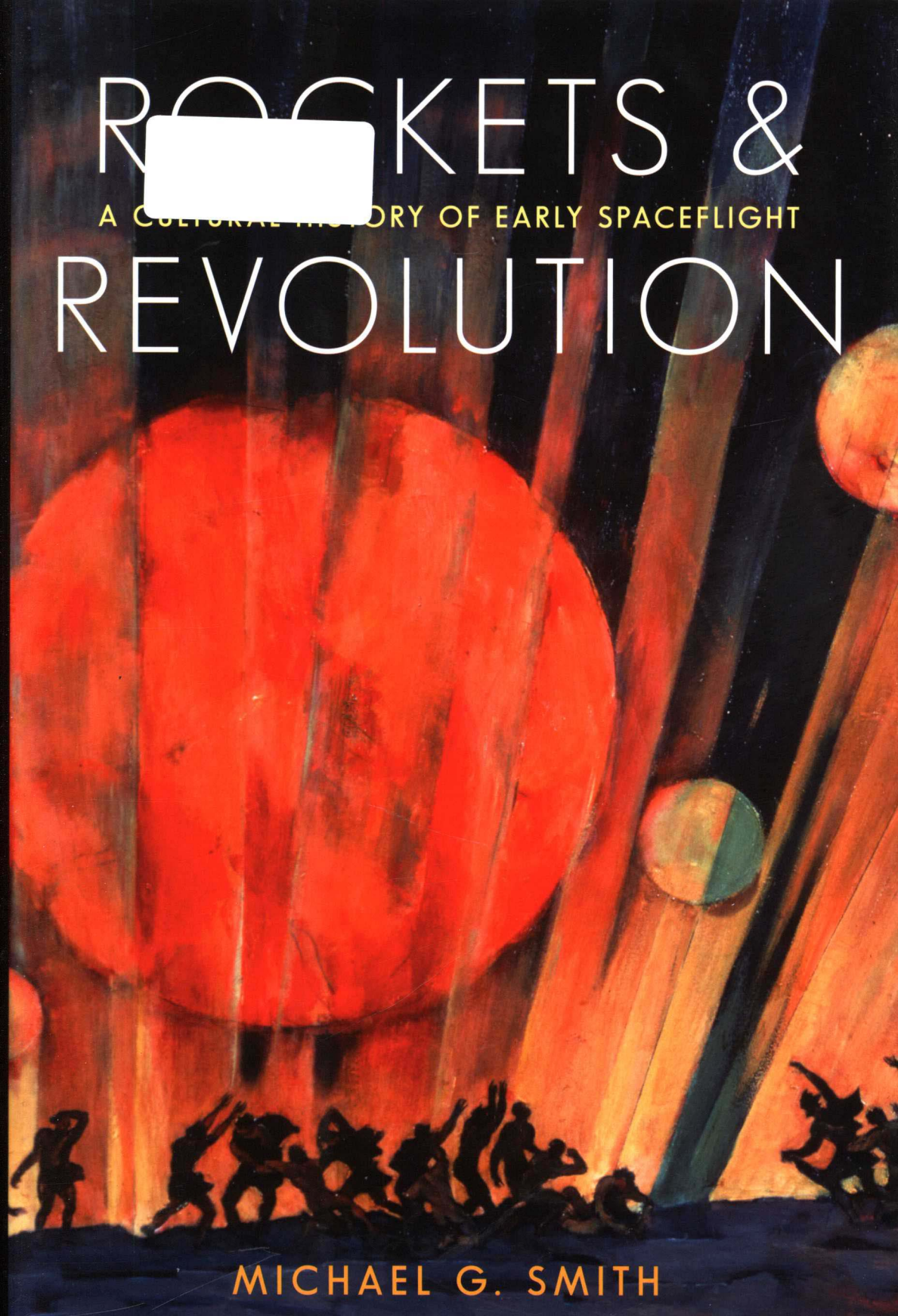
ROCKETS & REVOLUTION

A CULTURAL HISTORY OF EARLY SPACEFLIGHT



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A Cultural History of Early Spaceflight

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The front cover image—a portion of K. F. Iuon's *New Planet* (1921)—was also featured on the front cover of Richard Stites's *Revolutionary Dreams: Utopian Vision and Experimental Life in the Russian Revolution* (New York: Oxford University Press, 1989). This pathbreaking book, which has inspired my own approach here, is now in its twenty-fifth year of publication.

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Set in Minion Pro by Renni Johnson.

ROCKETS AND REVOLUTION

For our sister, Roberta Maria Smith (1949–2007)

ROCKETS AND REVOLUTION

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Introduction

Have some fun,
Shooting the heavens by rocket.
Chart your own course,
Take a spin along its parabola.
—VLADIMIR MAIAKOVSKII

The exploration of outer space, one of the more dramatic and complex technical achievements of our time, owes much of its success to a scientific paradigm of relatively distant origins: Sir Isaac Newton's third law of motion, "to every action there is always opposed an equal reaction."[1] This simple precept from the seventeenth century, once it was applied to the rocket engine of the twentieth, helped to launch America's Apollo missions to the moon. The conquest of space was not some grand "paradigm shift," some momentous "spaceflight revolution" of our times.[2] It was the result of forces and trends already long at work in our world: in modern astronomy and physics, in artillery ballistics and chemical engineering, in all the many experiments with heavier-than-air flight.

By 1924 Albert Einstein's theories of relativity represented the true new wave in science and were accorded significant debate in the academic and popular press. But Einstein's theories were difficult and obscure. A Newtonian universe made more sense to the average readers of modern science and to the rocketry enthusiasts among them, especially in Russia. One popular Soviet text from 1941

still taught the simple truth that our planet was round, that "up is always up above our heads wherever we are on earth, either in the USSR, or even somewhere in America."[3] The early Russian pioneers appreciated Newton more than Einstein. Theirs was still a mechanical age. Their hopes for rockets and space travel were fueled by his trusted celestial mechanics and differential equations, already over two hundred years old. Any future step toward rocket power first meant a step "backward to Newton" and to the truth of his famous rocket-powered carriage (whose image was widely disseminated in Russia). For his "genius" had been to discover the law of attraction (gravity) that binds us to the earth and the law of force (reaction) that allows us to escape from it.[4] The Russian pioneers understood that there was something uniquely modern about rocket power, something that set the human form itself into motion: enveloped in its machine, liberated by its own power of wonder and reason, placed on a trajectory into outer space. In truth the pioneers of rocketry and spaceflight theory worked between two historical eras: calculating from traditional Newtonian mechanics, if breaking out of its absolute, fixed universe; and moving into the freer, mobile depths of Einstein's relative, curved space.

Rocket propulsion straddled these two worlds, Newton's solar system and Einstein's spherical universe, always pointing upward and forward. Rockets were simple and elegant in design, a streamlined alternative to the rather cumbersome new technologies powering our lives: from steam and combustion to diesel and turbine. The wheel needed land, the steam wheel needed water, and the airplane propeller needed the air. The rocket operated through all three but most efficiently in the vacuum of outer space, without any supporting medium except its own. Its thrust was altogether self-generated and continuous, dependent only upon its own design and mass and upon the chemical and mechanical processes that we human beings had mastered to sustain them. In a moment of rare candor America's premier rocket experimenter, Robert H. Goddard, author of the pioneering *A Method of Reaching Extreme Altitudes* (1920), put it best when he defined the unique character of liquid fuel rockets as "the release of power *from within themselves*." Robert Esnault-Pelterie,

one of his rivals in the new field of rocket science, then called "astronautics," honored the rocket as a "self-propelled fuse," the perfect expression of human motion and achievement.[5]

These rocket pioneers translated Newton's calculus into applied geometry, into the very trajectories and parabolas upon which they imagined people moving through space. The scientific mingled with the existential. The modern mind was geometrical, proclaimed Henri Bergson in *Creative Evolution* (1907), read widely in Europe, the Americas, and Russia.[6] "The lines we see traced through matter are just the paths on which we are called to move." The material world was but an ocean "in which we are immersed," he wrote. We are always in flux, masters of the "movement that generates the curve," the curve that is also a "line," a "wave," a "vortex" of human action.[7] Bergson announced the mystic force of an "élan vital," or vital spirit, within us. "All the living hold together," he wrote, calling forth his Newtonian images, "and all yield to the same tremendous push." The task of humanity was to perceive the world of objects in their synthetic wholeness, to divine how "the smallest grain of dust is bound up with our entire solar system." Against "that undivided movement of descent which is materiality itself," human beings were born to act. We were born to give way to that "single impulsion," to fulfill the "overwhelming charge able to beat down every resistance and clear the most formidable obstacles, even death."[8]

The powder fuel fireworks rocket, not yet the liquid fuel space rocket, was one of Bergson's central metaphors for the movement of the human will and intellect through history. Human life was like a rocket, "*creative action which unmakes itself* . . . like the fiery path torn by the last rocket of a fireworks display through the black cinders of the spent rockets that are falling dead."[9] People similarly raced forward into the future, collapsing present into past, at the dynamic interface between life and death. Bergson transformed Newton's rather static model of natural attraction and repulsion into a dynamic model of human "ascent" and material "descent." He called the "ascending movement" an "impetus" and a "leap," a "recoil" and "thrust," corresponding to "an inner work of ripening or creating." Or as he wrote, "Matter . . . is weighted with geometry; and matter, the real-

ity which *descends*, endures only by its connection with that which *ascends*. But life and consciousness are this very ascension."[10] "Creative evolution" was not some horizontal, two-dimensional timeline in space. It was a vertical, three-dimensional curve ascending through history. The human form created itself, sui generis, like the rocket's movement upward.

These values were by no means unique to Bergson. They were already at the heart of the European experience, at one with its "self-consciousness," as René Descartes might have said. *Cogito ergo sum.* Or remember G. W. F. Hegel, who in his lectures on the philosophy of history celebrated the Age of Enlightenment, when "thinking becomes the principle, the thinking proceeding from itself."[11] Human sovereignty came to mean political self-rule, self-regulating markets, and self-evident rights—the modern ideal of "self-determination," be it Karl Marx's "class" or Woodrow Wilson's "nation" or Vladimir Lenin's "party." Friedrich Nietzsche called it our "will to power," embodied in his gravity-defying Zarathustra. Sigmund Freud called it our "sex drive," instinctive in each of us. As Marshall Berman explored in his study of modernity, writers as diverse as Johann Wolfgang von Goethe and Nikolai Chernyshevskii also spoke of the modern spirit as a "self-heightening, self-awakening, self-liberation." The modern world "pours us all into a maelstrom of perpetual disintegration and renewal, of struggle and contradiction, of ambiguity and anguish." To be modern is to be part of a universe in which, as Marx said, in a premonition of the rocket, "all that is solid melts into air."[12] Berman's fields of study were literary criticism and political theory, not modern science; his grounds were city streets and skyscrapers, not rockets. But his expressions and images, again and again, referred to modernity as a mutual striving and hurtling, a propelling and thrusting forward, a plunge into a constantly changing and challenging future. These are the verbal constructs that describe the rocket, that trace a parabolic line through historical time. They express the equations and theorems of modern mathematics and physics. They are the existential moments captured by modern writers in their traumatic story lines, by painters in their abstract designs. They are the very narrative arcs by which we moderns have defined ourselves.

The dramatic technological innovations at the turn of the twentieth century emboldened this ethic of self-creation. Rocket power followed the "automobile" and the "flying machine" as mechanical extensions of the human form, mechanizations of our bodies and cultures. Europeans and Americans crafted a whole new symbolic world to make sense of these invented things, especially the airplane, in a "passion for wings" ascending into the air and into our dreams.[13] At times, in the precise angles and curves of applied geometry, the scientific and the existential mingled with the occult. Some of the leading rocket enthusiasts and pioneers shared a sense of gnostic purpose, as if crafting a whole new structure of space and time and motion, a bridge by which they might escape from a cursed and broken Earth. Their spatial trajectories, as parabolas and hyperbolas, prefigured a teleology at the heart of the European consciousness: moving from ignorance to knowledge, from corruption to salvation. These pioneers were the "sun-snarers," according to H. G. Wells—the "fire-worshippers," as G. E. Langemak termed them. Goddard's own father called him an "angel shooter," as if under the spell of his own rocket creations, entranced by the sky and sun toward which they raced.[14] A few of the rocket pioneers and enthusiasts were even more dedicated. Max Valier, Hermann Oberth, and Jack Parsons actively promoted and participated in occult practices, as if rocketry, mixing chemistry and experiment, was a kind of new magic in motion.

Space exploration had its conflicted origins too. Amid the controversies raised by the publication of Hermann Oberth's book *The Rocket into Planetary Space* (1923), Goddard already predicted "something in the nature of a race" for rocketry.[15] This was nothing so very new. Europe and America had joined such contests before: the race for Africa, for empire, for the North and South Poles, for big battleship navies, eventually for Paris or Berlin. Aviators were already racing for distance, speed, and altitude records. The rocket pioneers worked within these strategic terrestrial and aeronautical paradigms, simply calling for another kind of race: one toward space. The distinction may seem trivial, but this was not yet a race *to* space, a competition to get into space first. Rather, it was more of a race to define the terms and technologies of space travel, to create a brand-

new model of rocket science and astronautics, all in a competition *toward* outer space.[16]

Russia enters the story in a dramatic way, a humbling way perhaps for most American audiences. In this race it enjoyed a remarkable series of initial firsts: the first theorist of spaceflight; the first popular monograph on space travel; the first public agency to promote interplanetary travel; the first media images of rockets reaching into space by reaction power and parabolic line; the first world exhibition on spaceflight; the first international language dedicated to spaceflight; the first encyclopedia of spaceflight; the first state institute and conference devoted to "reactive" (jet and rocket) propulsion; and the first theoretical tract on "cosmonautics." These initiatives combined to give Russia what one enthusiast called international primacy in the new field of "reactive astronautics."[17] The USSR was leading the way to rocket science. We have not yet even mentioned *Sputnik*, not to speak of the many other Russian space firsts that followed from it.

The Russian Revolution of 1917 played a critical role in these advantages. Its logic of crisis and resolution presumed a radical break in time, as if everything was now possible. Its intense political and economic development also drove the country's commitment to science and technology. To survive in a fiercely competitive world, impoverished Russia had to match the best achievements of the West. The imperative to race with it was always a function of a partly real, partly perceived sense of inferiority. To borrow a phrase from Louis Althusser, who borrowed it from Leon Trotskii, Russia "was at the same time *the most backward and the most advanced nation*," fraught with severe contradictions but also with unique opportunities.[18] Soviet Russia occupied a backward space on Earth but, thanks to the Russian Revolution, it had moved farther ahead of the historical curve. Its predicament was to catch up, not so much in time as in space, the real physical spaces of machines and military forces, factories and industrial techniques. The very pace of technological change, its interplay between obsolescence and innovation, meant that the backward USSR might be able to outstrip ("catch and surpass") the leading West. Aeronautics and astronautics were all about "tempos." As one Soviet calculus had it, "what today is a world record by tomor-

row is already obsolete." Rocket power and space travel offered Russia symbols of advancement as well as measures of geopolitical advantage. Just as it had leaped past the bourgeois to the proletarian revolution, so it might also leap from railroads to rocketry.[19]

Over the span of three tumultuous decades—first around 1914, again in 1924, and once more about 1934—rocketry and space travel became serious topics of public debate. With the new Soviet regime especially, the technocratic strain in Marxist-Leninist ideology added value to both ends and means: the whole universe as an arena of human action and progress, the rocket as machine par excellence. Technology was the premier mark of competitive advantage and strategic power. But ideology also dictated the certainty of war with the capitalist states of Europe and the United States. This theme of class warfare predisposed the regime to see the universe as a site of inevitable conflict and the rocket as a mighty weapon in its arsenal. Aleksandr Beliaev was already fighting the Cold War between Russia and America in his novel *The Struggle in Space* (1928).[20]

At its origins the race toward space was governed by Russia's attraction to, and repulsion from, much that was American, a function of Althusser's historical predicament. In contrast, Walter McDougall's Pulitzer-winning monograph, *Between the Heavens and the Earth*, has argued that the United States first borrowed something of the technocratic and statist impulses from its archrival, the USSR, after the stunning launch of *Sputnik* in 1957. *Sputnik* was the consummate "saltation" in American government policy and national character, forcing it to become something less of a democracy, more of a military-industrial dictatorship, this in order to better compete in the Cold War "race to space."[21] But that is only one in a pair of mirror images. Yes, Americans looked eastward to the Russians, true. But Russians looked westward to the Americans as well. They recognized the values of technocracy, and borrowed them first, from the American experience. McDougall's "saltation" was a turn around more than a turn toward. It was a turn back to ourselves, to the model of technocratic efficiency that the Soviets already imagined us to be.

The history of Russian and American competition in rocketry and space exploration is in this sense a history of language barriers.