researchers, to the smoker only one thing is worth striving for: Josetti Juno, Berlin’s most-smoked 4 Pf. cigarette.”



FIG. 8.—The cover of the sheet music for the “Rocket Flight March” has one of the classic Valier/von Römer spaceships from the late 1920s. Its shape appears to have been heavily influenced by the zeppelin.

exploited its anticipated launch for free advertising. *Frau im Mond* was not the first spaceflight movie, but it was certainly the first significant and technologically plausible one. It turned out to be only a moderate success, however, in part because the excellent special effects were diminished by Thea von Harbou’s melodramatic and unoriginal plot,

and in part because it was one of the last major silent films made in Germany and was overshadowed by the first talkies.²³

The phase of declining public and media attention began immediately after the publicity surrounding the movie subsided. The fad had run its natural course, and unrealistic expectations of imminent spaceflights fostered by the popular press led to disillusionment even among members of the Society for Space Travel. *Die Rakete* folded in late 1929 because of the failure of many members to pay their dues, and because of the decision of the VfR leadership to concentrate its resources on rocket experiments. The onset of the Great Depression and the gathering political storm were other distractions and problems. A further blow came with the death of Valier in May 1930 during experiments with his first liquid fuel rocket engine, which led to calls to outlaw private rocket research.²⁴ What kept rocketry and spaceflight alive after that were the private rocket experimenters, most notably the VfR group, which was more or less captured by Rudolf Nebel. It carried the grandiose title of *Raketenflugplatz* (Rocketport) *Berlin* and included the aristocratic university student Wernher von Braun (fig. 9). Accounts of rocket launches by them and by others appeared episodically in newspapers and magazines from 1931 to 1933, sometimes with great sensationalism. Wild rumors about rocket experiments elsewhere, especially about Goddard and the fraudulent claims of another American, “Dr.” Darwin O. Lyon, continued to circulate. The disastrous final crisis of the Weimar Republic in 1932–33 overshadowed any further activities, however, and when the Nazis came to power they discouraged public experimentation.

²³On Opel’s flight, see *Berliner Morgenpost*, October 1, 1929; *Germania* (Berlin), October 1, 1929; Winter, “1928–1929 Forerunners” (n. 3 above), pp. 80–81; Dr. Ing. von Langsdorff, “Der erste Raketenstart,” *Die Umschau* 33 (October 12, 1929): 826–27. For the movie and the Oberth rocket, see *Berliner Morgenpost*, October 17 and 31, 1929; *Germania* (Berlin), October 13 and 17, 1929; *Berliner Tageblatt*, Abendausgabe, October 16, 1929, Morgenausgabe, November 2, 1929; *Deutsche Allgemeine Zeitung* (Berlin), October 17, 1929; Barth, *Hermann Oberth* (n. 11 above), pp. 139–53; Paul M. Jensen, *The Cinema of Fritz Lang* (New York and London, 1969), pp. 79–92; Frank H. Winter, “Frau im Mond: Fritz Lang’s Surprising, Silent Space Travel Classic,” *Starlog*, no. 42 (January 1981): 39–41, 62; Ley, *Die Fahrt* (n. 10 above), pp. 80–81; Ley, *Rockets* (n. 4 above), pp. 124–30; and Ley’s manuscripts, collections of Ufa newsletters, and film magazines (he was chief publicist for the movie) in the Willy Ley Collection, box 2700, folder 164, and box 2701, folder 200, in the NASM Garber Facility.

²⁴“Vorbereitungen,” *Die Rakete* 3 (September 1929): 107; “An unsere Mitglieder,” *Die Rakete* 3 (November/December 1929): 122; Ley, *Rockets* (n. 4 above), pp. 131, 136; *Berliner Morgenpost*, May 18, 1930; “Extrablatt. Mitteilungen,” of the Verein für Raumschiffahrt, May 1930, in the Wernher von Braun Papers, Library of Congress Manuscripts Division, box 53, scrapbook 1.



FIG. 9.—Hermann Oberth is shown at center, in profile, after the certification of his small liquid fuel rocket engine by the Chemisch Technisches Reichsanstalt in Berlin, August 5, 1930. The *Raketensflugplatz* was just in the process of forming. On the far left is Rudolf Nebel; second from the right is the eighteen-year-old Wernher von Braun.

Some experimenters went to the army's secret rocket program, which had already lured von Braun into its employ in late 1932. Discussion of spaceflight did not completely cease in the Third Reich, but it became the province of only a small group of enthusiasts.²³

* * *

From this account of the Weimar rocketry and spaceflight fad, it is clear that any explanation of why Germany sustained such a high level of activity must take into account the influence of personalities. If

²³Frank Winter gives the best overview of this period in *Prelude* (n. 2 above), pp. 40–54; Willy Ley's memoirs are found in *Rockets* (n. 4 above), pp. 131–62; Rudolf Nebel's in his very unreliable *Die Narren von Tegel* (Düsseldorf, 1972). For contemporary materials and press accounts see Ing. Küttner, "Bitte Richtung Mond einsteigen! Ein Besuch auf dem Raketensflugplatz Berlin," *Wissen und Fortschritt* 5 (1931): 49–53; "Raketensflug," *Die Umschau* 35 (May 2, 1931): 351–52; Wernher von Braun, "Das Geheimnis der Flüssigkeitsrakete," *Die Umschau* (June 4, 1932): 449–51; and the collections of VFR bulletins and press clippings in the Willy Ley Collection (n. 23 above), box 2700, folders 167 and 171, and the Wernher von Braun scrapbook (n. 24 above).

Oberth had not published in German and had not so forthrightly discussed manned spaceflight, if Max Valier had not popularized the idea and had not persuaded Fritz von Opel to finance rocket stunts, and if Opel had not exploited these stunts for all the publicity they were worth, it is difficult to conceive the Weimar fad taking on the scope that it did. Valier's role was particularly crucial as a popularizer and as the link between Oberth's theory and Opel's money.

It is extremely difficult, however, to apply the traditional tools of the intellectual historian and give a cultural, social, or political explanation (as opposed to a psychological one) for why isolated individuals like Oberth came to the idea of spaceflight, or why people like Valier picked up on it. Nothing in their writings shows Weimar culture, or a specific school of social and political thought, to be a factor, except perhaps the amorphously nationalist belief that Germany must be first in rocketry.²⁶ When searching for the cultural roots of the spaceflight fad, then, the question becomes: Why was there such a strong reaction to Oberth and Valier? Or, to put it another way, what cultural or social resonance was there that made other people take up the cause; why did publishers and the media latch onto the idea of rocketry and spaceflight; and why did individuals like Opel (or Lang) obviously calculate that much attention (and money) could be won by exploiting the spaceflight fad?

In order to answer these questions, it is necessary to go beyond the literature of the spaceflight movement. In addition to reading all available citations to spaceflight articles in the press and magazines, I

²⁶Examples of the spaceflight pioneers' nationalism may be found in the Valier lecture program (ca. 1927) in NASM file "Max Valier"; Valier to Oberth, June 17, 1925, in Barth, *Oberth: Briefwechsel* (n. 14 above), 1:60, 75; Gail, *Mit Raketenkraft* (n. 10 above), p. 106; Ley, *Möglichkeit* (n. 22 above), pp. iv, 282; Rudolf Nebel's handbill (ca. 1931) "RAKETENFLUG Aufruf!" found in NASM file "German Federal Republic, 1920–1930," and pictured in Winter, *Prelude* (n. 2 above), p. 174. The one clear intellectual reason Valier had to become a spaceflight enthusiast was to prove the bizarre "glacial cosmology" of Viennese engineer Hanns Hörbiger, which asserted that most of the universe was made of ice. On the question of the links between culture and the origins of the idea of spaceflight, Walter McDougall makes the interesting speculation that in the case of Tsiolkovsky and the tsarist assassin Kibalchich (also a dreamer of rocketry), it was not coincidental that "the most 'backward' of the Great Powers . . . was the one that fostered violent rebellion against the chains of human authority and the chains of nature." See *Heavens* (n. 14 above), p. 19. But this is extremely difficult to prove—and may not even be accurate. An Austrian historian has claimed that one-third of the spaceflight pioneers came from the old Austro-Hungarian Empire, which would include, of course, Oberth and Valier. I leave that to someone else to explain. Fritz Sykora, "Guido von Pirquet: Austrian Pioneer of Astronautics," in R. Cargill Hall, ed., *Essays on the History of Rocketry and Astronautics* (NASA Conference Publication 2014) (Washington, D.C., 1977), 1:140.

have surveyed five Berlin newspapers, ranging politically from the moderate Right to the Communists, plus the Nazi daily issued in Munich, during the two peaks of the fad: April–June 1928, and October 1929. I have also consulted the popular science journals *Die Umschau* and *Kosmos* for 1923 to 1933, and *Wissen und Fortschritt* from its beginning in 1927 to 1933. This survey shows three social and cultural factors to be paramount: nationalism, a widespread faith in technological progress (especially in the late 1920s), and the growth of a very modern consumer culture.

Of the three, nationalism is the most obvious. One of the first reviews of Oberth's *Die Rakete zu den Planetenräumen* appeared in a right-wing Berlin newspaper, and it celebrated the Germanness of the author "in these years of the deepest distress of Germandom" (i.e., the crises of 1918–23).²⁷ The Weimar rocketry fad took place primarily, however, in the illusory golden years of the republic: the years of "stabilization" from 1924 to 1929. The right-wing press in particular celebrated the Opel-Valier rocket stunts as the latest accomplishments of German technology, much as they did the zeppelins, with the implicit message of pride in the recovery from the war and postwar humiliation.²⁸ It is impossible to measure the mind of the general public of that day, but it is hard to believe that many Germans did not react the same way in a culture soaked with nationalism.

When one reads the press reaction to the rocket stunts and *Frau im Mond*, one is also struck by the relative lack of criticism of either rocketry or of technological change in general. Certainly critiques of space travel as utopian did appear, but even then the authors almost always accepted Valier's belief in the potential of the rocket for intercontinental transport.²⁹ The Nazi *Völkischer Beobachter* praised the first Opel-Valier rocket car in April 1928 as a national achievement, but used the occasion to dismiss spaceflight and the theory of relativity as unscientific. Later articles were mostly pro-spaceflight, however, the

²⁷*Deutsche Allgemeine Zeitung* (Berlin), December 2, 1923.

²⁸*Völkischer Beobachter* (Munich), Bayernausgabe, April 15/16, 1928; *Deutsche Allgemeine Zeitung* (Berlin), May 24, 1928; *Der Sonntag: Braunschweiger Neueste Nachrichten*, May 13, 1928, found in the Willy Ley Collection, box 2703, folder 255; Anton Klöma, "Die Rakete: Der Werdegang einer uralten Erfindung," *Wissen und Fortschritt* 2 (September 1928): 283. On zeppelins, see Clausberg, *Zeppelin* (n. 3 above), pp. 14–20, and A. Lion, "Deutschland, die Heimat der Luftriesen," *Wissen und Fortschritt* 2 (January 1928): 31–34. For technological nationalism generally, see the first issue of *Wissen und Fortschritt* (April 1927).

²⁹The German pioneers, at least, were not subjected to the universal ridicule some space historians, based on the American experience, have asserted was the fate of these early advocates of spaceflight. See, e.g., Frederick C. Durant III's "Foreword" to Winter, *Prelude* (n. 2 above), p. 9.

exception being one in September 1929 that objected to Oberth's ideas because Germany must concentrate on its immediate problems.³⁰ The *Deutsche Allgemeine Zeitung*, a paper connected to the right-wing barons of heavy industry, expressed some doubts about the economic sense of the first rocket car and published a scientific attack on the concept of spaceflight just before Opel's run in Berlin a month later. But the paper reacted to the actual run with considerable enthusiasm. The moderately conservative Catholic newspaper *Germania* ran a large article in favor of spaceflight in the aftermath of this event, while the left-liberal and socialist newspapers, which avoided the expression of much nationalism, also ran pro-rocketry articles or treated it as a straight news event. Only the Communist *Rote Fahne* ignored the whole rocket car and plane business. (There was, however, a famous Communist agit-prop group called the Red Rockets formed in Dresden in 1927/28.) Press reaction to the Opel railcar experiment in June 1928 and his rocket plane stunt in September 1929 followed a similar pattern.³¹

This evidence, plus the publication of pro-spaceflight articles in popular science journals throughout the 1924–33 period and the pervasive pride in German technological achievements displayed in the Weimar media, leads me to my second conclusion: a belief in, or at least an acceptance of, technological progress extended across the bitterly divided political and ideological spectrum of Weimar during the late 1920s, resulting in open-mindedness toward futuristic technologies. Socialism and liberalism, as heirs of the Enlightenment,

³⁰*Völkischer Beobachter* (Munich), Bayernausgabe, April 15/16, May 27/28/29, July 24, and December 29/30, 1928, September 22/23 and 29/30, October 2 and 5, 1929. According to Walter Dornberger, *V-2* (New York, 1958), p. 66, in 1939 Hitler discussed his acquaintance with Valier in Munich, but dismissed him as a dreamer. Heinz Dieter Hölsken, *Die V-Waffen* (Munich, 1984), pp. 87–88, repeats the story of Henry Picker, ed., *Hitlers Tischgespräche im Führerhauptquartier*, 3d ed. (Stuttgart, 1976), p. 476, that Hitler was an enthusiastic supporter of Valier and wrote a number of pro-Valier articles in the *Illustrierte Beobachter* in 1929–30. That periodical was unavailable to me, but a quick survey of the whole run of the *Völkischer Beobachter* from January 1928 to Valier's death in May 1930 makes the story highly unlikely. Only one particularly pro-Valier article was found (August 5/6, 1928), and Picker's editorial comment is so riddled with errors as to be completely unreliable.

³¹*Deutsche Allgemeine Zeitung* (Berlin), April 22, May 22 and 24, June 26, 1928; *Germania* (Berlin), May 23 and June 2, 1928, October 1, 1929; *Berliner Tageblatt*, May 23 and June 3, 1928; *Berliner Morgenpost*, May 24, 1928, October 1, 1929; *Vorwärts* (Berlin), April 14, May 19, June 15, 1928, October 1, 1929. Except for an article attacking Fritz Lang's movies as kitsch, the *Rote Fahne* ignored the rocket fad in the periods that I surveyed. On the "Red Rockets" see Bärbel Schrader and Jürgen Schebera, *The "Golden" Twenties* (New Haven, Conn., 1988), pp. 223–24, 227. Two months before the first Opel-Valier stunt (February 8, 1928) the highly respectable and liberal *Berliner Tageblatt* ran two major articles—one very pro-spaceflight, one in favor of rocket planes as intercontinental transportation but skeptical of spaceflight.

were by definition “progressive” on scientific and technological issues; the Right increasingly accepted the necessity of technological change for nationalist reasons even when it was worried about some of the implications of capitalist modernization, such as the decline of morality and the “German spirit” and the rise of class conflict and an anonymous mass society.

Fear of the social effects of technology was certainly present in all ideologies and among all classes. The enslavement of the workers by the machine in Fritz Lang’s *Metropolis* symbolically expressed the vague but pervasive anxiety in Weimar (as elsewhere in the West) about the implications of Taylorism and Ford’s assembly line—not to mention the “rationalization movement” in German industry, which became necessary after the stabilization of the mark in 1923/24. But even in the case of the Social Democratic labor movement, one of the groups one would most expect to have questioned the transformation of industrial work, a powerful ideological commitment to scientific progress prevented any thoroughgoing criticism of rationalization.³²

After 1923, with the decline of radical Expressionism in the arts, the only remaining bastion of antiscientific and antitechnological criticism was in the universities and among the intellectuals of the “conservative revolution”—the creators of *Lebensphilosophie*. Paul Forman has written persuasively of the influence of reactionary, neo-romantic idealism on Weimar physicists, especially as a result of Oswald Spengler’s best-selling *Decline of the West* (vol. 1, 1918). Many university physicists felt impelled by their institutional environment to reject strict causality in their theory.³³ Forman’s article is a seminal contribution to the history of science, but it is based primarily on the period 1919–23, when the loss of the war and severe political and economic crises produced a corresponding sense of intellectual crisis inside and outside the universities. Because Forman looks toward the rise of probabilistic quantum mechanics in the later 1920s, he underrates the perceptible change in mood outside academia that came with the “stabilization” in 1924. The “New Objectivity” (*die neue Sachlichkeit*), a

³²For a brilliant analysis of *Metropolis*, see L. J. Jordanova, “Fritz Lang’s *Metropolis*: Science, Machines and Gender,” *Radical Science* 17 (1985): 5–21. On rationalization see Charles S. Maier, “Between Taylorism and Technocracy: European Ideologies and the Vision of Productivity in the 1920s,” *Journal of Contemporary History* 5 (1970): 27–51; Robert A. Brady, *The Rationalization Movement in German Industry* (Berkeley, Calif., 1933); Gunnar Stollberg, *Die Rationalisierungsdebatte 1908–1933* (Frankfurt, 1981).

³³Paul Forman, “Weimar Culture, Causality, and Quantum Theory, 1918–1927: Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environment,” *Historical Studies in the Physical Sciences* 3 (1971): 1–115. The only antiscientific *Lebensphilosophie* attack on the rocket fad I have found so far is that of Walter Deubel, “Die Religion der Rakete,” *Deutsche Rundschau* 55 (October 1928): 63–70.

movement that began in painting, soon became a popular slogan among intellectuals; it meant a rejection of utopian hopes, an emphasis on realism and cold analysis, and an acceptance of seemingly inexorable technological change.³⁴

The stabilization era, it must be remembered, was one overshadowed by technological innovation. Commercial radio began broadcasting to 200 crystal sets in Berlin in October 1923; by 1930 there were 3 million radios and a national network. The hoopla surrounding the transatlantic flights by zeppelins and aircraft after 1924, the advent of neon lighting, the massive expansion in the production of German films and of gramophones and records, the new (if temporary) respectability of the Bauhaus’s modernist architecture, and the fascination with Henry Ford and American skyscrapers—all these are indicators of the role technology played in high and popular Weimar culture in this period (fig. 10).³⁵ Of course, the mood of optimism inevitably declined with the new crisis at the end of Weimar, and the university professoriat remained a stronghold of right-wing, anti-Weimar ideas throughout the republic. *Lebensphilosophie* remained very much alive during the stabilization epoch, if very marginal to the mass media—as my survey of press reaction to the rocket fad demonstrates. But even on the intellectual radical Right, as Jeffrey Herf has shown, many writers tried to integrate irrationalism and technology in the 1920s and 1930s. Spengler was among them. These thinkers appreciated technology for aesthetic and nationalist reasons (not the least for its importance in modern warfare), while rejecting with horror many of the ultramodern and “American” aspects of the culture of the Weimar Republic.³⁶ In an anti-intellectual way, the Nazis embodied the same contradictory appreciation of technology.

³⁴In fairness to Forman, it should be pointed out that the rise of the New Objectivity has only been emphasized more strongly in recent German scholarship. See Schrader and Schebera, *The “Golden” Twenties* (n. 31 above), pp. 150–51; Eberhard Kolb, *The Weimar Republic* (London, 1988), pp. 85–90. The effect of the change in mood on the Bauhaus’s parent organization, the Werkbund, was earlier described by Joan Campbell in *The German Werkbund* (Princeton, N.J., 1978), pp. 172–75, 201–3. The New Objectivity and the whole influence of American technology on Weimar culture has recently been illuminated by Thomas P. Hughes in *American Genesis: A Century of Invention and Technological Enthusiasm* (New York, 1989), pp. 284–94, 309–19, 346–52.

³⁵Schrader and Schebera, *The “Golden” Twenties* (n. 31 above), pp. 86–90, 117–25; Kolb, *Weimar Republic* (n. 34 above), pp. 89–95; Barbara Miller Lane, *Architecture and Politics in Germany, 1918–1945* (Cambridge, Mass., 1968); Hughes, *American Genesis* (n. 34 above), pp. 284–94, 309–19.

³⁶Herf, *Reactionary Modernism* (n. 7 above). On the alienation of right-wing intellectuals from Weimar Germany, see Walter Laqueur, *Weimar: A Cultural History* (New York, 1976), chaps. 3 and 6.

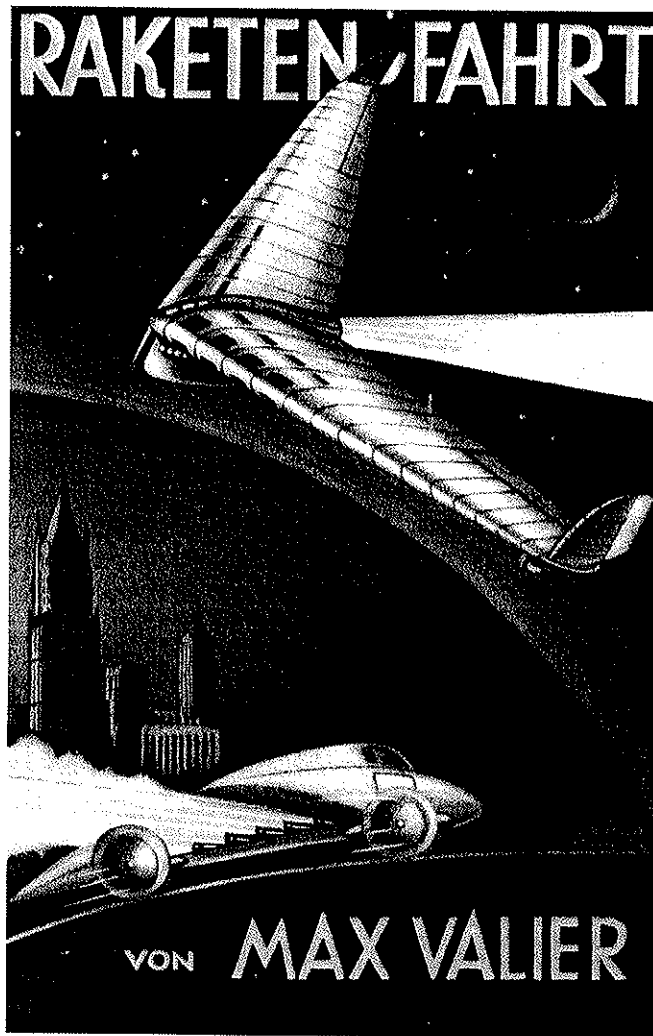


FIG. 10.—The ultramodern aesthetic of the Weimar Republic in the stabilization era is shown in this cover illustration from Max Valier's *Raketenfahrt* (Rocket Travel, 1930). Note the inclusion of skyscrapers.

A pervasive sense in Weimar of an onrushing technological world symbolized by the United States, to which Germany must somehow adapt, points us toward the third and final cultural factor that contributed to an acceptance of futuristic technologies like the rocket: the development of a very modern “consumer culture.”³⁷ With some exaggeration, Walter Laqueur has called Weimar “the first truly modern culture” and has pinpointed some of the reasons why that might be the case: personal and political freedom unprecedented in Central Europe, a palpable break in historical continuity caused by the collapse of the empire in 1918, many sources of ideological and social conflict, and a search for entertainment and escape provoked by those conflicts and the political and economic troubles that followed the war.³⁸ To this list should be added the influence of technology itself, as we have seen.

In the United States, freedom and escapism in combination produced what Joseph Corn, in his history of aviation in American popular culture, has called “the zany exhibitionism of the Jazz Age.” Corn continues: “In that period, many Americans went overboard, as it were, in a cultural climate that supported a new permissiveness regarding public and intimate behavior. The ballyhoo of the era also reflected new and more aggressive ways of merchandising and advertising products, including the use of public relations professionals and new forms of media, such as radio and billboards.”³⁹

Similar processes must have contributed to the success of the Weimar rocket stunts in 1928–29 and thus to the scope of the fad. In the most modern and Americanized culture in Europe, one in which the rise of the mass media was accompanied by a rapid growth in spectator sports and other forms of consumer culture,⁴⁰ Germans must have had an appetite for spectaculars that not only symbolized national triumphs and technological progress but also provided

³⁷I have adopted the term from Richard W. Fox and T. J. Jackson Lears, eds., *The Culture of Consumption* (New York, 1983), pp. x–xii, a book of essays concentrating exclusively on the United States.

³⁸Laqueur, *Weimar* (n. 36 above), pp. ix, 32, 182, 225.

³⁹Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation, 1900–1950* (New York, 1983), p. 51.

⁴⁰Kolb, *Weimar Republic* (n. 34 above), p. 91. The introduction to Linke's 1928 popularization, *Das Raketen-Weltraumschiff* (n. 22 above), p. 3, comments explicitly on mass spectator sports as one form of entertainment competing for public attention. It must be kept in mind, however, that the “Americanization” of German popular culture was somewhat superficial, and that Weimar German society remained deeply divided along class lines and had a flourishing working-class socialist “alternative culture.” On the latter, see Peter Lösche and Franz Walter, “Zur Organisationskultur der sozialdemokratischen Arbeiterbewegung in der Weimarer Republik: Niedergang der Klassenkultur oder solidarische Höhepunkt?” *Geschichte und Gesellschaft* 15 (1989): 511–36.

escapist entertainment. Radio certainly contributed to the popularization of rocketry, and the press, too, was freer and more able to exploit sensationalism in Weimar Germany than had been the case in the past. Finally, for Fritz von Opel the rocket stunts were free advertisement for his family's cars, and it is unlikely that without this new mass culture and American-style forms of advertising he would have associated his respected firm with what amounted to "zany exhibitionism."

In sum, there are convincing cultural and social historical reasons why Weimar Germany sustained the greatest rocketry and spaceflight fad of the interwar period and the most lively and productive movement for the same cause. There is indeed some truth to the statements of the popular space-history literature, which has emphasized nationalism and escapism. But it was not a nationalism or an escapism produced by the immediate postwar crisis, because the fad began and reached its apogee in the stable middle years of the republic, precisely when relative prosperity and the *lack* of distractions from pressing political and economic issues allowed the highest development of the Weimar spaceflight movement and the consumer culture. A widespread belief in the inevitability—and usually the desirability—of technological progress also encouraged an openness to futuristic technological concepts, but this did not spring from romantic *Lebensphilosophie*, which was in any case very divided on technological issues and very marginal to the mainstream media.

The most challenging historiographical questions arise in comparisons to other countries, especially the United States. One can see how the utopian and scientific culture of the early Soviet Union might contribute to a lively spaceflight movement, while the absence of a consumer culture, plus government control of most of the media and the industrial economy, could prevent the outbreak of a popular fad such as occurred in Germany. But a lively popular culture and faith in the beneficence of technology were even more developed in the United States than in the Germany of the 1920s, yet the American spaceflight fad was certainly weaker in spite of a number of imitators of the German rocket stunts.⁴¹ Personalities must have played a crucial

⁴¹My impressions of the Soviet and American movements are based on Winter, *Prelude* (n. 2 above), pp. 27–30, 55–85. One Opel/Valier imitator in the United States is described in Keith Martin, "Misguided Missile: The Strange Tale of a Recluse's Rocket-powered Car," *Special Interest Autos*, no. 55 (February 1980): 24–29, a reference I owe to Frank Winter. For American technological utopianism, see the selections in Joseph J. Corn, ed., *Imagining Tomorrow: History, Technology, and the American Future* (Cambridge, Mass., 1986), as well as Corn, *Winged Gospel* (n. 39 above). A background

role: Goddard ran from publicity because of his shyness and his professional role as an academic physicist, whereas Oberth, and especially Valier, understood the need to build popular support.

Of the cultural factors, perhaps the rather pathetic nationalism of many Weimar Germans was crucial, since they seemed to seize on any technological accomplishment by a German as evidence of national recovery or superiority. It is also possible that the strong association between science fiction and rocketry in the United States put the idea of spaceflight in disrepute among academics and "respectable people" from the outset. Brian Horrigan has shown how American popular culture incorporated the spaceflight idea as a form of entertainment as early as 1901, when carnival rides appeared with this theme. In 1926 Hugo Gernsback created the pulp science-fiction magazine *Amazing Stories* with its sensational covers, and "Buck Rogers" became a regular comic strip in 1928.⁴² These were products of American consumer culture that had no German equivalents. In the 1930s and 1940s, the association between spaceflight and science fiction became so great that the American Interplanetary Society (founded in 1930 by science-fiction writers) became the American Rocket Society, while among scientists, according to the famous aerodynamicist Theodore von Kármán, "the word 'rocket' was in such bad repute that for practical reasons we decided to drop it from our early reports and even our vocabulary." When dividing Army Air Corps contracts in 1938, another colleague let von Kármán "take the Buck Rogers job," and thus arose at Caltech the Jet Propulsion Laboratory and the JATO (jet-assisted takeoff) rocket for aircraft.⁴³

If exploration of the origins of the Weimar spaceflight and rocketry fad are illuminating for the social history of technology, we must not forget finally that the fad itself had crucial historical importance: without it one can scarcely imagine the development of the German

factor in the interest in spaceflight in the 1920s, which may indeed have been stronger in the United States than in Germany, was the debate over extraterrestrial life, in particular Mars and its supposed canals. See Ley, *Möglichkeit* (n. 22 above), pp. 14–15, and *Völkischer Beobachter* (Munich), Bayernausgabe, October 24, 1929, for Germany. See Susan J. Douglas on the American fad for radio communication attempts with Mars in the early 1920s in Corn, *Imagining Tomorrow*, pp. 54–55.

⁴²Brian Horrigan, "Popular Culture and Visions of the Future in Space, 1901–2001," in Bruce Sinclair, ed., *New Perspectives on Technology and American Culture* (Philadelphia, 1986), pp. 51–54.

⁴³Theodore von Kármán with Lee Edson, *The Wind and Beyond* (Boston, 1967), pp. 242–43; Winter, *Prelude* (n. 2 above), pp. 82–83; Clayton Koppes, *JPL and the American Space Program* (New Haven, Conn., 1982), pp. 1–2, 20.

army rocket team and the first long-range ballistic missile—the V-2. Oberth, Valier, and the fad were responsible for teenagers like Wernher von Braun accepting spaceflight as personal crusade and rocketry as a career, and for the German army looking to rockets as a means to circumvent the restrictions of the Treaty of Versailles. It was precisely in 1929, at the fad's apogee, that Army Ordnance first ordered a study of the rocket problem, and Walter Dornberger, later military commander of the rocket program, first read Oberth.⁴⁴ Within a year that program had begun.

High-Technology Calculation in the Early 20th Century: Punched Card Machinery in Business and Government

ARTHUR L. NORBERG

Information-handling techniques changed dramatically in the last quarter of the 19th century with the introduction of mechanical contrivances for counting and for analyzing data. Calculators could perform all four basic arithmetical functions;¹ bookkeeping machines, similar in most respects to calculators, could generate various types of ledgers; and tabulating systems could analyze data stored on punched cards.² The effect of the tabulating system was substantially different from that of other business machines, such as desk calculators,

DR. NORBERG is director of the Charles Babbage Institute and associate professor in the Program in History of Science and Technology at the University of Minnesota. He is grateful to William Aspray, Martin Campbell-Kelly, and I. Bernard Cohen for many helpful suggestions. Research for this article was part of a larger project supported by the National Endowment for the Humanities (RO-21098-85) and the National Science Foundation (SES-8420481), whose generosity is gratefully acknowledged.

¹The basic arithmetical functions were difficult to handle mechanically. Addition involved two distinct operations: the addition of digits and the carrying of figures. Various techniques were devised for these two operations. Multiplication was essentially repeated addition. Division was very cumbersome and was analogous to ordinary long division. Subtraction often involved a switch for reversing the motion of the main shaft but keeping the rotation of the handle constant. In business calculations, credits were entered as nines complements and debits as ordinary numbers, so that subtraction was not done directly. According to I. Bernard Cohen, at the beginning of the 20th century the scale with which mechanical calculators were used shifted. It was the introduction of the keyboard and the key-driven machines, plus the high level of reliability, that made them so generally acceptable. For details on the operation of calculators, see E. M. Horsburgh, ed., *Handbook of the Napier Tercentenary Celebration or Modern Instruments and Methods of Calculation* (1914), Section D, vol. 3 of the Charles Babbage Institute Reprint Series for the History of Computing (Los Angeles, 1982). See also D. Baxandall, "Calculating Machines and Instruments," in *Catalogue of the Collections in the Science Museum* (London, 1926); and "Instruments et machines à calculer," *Catalogue du Musée*, Section A (Paris: Conservatoire National des Arts et Métiers, 1942).

²For a discussion of the introduction of these mechanical devices, see James R. Beniger, *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge, Mass., 1986).

© 1990 by the Society for the History of Technology. All rights reserved.
0040-165X/90/3104-0002\$01.00

⁴⁴Winter, *Prelude* (n. 2 above), p. 51; Dornberger to Oberth, June 12, 1964, in an unpublished Festschrift for Oberth found in NASM file "Hermann Oberth."