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## Chapter 7

# Word Cosmonautics: A History\*

Mike Gruntman<sup>†</sup>

### Abstract

Science and engineering of spaceflight describe the field by two different words, *astronautics* and *cosmonautics*. While both these words came from the French language, they appeared as the terms of science under very different circumstances. The introduction of the word “astronautics” is well documented. In contrast, the origin of the scientific term “cosmonautics” remains poorly known. This chapter describes a history of the introduction of the word “cosmonautics.”

### Forgotten Pioneer

American *astronauts* and Russian (Soviet, in the past) *cosmonauts* routinely travel in space. They orbit Earth and live and work at the *International Space Station*. Men landed on the Moon and plan on reaching Mars. The field of science and engineering dealing with spaceflight describes itself by two different words, *astronautics* and *cosmonautics*. The United States and Western Europe

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commonly use the word *astronautics*. In contrast, the Russian language relies today almost exclusively on the word *kosmonavtika* (*cosmonautics*).

Both these words originated from the French language—*l’astronautique* and *la cosmonautique*. Two pioneers of space exploration, Robert Esnault-Pelterie and Ary J. Sternfeld,\* introduced the words into the scientific language under very different circumstances.

The origin of the term *astronautics* is well documented.<sup>1,2</sup> In contrast, the history of the word *cosmonautics* remains poorly known. Ary Sternfeld, a space pioneer who introduced the latter word in 1930s, is also largely forgotten. The approaching 50th anniversary of the breakthrough to space makes it especially appropriate to remember those visionaries who paved the way to the cosmos.

### **Astronautics Was the First**

The word *astronautics* was the first. On 8 June 1927 a prominent French learned group, the French Astronomical Society (*Société Astronomique de France*), held its annual general meeting in the splendid Richelieu amphitheater at the Sorbonne University. There, Robert Esnault-Pelterie delivered a lecture “L’Exploration par fusée de la très haute atmosphère et l’avenir des communications interplanétaires” (“Rocket Exploration of the Very High Atmosphere and the Future of Interplanetary Travel”).<sup>3</sup> The lecture “aroused lively interest” and the audience “frequently interrupted it with applause.”<sup>3</sup>

Esnault-Pelterie, 1881–1957, occupied a unique place among great space pioneers.<sup>1</sup> The fourth man in France to obtain a pilot’s license, he made remarkable contributions to the development of airplanes. In the public mind in the beginning of the 20th century, rocketry and space exploration belonged more to the realm of science fiction than to the field of “serious” research. Certainly, Esnault-Pelterie’s fame as an aviation pioneer helped him to gain acceptance by mainstream scientific audiences.

On 26 December 1927, Esnault-Pelterie and his friend and supporter André Hirsch organized a dinner to discuss the promotion of the emerging science of space travel.<sup>2</sup> Several prominent men gathered at the house of the mother of Hirsch: famous physicists Jean Baptiste Perrin (Nobel Prize in physics, 1926) and Charles Fabry, astronomers Felix Esclançon and Henri Chrétien, director of the hydrological service of the French Navy and president of the French Astronomi-

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\* The spelling of the name *A. J. Sternfeld* changed during his lifetime to *A. A. Shternfel’d*. For consistency, I use the original spelling in the text, while his name in references and in quotes is spelled as in the sources.

cal Society Eugène Fichot, General Gustave Ferrié, who had pioneered many military applications of radiotelegraphy, and a science-fiction writer, J. H. Rosny the elder.

The guests discussed the name that should be given to the new science. Esnault-Pelterie first proposed *sideration* (the word structured similarly to *aviation*), but it did not appeal. Somebody suggested *cosmonautique* (cosmonautics), but it did not appeal either. Then, Rosny proposed the word *astronautique* (astronautics). This was it! The scientists adopted the word at once.<sup>2</sup>

The French Astronomical Society published the expanded version (and under a slightly modified title) of Esnault-Pelterie's 1927 lecture in a special supplement to a March issue of its bulletin<sup>4</sup> and as a separate book.<sup>5</sup> It was in these publications where the word *astronautics* appeared for the first time. Then in 1930, Esnault-Pelterie wrote a comprehensive treatise on rocketry and spaceflight under the title *L'Astronautique*.<sup>6</sup> He presented the new science in a consistent and detailed way: discussed rocket motion in vacuum and air; considered gas flows in converging-diverging nozzles; applied thermodynamics to the combustion processes of various fuel-oxidizer combinations; and pointed out the exceptional properties of atomic hydrogen as a propellant. Esnault-Pelterie outlined possible rocket applications, including studies of the aurora borealis and of the upper atmosphere, missions to the Moon and to the planets. He suggested reaction wheels for spacecraft attitude control and discussed the effects of spaceflight on humans.

*Astronautics*—the art or science of designing, building, and operating space vehicles—was quickly accepted as the name of the new field of science and engineering, and it entered many languages.

At the same eventful dinner on 26 December 1927, the guests also worked out the plan to establish an annual award in astronautics.<sup>2</sup> Esnault-Pelterie and Hirsch provided funds, 5,000 francs annually for three years, to the French Astronomical Society for the REP-Hirsch International Astronautics Prize (*Prix REP-Hirsch*).<sup>7</sup> The society formed a committee of prominent scientists to award the prizes. The stellar reputation of the committee members helped to establish the respectability of the emerging science.

The first REP-Hirsch Award went in 1929 to Hermann Oberth for his book *Wege zum Raumschiffahrt (Road to Space Travel)*.<sup>8</sup> The awards were given until 1939, with the last prizes bestowed on Americans Frank Malina and Nathan Carver.<sup>1</sup> (At this 57th International Astronautical Congress in Valencia, Spain, the IAF and IAA celebrate the achievements of Frank J. Malina by a special “highlight lecture” given by his son Roger F. Malina.) The REP-Hirsch encouragement award also recognized—in 1934—Ary J. Sternfeld,<sup>1</sup> who introduced the word *cosmonautics*.

## Dreams About Space and Communism

The story of the word *cosmonautics* is also a story about a largely forgotten space pioneer. We have again to step back in time to France of late 1920s and meet a young Polish Jew Ary J. Sternfeld, 1905–1980 (Figure 7–1). Ary got interested in space travel as a teenager. After graduating from a gymnasium (high school) in the industrial Polish city of Łódź, he enrolled in the Jagiellonian University in Kraków in 1923. One year later, he went to France to study mechanical engineering at the University of Nancy. He graduated in 1927.<sup>9</sup>



**Figure 7–1:** Ary J. Sternfeld in France in 1932.  
Credit: Polytechnic Museum, Moscow.

A successful career as a mechanical designer and engineer did not satisfy Sternfeld. He remained fascinated with the ideas of space travel. Consequently, Sternfeld enrolled in a graduate program at the Sorbonne in Paris, staying there for three years from 1928–1930. Unfortunately for him, his science advisors declined his proposal to write a dissertation about interplanetary flight. Sternfeld disagreed and left the Sorbonne. He wanted to work on spaceflight.

A dream of building a spaceship brought me [first] to the Jagiellonian University (Kraków), then to the Institute of Mechanics of the University of Nancy, and then to the Sorbonne [University]. Draft pages of the future book “Introduction to Cosmonautics” [published in 1937] multiplied. But these pages had not, as I thought about it, become my [doctoral] dissertation on future space flights. My official [science] advisors . . . refused to ap-

prove such a fantastic topic [of spaceflight] for the dissertation. They suggested concentrating instead on theory of metal cutting (since I had designed by that time a couple specialized mechanisms for machining wood), offering an increased stipend and unlimited time for completing the dissertation. But I declined these offers and decided to devote my effort to cosmonautics and to continue my work in this direction relying on myself. . .<sup>10</sup>

Sternfeld published his first two articles about space travel on 19 August and 2 September 1930.<sup>11</sup> Esnault-Pelterie had introduced the word *astronautics* two years earlier in 1928. The word had been widely accepted and Sternfeld used it four times.

Sternfeld's first articles appeared in . . . the official newspaper of the French Communist Party, *L'Humanité*. As early as high school, Sternfeld became involved in the socialist movement. His elder sisters, especially a member of the Polish Communist Party Franka, influenced young Ary. Ary's future wife was also an active member of the Polish section of the French Communist Party.<sup>9</sup>

Sternfeld met in France and married Gustava Erlich, a schoolmate of his sister's in Łódź. Gustava studied psychology and teaching the French language to foreigners at the Sorbonne. Her knowledge of French would become handy later when her private French lessons helped the family to survive hardships in the Soviet Union.

Sternfeld's articles in *L'Humanité* appeared under a French sounding name of *engineer L. Rolin*, concealing the identity of the author. It is possible that Ary coined the penname by transposing the letters in the name of a famous Frenchman René Lorin. Lorin studied applications of jet propulsion in aviation from 1907 and invented the ramjet in 1913. Sternfeld was well aware of René Lorin and his work.<sup>12</sup>

Publicizing achievements of Russian space pioneers directly contributed to propaganda by communists and their fellow-travelers, who projected an appealing humane image of the Soviet Union. Sternfeld concluded his second article in *L'Humanité* as follows,

Lack of immediate profit makes a capitalist [commercial] company completely uninterested in this major problem [of interplanetary navigation]. It is known in fact that it is the socialist society of tomorrow that will be the heir of the scientific and industrial progress.

It will be the socialist society that will master space.<sup>11</sup>

By the early 1930s, the socialist society of the Soviet Union had exterminated millions of people in an unmatched feat of social engineering. Many more would perish—with a cheerful support and encouragement of Western leftists—in the following years. Not only political opponents but also millions of other men, women, and children belonging to unwanted groups were murdered, tor-

tured, banished, and confined to concentration camps where many died from maltreatment, starvation, overwork, and savage conditions.<sup>13</sup> As the U.S. Senate described it factually, “Communism has claimed the lives of more than 100,000,000 people in less than 100 years.”<sup>14</sup> Sternfeld became one of many Westerners who changed his life to support this social experiment. He himself would be cruelly punished by socialism.

Sternfeld’s ideological and emotional links to the beloved socialist paradise further solidified in 1932, when he visited Moscow for one month.<sup>9, 10</sup> The French Communist Party recommended his design of a robot to the Soviet Ministry of Heavy Industry. For one month Sternfeld lived and worked in a luxurious hotel in downtown Moscow. He later explained,

I felt such a captivating atmosphere of building the new [communist] world during this my trip to the USSR. Despite food rationing in the Soviet Union in those years, despite poorly dressed people in the streets, and [despite that] Moscow with its long lines [in stores] produced unhappy impression compared to fake glamour of Western capitals, all that could not dissuade me from the decision to move [relocate] to the USSR in order to live and work there.<sup>10</sup>

### REP-Hirsh Encouragement Award

From Moscow Sternfeld returned to the home of his parents in Łódź in Poland. It was August 1932. He stayed there for one year and a half in seclusion working on a manuscript, collecting his ideas about spaceflight. He wrote in French, with his sister typing for him and his wife editing the manuscript.

Ary recalled very difficult conditions:

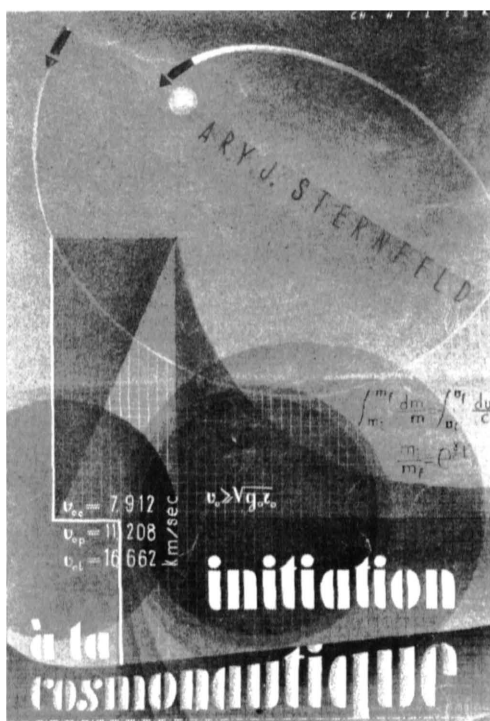
... there was not even enough paper: I was writing on pieces of wrapping paper ... which I first cut to the same size. Besides, there was very little light in the room, with direct sunlight never reaching it. Breathing was difficult because it was impossible to open the window—there was a communal latrine next to it [the window] in the yard, without a sewage line. Under such conditions I worked days and nights, bringing myself to exhaustion.<sup>15</sup>

The 490-page manuscript titled *Initiation à la Cosmonautique (Introduction to Cosmonautics)* was finally ready in November 1933. Sternfeld thus firmly chose the new word *cosmonautique (cosmonautics)* instead of the already accepted *astronautique (astronautics)*. A local Łódź artist, Ch. Hiller, designed a cover (Figure 7–2) for the manuscript. It showed a trajectory for efficient transfer to an orbit approaching the central body suggested by Sternfeld and three characteristic spacecraft velocities (velocity in a circular Earth orbit; escape velocity from Earth; and escape velocity from the solar system). These velocities would



become known later in the Soviet technical literature as the *first, second, and third cosmic velocities*, respectively. This manuscript cover was first published, as frontispiece, in a later Russian translation of the manuscript.<sup>16</sup>

With little hope of publishing the manuscript in his native Poland, Sternfeld went again to Paris in December 1933. Following the advice of a well-known French physicist Paul Langevin, he promptly submitted the manuscript for the REP-Hirsch Award. Sternfeld also made two presentations of his results at the meetings of the prestigious French Academy of Sciences, with the written versions appearing in Academy's *Comptes rendus*, or *Reports*. Making presentations required endorsement by the members of the academy, which was done by Jean Perrin and Ernest Esclangon.



**Figure 7-2:** Cover of the manuscript *Initiation à la Cosmonautique*, first published as frontispiece in a Russian translation of the manuscript in 1937.<sup>16</sup> The cover shows Sternfeld transfer to a point near the central body, three “cosmic velocities,” and equations relating rocket velocity and mass. The name of the artist who designed the cover shows in the right upper corner. Credit: Maya A. Shternfel’d and Polytechnic Museum, Moscow.

At the 22 January 1934 meeting of the academy, Sternfeld presented a technique for determining positions and velocities of interplanetary spaceships.<sup>17</sup>

Then on 19 February 1934, he described orbital transfer from a given Keplerian orbit to a trajectory approaching a point near the central body.<sup>18</sup> He showed that bielliptical transfer might minimize required velocity increments if a space vehicle first moved away from the central body and raised the transfer orbit apocenter. This counter-intuitive finding has become perhaps the best known contribution of Sternfeld to orbital mechanics, his “trademark.” The cover of his manuscript highlighted the trajectory (Figure 7–2). After his death, it would be engraved on his tombstone. It seems appropriate to call such an orbital maneuver “Sternfeld transfer.”

Ary Sternfeld also discussed his spaceflight ideas at a meeting of the French Astronomical Society on 2 May 1934. The session chairman warmly thanked him for the interesting talk, “you are as much a poet as an implementer. You have faith in the ideal of future times and I wish you to preserve this creative spirit for a long time.”<sup>19</sup> The audience responded with animated applause.

On 6 June 1934 the Committee on Astronautics of the French Astronomical Society bestowed the REP-Hirsch Award of Encouragement (Prix d’Encouragement) on Ary Sternfeld. The minutes of the society described the award:

To Mr. Ary J. Sternfeld, Award of Encouragement, for his interesting treatise titled “Initiation à la Cosmonautique,” expressing regret that [the Committee] could not better recognize the definitely considerable effort of Mr. Sternfeld, because this effort had unfortunately been applied to a large number of questions which does not fit into the first article of the Rules of the Award.

The Committee on Astronautics would like to state that the questions of pure theory [of spaceflight] seem now to be well clarified, and it will attribute henceforth more importance to experimental results or to the work capable of accelerating obtaining such results.

It is necessary, in fact, to note that one knows sufficiently about general conditions of astronomical travel and it is of little interest to perfect their details, while we are not able to send a rocket to a 100-km altitude (even much less than that) in order to explore directly the real composition of the upper atmosphere.<sup>20</sup>

The referred to “first article of the Rules” had specifically required the work to advance “one of the problems on which solution depends the realization of interstellar navigation or advancing the knowledge in one of the branches relevant to the astronomical science.”<sup>6</sup> Clearly, Sternfeld’s broad treatise “Initiation à la Cosmonautique” did not fit into the defined category. The Award of Encouragement was however a major recognition of the contribution of the young engineer. Sternfeld followed the award by publishing a number of articles in popular

and trade publications in France.<sup>12,21</sup> His articles unambiguously introduced the new scientific word *cosmonautique* in the titles.<sup>21</sup>

### *Introduction to Cosmonautics*

After accepting the REP-Hirsch Encouragement Award Sternfeld began to receive “very serious and attractive offers of continuing [his] scientific work in the West.”<sup>15</sup> He wrote that he,

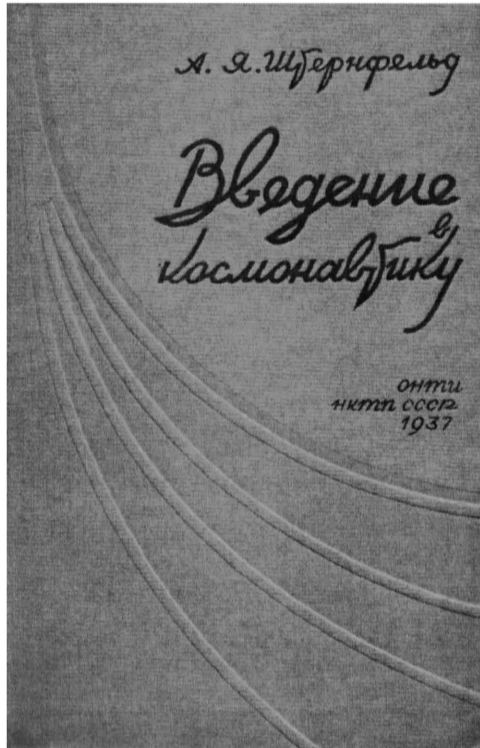
... replied then to all of them “no” and “no.” It was so that I had firmly decided to relocate to the Soviet Union forever, in order to facilitate development of cosmonautics with all [my] abilities in the then-only socialist country. Already then I deeply believed that the Soviet Union would be the country to open the road to cosmos to the humankind.<sup>15</sup>

On 14 June 1935, Ary Sternfeld and his wife arrived in the Soviet Union to settle permanently. One month later Sternfeld joined Moscow’s Jet Propulsion Scientific Research Institute, the famous RNII. RNII was formed in September 1933 to consolidate the Soviet effort in jet propulsion.<sup>1</sup> The institute embarked on a large-scale research and development program in solid- and liquid-propellant missiles and rockets. Many leading Soviet pioneers of rocketry and spaceflight worked at RNII in the 1930s, including Fridrikh A. Tsander, Valentin P. Glushko, Sergei P. Korolev, and Mikhail K. Tikhonravov.<sup>1</sup> The transformation of Ary Jacob Sternfeld (A. J. Sternfeld) into Arii Abramovich Shternfel’d (A. A. Shternfel’d) had begun. He became a Soviet citizen on 4 September 1936.<sup>9</sup>

At RNII, Sternfeld studied various problems of rocket dynamics. He also prepared his manuscript “Initiation à la Cosmonautique” for publication with the help of deputy director of RNII Georgii E. Langemak, who translated it into Russian.

In 1937, the leading Soviet publishing house of technical literature printed 2,000 copies of the book:<sup>16</sup> *Vvedenie v Kosmonavtiku (Introduction to Cosmonautics)* by A. Sternfeld (Figure 7–3). The book was largely based on Sternfeld’s original manuscript for which he had received the REP-Hirsch award. A few omissions included hypothetical inhabitants of other planets described by earlier writers and the idea of mirrors in space illuminating Earth.<sup>22</sup> The book’s cover page<sup>16</sup> explained that it was a translation “from a manuscript in French” and that the original manuscript had been “augmented by new research results in 1935–1936.”

Sternfeld's *Introduction to Cosmonautics* was a major treatise on the fundamentals of the new science called, in the title, *cosmonautics*. The book preface (dated "Paris, December 1933") opened as follows, "During several centuries a number of scientists, whose names the reader would see many times in this book, contributed to the science that we now call cosmonautics."<sup>22</sup>



**Figure 7–3:** Cover of the book *Vvedenie v Kosmonavtiku (Introduction to Cosmonautics)*, 1937.<sup>16</sup> Credit: Maya A. Shternfel'd and Polytechnic Museum, Moscow.

Why did Sternfeld insist on using the new word, *cosmonautics*, instead of the already established and widely accepted *astronautics*? In the book's second edition<sup>22</sup> (1974) he added the following explanation footnote to the preface to the book's first edition,

The author believes that the word "cosmonautics" (cosmonautique) used in the English and German languages and introduced by him to the French terminology is more correct than "astronautics" (astronautique) because the definition of a science studying motion in interplanetary space should provide the notion of the medium where the motion is assumed to occur (cosmos) but not one of its goals [goals of the motion].<sup>22</sup>

## *Cosmonautics Comes Out on Top*

The introduction of the new word *kosmonavtika* (*cosmonautics*) was not first welcome in Russia. A prominent Soviet space writer, Yakov I. Perel'man, wrote in his review of the Sternfeld's *Introduction to Cosmonautics*,

The translator of the book uses the word "kosmonavtika" [cosmonautics]. While this word may be preferred in French compared to "astronavtika" [astronautics], it is hardly justified to introduce the word to the Russian language with the existing [Russian] word "zvezdoplavanie" [star sailing] already established to a certain degree. "Zvezdoplavanie" is more in the spirit of the Russian language than "kosmonavtika". . .<sup>23</sup>

The compound word *zvezdoplavanie* is similar to, a linguistic calque of, the word *astronautics*: *zvezda* means *a star* and *plavanie* means *navigating* or *sailing*. The word *zvezdoplavanie* was structured similar to another word common in the Russian language of the early 20th century—*vozdukhoplavanie* (*vozdukh* means *air*)—until this word was later largely replaced by a word of similar meaning,  *aeronavtika* (aeronautics).

Moreover, Tsiolkovsky himself anointed the word *zvezdoplavanie* and the related word *zvezdolet*, or a *starship*. (Tsiolkovsky however also used the word *astronautics*, for example, in private correspondence to Fridrikh Tsander in 1932.<sup>24</sup>) Perel'man wrote in 1932,

"Zvezdoplavanie"—controlled motion of a vehicle ("zvezdolet") in space. Both words ["zvezdoplavanie" and "zvezdolet"] are suggested by me and approved by Tsiolkovsky, who uses them in his latest publications.<sup>25</sup>

A major authority in the pre-World War II Soviet space literature Yakov Perel'man, 1882-1942, was known for his numerous popular books about mathematics, physics, mechanics, rockets, and interplanetary travel. He personally had known Tsiolkovsky as early as 1913.<sup>25</sup> Perel'man published his famous popular book, *Mezhplanetnye Puteshestviya (Interplanetary Travel)*, in 1915. In 1935, the book went through the 10th edition of 50,000 copies.<sup>26</sup> It was Perel'man who, through his popular publications, made Tsiolkovsky's ideas and writings known to broad segments of the public in Russia.<sup>1, 26-28</sup>

In spite of Perel'man's disapproval, the word *cosmonautics* would eventually become accepted. It had first to compete however with the word *astronautics* that dominated Soviet technical and popular writings for many years. (Many authors also continued to use the word *zvezdoplavanie*.<sup>28</sup>) For example, when spaceflight enthusiasts formed a group in the V. P. Chkalov Central Aero Club in January 1954, they called it *Section of Astronautics*. Sternfeld himself published a large article, titled "Astronautics," about spaceflight in an official magazine for

high school physics teachers.<sup>29</sup> He described in this article the “first astronomical velocity,” “second astronomical velocity,” et cetera. These characteristic velocities would later be called “cosmic velocities” in the Russian technical literature. Sternfeld’s highly popular book on artificial satellites<sup>30</sup> published in 1956 and then in an expanded edition<sup>31</sup> after the *Sputnik* launch in 1958 also used the word *astronautics*. The official organ of the Communist Party of the Soviet Union *Pravda*, the ultimate authority on all forms of “political correctness” in the Soviet Union, described the new science as *astronautics* in an article celebrating the successful hit of the Moon by a Soviet space probe.<sup>32</sup>

Finally, the word *cosmonautics* won supremacy. The flight of the first man—a *cosmonaut*—to space in April 1961 effectively ended any competition between the two words. The field of science and engineering would be uniformly called *kosmonavtika* (*cosmonautics*), with *kosmonavty* (*cosmonauts*) traveling in space.

### **Socialism Bites Back**

Ary J. Sternfeld introduced the new word *cosmonautics* in a pioneering effort of the early 1930s. The word is now an official name for a field of science and engineering in the country of his choice. One would think that this bright young man, a space visionary and a true believer in socialism, successfully put all his abilities to advancing spaceflight in the Soviet Union and materially contributed to the breakthrough of *Sputnik* and beyond. It has not happened that way, however . . . Sternfeld was very lucky to stay alive.

After settling in Moscow, Sternfeld quickly lost his job in RNII. The Soviet state would never allow him to join any work on spaceflight and rocketry. The authorities would also never permit him to leave or travel outside the Soviet Union even in order to receive honorary degrees and awards. The only exceptions would be short, filled-with-propaganda trips to communist-controlled Poland in 1964, 1967, and 1976. Poland as well as other “fraternal socialist countries” were considered relatively “safe” since Soviet citizens could not defect from there to the free world.

When Sternfeld published his comprehensive treatise on cosmonautics in 1937, he optimistically looked in the future. He lived and worked in his chosen country that, in his own words, was “the first to experience a socialist revolution, thus creating unlimited opportunities for social progress.”<sup>10</sup> This was also the year when a wave of political purges had reached impeccably loyal parts of the Soviet establishment. The heads of leading Soviet rocketeers also began to roll in late 1937 and 1938, after the patron saint and protector of the Soviet rocketry,

Marshal Mikhail Tukhachevsky, who had organized RNII several years earlier, was arrested and shot during a purge of the communist inner ruling circle.<sup>1</sup> RNII director Ivan T. Kleimenov and deputy director Georgii E. Langemak (the translator of Sternfeld's manuscript) were shot in January 1938. RNII's Valentin P. Glushko and Sergei P. Korolev were arrested in 1938 and imprisoned for several years.<sup>1</sup>

Sternfeld took a temporary leave of absence from RNII in August 1937 in order to work in another institute on design of a robot. At the end of 1937 he first lost his job in RNII and then in April 1938 the job in the other institute. He would never find a research-and-development job, or any technical job, in rocketry or spaceflight. "While the scientist [Sternfeld] did not share the tragic fate of his other colleagues in the institute [RNII] . . . he took . . . [his removal from the rocket work] as a life catastrophe."<sup>33</sup> The socialist society could not trust a former foreigner and a true believer in communism. Never mind that Sternfeld personally sacrificed so much to advance the cause of socialism. Being a Jew would soon make Sternfeld's situation even worse as the Soviet state-sponsored anti-Semitism rapidly gathered strength.<sup>34, 35</sup>

Sternfeld knocked at many doors in an attempt to interest the Academy of Sciences and industrial institutions in his work in astronautics. All the doors remained closed to him. Sternfeld was not the first or the last Westerner who joined the march to a socialist paradise and who was subsequently cruelly punished by the Soviet state.

Desperate, Ary Sternfeld sent a letter to the "Father of the Peoples," Joseph V. Stalin, himself. He summoned all conceivable arguments, including those of a good Marxist,

I dare to ask you to help me to get a possibility to continue my works.

More than 10 years I was working on the problems of interplanetary communications [travel]. My treatise on jet [propulsion] motion and space travel (*Introduction to Cosmonautics*, 1937) received an international award in astronautics . . .

It is necessary to say that since the death of Konstantin Eduardovich Tsiolkovsky nobody—as far as I know—works on these problems here in the USSR.

There are pitiful practitioners who claim that we know sufficiently about theoretical capabilities of interplanetary travel and that we need to work exclusively on tests in the field of rocket technology.

Such statements are deeply wrong. It seems to me that these comrades completely do not understand the guidance of the classics of Marxism about the role of theory that should shine the light on the road for practice.

. . . There is no doubt that development of such . . . theoretical problems as interplanetary communications [travel] also accelerates solution of practical problems such as, for example, ultra-high-speed travel on the ground, extra-long-range artillery, etc.

While hundreds of our people work on experimental problems of jet [propulsion] motion, nobody works on the future [problem of] motion in vacuum in the special institute [Author note: Sternfeld likely meant RNI] and in other [research] groups.

On the other hand, enormous state resources [funds] are continuously directed to works on certain problems in astronomy, entirely detached from practice . . . As far as cosmonautics is concerned, which is essentially an “applied” astronomy, nobody works on these problems at all.

It seems to me paradoxical that at the time when the problems of interplanetary communications [travel] are so important for the Soviet public, as witnessed by large demand for articles and other [published] materials in this area, there is no possibility for normal scientific research work for one, who I am, of the few specialists [in this area] in the world.

I want to give all my knowledge and abilities to my new, true Motherland.<sup>36</sup>

Sternfeld’s words, that some “pitiful practitioners” and “comrades completely do not understand the guidance of the classics of Marxism,” or that “enormous state resources” are being wasted on problems “entirely detached from practice” might have easily triggered persecution of other scientists and specialists, with their heads (literally) rolling. With his life wrecked by the socialist state and being trapped, Sternfeld perhaps inadvertently denounced others. It is unknown whether this letter had any consequences. In any event, no response or help came from Comrade Stalin.

Although Ary Sternfeld belonged to an exceptionally “high-risk” category of Soviet citizens, a former foreigner and a Jew, he was never arrested, tortured, imprisoned, banished, or murdered. He was definitely lucky to live through that time and survive. Sternfeld’s daughter, Maya, speculated that her father’s “luck” was explained by the fact that he did not work in any organization and thus “did not exist” for the authorities [Maya A. Shternfel’d, conversation with the author, 19 May 2006]. Without a job, Sternfeld continued his studies of spaceflight on his own. As his daughter later wrote,

from that time on and till the end of his life during the 43 years he remained a lone-scientist who spent sometimes 20 hours per day at his desk at home studying theoretical problems of spaceflight, stubbornly following his path. That he did not belong to any organization and even did not belong to a trade union [as practically everybody did in the Soviet Union] saved him from Stalin’s [concentration] camps. He was not even permitted to join the armed forces [during the war].<sup>37</sup>



So, Sternfeld concentrated on popular writings about spaceflight. His articles on astronautics and about history of Russian rocketry appeared in newspapers and popular magazines. Only once, in 1945, he published an article in a scientific archival journal, *Doklady* or *Reports of the Academy of Sciences*. The Sternfeld family went through hard times with some financial help from his sister in Poland. She was the only member of the immediate family who survived the war. The remaining relatives perished in the final solution prepared for the Jews by the national-socialist Germany.

### Rootless Cosmopolitans

We do not know why Sternfeld was not persecuted in the late 1930s and survived. It looked like a miracle for someone with his background. Another such miracle occurred in 1951, when he could have perished in an anti-Semitic campaign launched by the all-powerful leftist state against “rootless cosmopolitans.”<sup>34, 35</sup> This broad persecution of the Jews culminated in 1953 with an infamous cooked-up doctors’ plot by a “terrorist . . . gang of human-looking animals” and “enemies of the people” to “shorten lives of active leaders of the Soviet Union.”<sup>38</sup> Subsequently, the persecution of Soviet Jews would gradually abate into less violent forms, characterizing the last 40 years of the Soviet Union.

Beginning in the late 1940s, many leading managers, scientists, engineers, writers, administrators, doctors, and other professionals were losing their jobs because they were Jews. The emerging Soviet ballistic missile and space establishment was not an exception. For example, the first director of Scientific Research Institute N. 88 (NII-88) Lev R. Gonor was fired in July 1950 and arrested in January 1953.<sup>34, 35</sup> The government decree established NII-88 in Podlipki near Moscow in 1946 as the leading research institution in liquid-propellant ballistic and anti-aircraft missiles.<sup>1</sup>

At this perilous time a fellow rocketeer denounced a seemingly “harmless” writer of popular articles Ary Sternfeld. Nikolai G. Chernyshev published a short note<sup>39</sup> in the newspaper *Kul'tura i Zhizn'* (*Culture and Life*), the official organ of the Department of Propaganda and Agitation of the powerful Central Committee of the Communist Party. Chernyshev stated that Sternfeld misled the public that he had been awarded an international “encouragement prize in astronautics.” He then continued,

There has never been an international encouragement prize in astronautics and it does not exist. In reality, the history of this question is the following. A foreign engineer R. Esnault-Pelterie, known for his unsuccessful infringement on the priority of [the work of] Tsiolkovsky and for self-glorification, established in 1927 in France, as charity, jointly with a capi-

talist A. Hirsch, an encouragement prize for “the best works in astronautics.” This award has been correspondingly called the “award of R. Esnault-Pelterie-Hirsch” and not an international encouragement prize. This award was given not by an international committee, but by the French astronomical society.

This was the prize that was given to A. Shternfel’d in 1934 for his treatise “Introduction to Cosmonautics,” filled with admiration of foreign authorities [of spaceflight] and with disdain to achievements of the Russian and Soviet science. In this treatise, contrary to the facts, Shternfel’d claimed the priority of French authors in the field of theoretical foundations of interplanetary communications [travel], in every possible way extolled imaginary “scientific achievements” of R. Esnault-Pelterie and suppressed [and ignored] research of Kibalchich, Tsiolkovsky, and other Russian scientists, whose bold creative thought went substantially ahead of foreign researchers.<sup>39</sup>

A veteran rocketeer Doctor of Science Chernyshev, 1906–1953, was a prominent specialist in the chemistry of rocket propellants. In the 1930s, he worked in the Gas Dynamic Laboratory (GDL) in Leningrad and then at RNII. In the late 1940s, he joined the leading military research institute in ballistic missiles, NII-4,<sup>1</sup> in Bolshevo near Moscow. Chernyshev also published popular books on spaceflight,<sup>28</sup> which made him especially qualified to destroy Sternfeld. (Chernyshev wrote, for example, that “our [Russian] ancestors used military rockets in the first half of the 10th century.”<sup>28</sup> This statement loyally contributed to a major Soviet effort, from 1946, to claim priority for Russian/Soviet scientists, engineers, and inventors.)

In the middle of the state-guided anti-Semitic campaign, a denunciation by a prominent member of the establishment could have sent a Jew, Sternfeld, straight to a concentration camp. The milder consequences of the article quickly followed:

The publication by Chernyshev was a crashing blow to the reputation of Shternfel’d. His articles could not be published, the publications already in printing houses were destroyed, including an article . . . on the nature of the Tungus meteorite [Tunguska event of 1908]. Shternfel’d began a stubborn fight against the accusation and wrote letters to the newspapers and to Secretary of TsK VKP(b) [Central Committee of the All-Russian Communist Party (Bolsheviks)] M. A. Suslov . . . Shternfel’d reminded about his [personal] friendly relations with K. E. Tsiolkovsky and that it was he who was the first in 1930 to tell about Tsiolkovsky’s works to the French public. A. A. Shternfel’d especially emphasized that he was the first among Soviet authors who published an article about the history of Russian rockets in 17–18th centuries, and that during many years he specifically argued about the advanced [leading] role of Russian scientists and inventors in the development of artillery.<sup>40</sup>

Ary Sternfeld again miraculously survived the calamity.

## In the Spotlight

In a twist of fate, a spotlight of international attention focused on Ary Sternfeld in the late 1950s. In 1955, he published a 56-page book *Interplanetary Travel*, with the second edition in 1956.<sup>41</sup> In 1956, he wrote another book, *Artificial Satellites of the Earth*,<sup>30</sup> followed by *From Artificial Satellites to Interplanetary Travel* in 1957.<sup>42</sup>

The Soviet Union launched the first artificial satellite *Sputnik* on 4 October 1957. It was not only a feat of science and technology but also a potent weapon in a sharp ideological confrontation of the Cold War.<sup>1</sup> The Soviet launch did not come as a surprise to people in the know. A number of open publications in the Soviet Union and pronouncements of Soviet officials unmistakably pointed at the forthcoming launch. The U.S. government was aware of the Soviet advances, and the American intelligence community rather accurately predicted the event.<sup>1</sup> In the United States many infallible media personalities and politicians conveniently chose to remain uninformed, however, and used the opportunity to pin the blame on their political opponents.

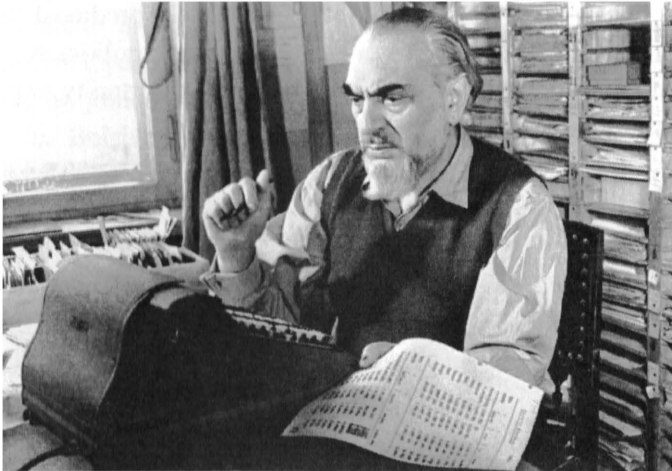
*Sputnik* had shocked the general public in the United States and elsewhere. Journalists, who did not usually know much themselves about the subject, tried to explain artificial satellites to their readers. People demanded information about the satellites and spaceflight. Because of the secrecy permeating the Soviet society, very little had been ever published on ballistic missiles and space technology outside classified reports. In addition, journalists rarely looked at those very few open scientific publications which were often too difficult for non-specialists.

Suddenly, Sternfeld's high-quality popular books became an excellent source explaining the basics of rocketry and spaceflight, orbital properties, satellite visibility from the ground, communications with satellites, and conditions in space, such as vacuum and weightlessness. Moreover, these publications originated from the country that had been the first to launch a satellite.

Sternfeld's books gained enormous popularity immediately after the launch of *Sputnik*. Almost 600,000 copies of his books were sold in the Soviet Union from 1949–1959, and they were translated into 14 languages spoken in the Soviet Union.<sup>9</sup> Sternfeld quickly prepared the second, expanded edition of his book *Artificial Satellites* which appeared in 1958.<sup>31</sup> Only in 1957–1958, this book was published in translation in 18 foreign countries: Argentina, Bulgaria, Brazil, Hungary, Greece, Denmark, Egypt, Finland, Japan, Iceland, India, Italy, Mexico, Netherlands, Poland, Romania, the United States, and Yugoslavia.<sup>9</sup> Sternfeld's *From Artificial Satellites to Interplanetary Travel*<sup>42</sup> appeared in translation in

Bulgaria, Czechoslovakia, Greece, Italy, Norway, People's Republic of China, Romania, the United States, and Yugoslavia.<sup>9</sup>

In total, 39 countries published Sternfeld's books 85 times and in 36 languages.<sup>9</sup> In the United States, the government translation service quickly translated Sternfeld's *Artificial Satellites* after the *Sputnik* launch to make it available to scientists and engineers.<sup>43,44</sup> Translated compilations of Soviet writings on spaceflight also prominently presented his publications.<sup>45</sup> People in foreign countries often connected a well-known name of Sternfeld with the space successes by the Soviet Union. In reality, he remained confined to his home office (Figure 7-4), and the Soviet state had never permitted him to contribute to the program. At that time, the true leaders of the Soviet rocketry and space establishment remained behind the curtain of secrecy.<sup>1</sup>



**Figure 7-4:** Ary Sternfeld in his home office in Moscow, 12 December 1959. Credit: Polytechnic Museum, Moscow.

Sternfeld's writings on spaceflight brought him world recognition. First his University of Nancy bestowed on him an *honoris causa* doctor degree in 1961. He was not allowed to go to France, however, to accept the degree or to receive an international award in 1963. Finally in 1965, the USSR Academy of Sciences awarded Sternfeld an *honoris causa* degree of doctor of technical sciences.<sup>9</sup>

In spite of his international fame, life was never easy for Ary Sternfeld. The authors of the first book<sup>9</sup> about Sternfeld wrote:

It would be a mistake to think that Shternfel'd accumulated a fortune from royalties from his books. The Soviet Union did not participate in the international copyright agreements. Many years the living conditions [apartment] of Shternfel'd were difficult and not conducive to creative work. In

order to work on [problems of] cosmonautics, he had to accept material assistance from his sister living in Poland. Everyday hardships and difficulties have not, however, broken the spirit of the scientist and have not wrecked his personality.<sup>33</sup>

Almost everything seemed to be stacked against Ary Sternfeld in the Soviet Union.

. . . It was difficult . . . to include his [Shternfel'd] name in the last edition of the Great Soviet Encyclopedia. The scientist did not [formally] qualify [for inclusion] because he had not reached the rank of the member of the Academy of Sciences [of the USSR]. Then the editor of this publication [encyclopedia] German Nazarov obtained signatures [under the petition] of five academicians representing the field of space technology and presented them to Nobel Prize winner [academician Aleksandr M.] Prokhorov, the chief editor [of the encyclopedia]. Prokhorov ordered to include the name of Shternfel'd [in the encyclopedia] without [required] endorsement of the Presidium of the Academy of Sciences . . .<sup>33</sup>

Valentin P. Glushko seemed to be the only leader of the Soviet rocket and space establishment who supported Sternfeld. At least, he publicly recognized his contributions. Glushko first met Sternfeld in RNII in 1930s. Later, Glushko became the head of the leading liquid-propellant engine design bureau *Energomash* in Khimki.<sup>1</sup> It was Glushko who congratulated Sternfeld on the occasion of his 60th anniversary (Figure 7-5).



**Figure 7-5:** Soviet space pioneer and leading rocket engine designer Valentin P. Glushko (right) congratulates A. A. Sternfeld with his 60th birthday, May 1965, Moscow. Credit: NPO Energomash, Khimki.

The first book<sup>9</sup> about Sternfeld appeared in the Soviet Union in 1987. It took a letter campaign by prominent rocketeers to include this book in the plans of the publishing house *Nauka* of the Academy of Sciences. Even adding a subtitle, “A Pioneer of Cosmonautics,” to the book title (*Ari Shternfel’d*) required another letter campaign.<sup>33</sup>

Ary J. Sternfeld passed away in Moscow in 1980. The hostility and indifference of Soviet authorities to the scientist who introduced the words “kosmonavtika” and “kosmonavt” in the Russian language continued after his death. Here again Valentin P. Glushko paid tribute and extended his helping hand.

Academician Glushko ordered to provide funds for the [funeral] wreath from our . . . design bureau [Energomash] and participated in the . . . [funeral] procession as part of the [design bureau’s] delegation at the . . . cemetery. Official [Soviet] science [establishment] and the authorities did not react to the death of a pioneer of cosmonautics . . . [Presidium of the Academy of Sciences] did not provide funds to put the memorial plaque on the house where Shternfel’d lived. His relatives paid for it. But now the Moscow [municipal] authorities put its installation on hold. It was again necessary to collect the signatures [under the petition] and appeal to the wife of M. S. Gorbachev, the patron of culture [in the Soviet Union, in order to install the plaque].<sup>33</sup>

Sternfeld’s tombstone at the Soviet necropolis, Novodevichiye Cemetery in Moscow, shows the engraved trajectory—Sternfeld transfer—to reach a point near the central body and an inscription “Ari Shternfel’d, Pioneer of Cosmonautics” (Figure 7–6).

The collapse of the Soviet Union brought many changes. The Polytechnic Museum in Moscow holds the personal archive of Ary J. Sternfeld. The museum reconstructed the study room of Sternfeld and exhibits materials about his life and work in one of its halls. Several articles about Sternfeld recently appeared in the media, and in 2005 the museum published a special book commemorating his 100th anniversary.<sup>46</sup>

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**Figure 7–6:** Tombstone at the Novodevichiye Cemetery in Moscow. The inscription reads “Ari Shternfel’d, Pioneer of Cosmonautics.” The Sternfeld transfer to reach a point near the central body is engraved on the stone. Credit: Mike Gruntman.

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