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## Hermann Oberth's influence on Soviet space exploration

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*Russian Academician Boris V. Rauschenbach, whose new biography of the late German space scientist's work has just appeared in English, was interviewed by Marsha Freeman and William C. Jones.*

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On June 24-25, an international celebration took place in Feucht, Germany to honor the 100th birthday of Hermann Oberth, the father of space flight. The gathering of over 400 space pioneers, astronauts from America and Germany, cosmonauts from Russia and Romania, German government and industry representatives, and space enthusiasts paid homage to a remarkable man.

During the 1930s, Hermann Oberth's published works laid the theoretical basis for rocketry and space exploration. His public campaigns to organize support for such efforts created a following of young enthusiasts, which included Wernher von Braun and Krafft Ehrlicke. His students went on to create the space age. His work had an impact far beyond the U.S. space program. Oberth himself did not visit the Soviet Union until he was 88; nonetheless, the excitement that his early books generated helped to rekindle interest there that had lain dormant since the 1903 publication of Russian theorist Konstantin Tsiolkovsky's research.

On June 23, Boris V. Rauschenbach, a member of the Academy of Sciences, gave a wide-ranging interview to *21st Century Science & Technology* associate editor Marsha Freeman and *EIR*'s William Jones, in Feucht, about Oberth's influence on the Soviet space program, and that program's history.

Rauschenbach wrote a biography of Oberth that appeared in Russia last year; it has recently been published in English (Clarence, New York: West-Art, 1994), under the title, *Hermann Oberth: The Father of Space Flight*. In addition to being able to discuss Oberth's work with the benefit of having known him personally, Rauschenbach himself was involved in space development since 1937, and adds a history of the early Soviet space program to his review of Oberth's life and work in his biography.

In 1982, the Academy of Sciences of the U.S.S.R. hosted a scientific conference to which Hermann Oberth was invited, as Rauschenbach recounts in his biography, "done more out of deep respect for the patriarch of space travel than in the hope of actually seeing him present among the guests. He was, after all, 88 years old at the time. As everyone had expected, a sincere thank-you for the invitation came from Germany, and the message that, due to his age and his bad health, he could not come. How great was the astonishment of the organization committee when, one day before the opening of the congress, a telegram arrived informing them that Oberth would be making the trip after all."

Oberth explained that one reason for his decision was a "long-standing desire to visit the homeland of my highly esteemed colleague, Konstantin Tsiolkovsky, with whom I had corresponded." His presence was greeted with "unanimous applause," according to Rauschenbach, "which bore witness to the fact that Oberth's leading role in the birth and development of space travel was well known in Russia."

Rauschenbach gave a presentation at a wreath-laying ceremony at Oberth's grave on June 25 in Feucht. He said that, although Oberth's influence in Russia was "not a direct one since he was not there" during the early formative years of the space program, his indirect influence through his books had a "great effect." Oberth is perhaps more appreciated in Russia than in Germany, he added, because "from a distance you see the main concepts more than the details," or the forest, rather than the trees. He predicted that 100 years from now "his significance will be much greater because we will have come much further" in space exploration, and much more will be known and appreciated about his many yet-unfulfilled ideas. "Great men grow with time," Rauschenbach said. "It will be a long time before all of what Hermann

Oberth envisioned is realized.”

In our discussion with him in Feucht, Rauschenbach offered his explanations of aspects of the Soviet space program that are somewhat different from the usual view of its history. These include the effect on the Soviet program of the purges that began in 1937; the role of the Germans captured after World War II in the Soviet rocket program; and the reasons why the Soviets never sent men to the Moon. All of these are important questions, both for the history and the future of manned space exploration.

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## Interview: Boris V. Rauschenbach

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**Q:** You have recently written a wonderful biography, *Hermann Oberth: The Father of Space Flight*. It is unique, in that you are a space pioneer yourself, having been involved in the Soviet space program since the 1930s. Could you tell us a little about your own involvement in the Soviet space program?

**Rauschenbach:** I was born in 1915 in Leningrad. My father is a German from the Volga region and my family has lived in Russia for 200 years. My mother came from the Baltic states. And so I am a German from both sides. But since I have always lived in Russia, studied in Russia, worked in Russia, my spirit, my destiny has been a Russian one. In this sense I am Russian.

I lived in Leningrad until 1937. I spent my school years there and also studied at the technical university. I became an aeronautical engineer. Even as a student I was very interested in rocket technology and sought employment in the field. But in order to work with rockets, I had to move to Moscow, and since 1937 I have worked in the area of space research. Today I'm not involved so much in the industrial side of things because of my age, but am a professor in the technical university, and my faculty is spaceship dynamics. In this sense, I remain active in the area of space.

In 1937 I began to work in the Institute for Rocket Propulsion, a scientific institute doing work for the Army. I worked together with [Chief Designer Sergei] Korolev and was chiefly occupied with rocket guidance systems.

Two years later, [during the Stalin purges] Korolev was arrested by the NKVD [Soviet secret police]. I continued working at the institute, but the work I was doing with Korolev on guidance was abruptly concluded. Then I started working on another secret project. This was research on ramjets.

**Q:** Was this during the war?

**Rauschenbach:** It was before the war, but it lasted until 1942. In 1942 I had to spend time in a “gulag school.” As a Volga German, I spent five years in a camp—until 1946. Because I was 100% German. We used to joke about how in

the Soviet Union every honest person had to spend at least a couple of years in the gulag. It was a fairly normal condition in the country in those days.

Then in 1948 I succeeded in getting back to my old institute in Moscow. I was lucky to be able to travel to Moscow because of the restrictions placed on Volga Germans. This was thanks to the efforts of [Academician Mstislav] Keldysh, who was later the president of the Academy of Sciences, with whom I had been in correspondence since 1946. After two years, he succeeded in getting permission for me to come. Keldysh was at the time the director of the Institute [of Applied Mathematics].

I then began working with Keldysh on the problems of combustion in ramjets. In 1954 I told Keldysh that I would be interested in again working on guidance and control problems, and he gave me permission to do so. I was working in the area of guidance and control of space ships which still didn't exist. As we began to enter the space age in 1957 [with Sputnik], my group was the only one which really understood how to build space ships.

We began to work on practical projects. The first one was to take photographs of the dark side of the Moon. We succeeded in doing it. I received a Lenin Prize for this work. At that point, the work had to be broadened. In the Keldysh Institute this was impossible, because it was much too small. I turned again to Korolev, whom I knew very well. My group became very large. I had now 200-300 people under me. In addition, there were about 200 more working for us. So, all in all, I had about 400-500 people working under me.

The work was significantly broadened, so that, during the first 10 years of the space age, all the guidance systems of the Russian space vehicles were my construction. The flight of Gagarin, for instance: Gagarin was supposed to fly in the morning. But the evening before, one hour before he went to sleep, we had to give him once more his final instructions. I tell you these things to show you how interesting my life has been.

After the death of Korolev, I remained at the institute and worked with my team on the guidance systems for the Salyut [space] station. But after a while, that work became somewhat boring and very repetitious. First we worked on unmanned flights, then manned flights, then docking systems, then the flight to the Moon, then to Venus, then to Mars. Every year there was something new. After the death of Korolev [in 1966], things became very repetitious.

For that reason, I divide the space age into two parts—and this goes for Russia as well as for the United States, in my opinion. From 1957 until 1969, it was a romantic episode. Everything was new and interesting. And it was something of a sport—the competition with America. I don't mean the political side. I'm an engineer, and I wanted to do it better than the Americans. It was a really interesting period of time, this romantic period of space. This lasted about 10 years.

And then began a period of normal industrial activity in

the field of space. In 1978 I began my professorship at the technical university, and I have been there for 15 years. I have my professorial chair in theoretical mechanics. But I have several professors under me, and I myself lecture on the dynamics of space flight.

**Q:** When you were a student, were you involved in the amateur rocket work in Leningrad?

**Rauschenbach:** I was involved, but not very actively. As a student, I really couldn't begin with anything. I had contact with the GDL (Gas Dynamics Laboratory), and it was natural that I remained with that group. But I never worked with them while they were in Leningrad. By the time I had concluded my studies, they had already moved their activity to Moscow.

**Q:** The reason I asked is that both in the United States and in Germany, from the early 1930s until the beginning of the war, amateur rocket societies were doing all kind of things, holding lectures, public events, and many young people became interested because of that.

**Rauschenbach:** It was similar in Russia. All the [experimental] rocket work was secret. But there was another group of people, writers like Dr. Yakov Perelman, who wrote books, held lectures, but had no idea of the work we were doing. It was similar to what happened in Germany.

**Q:** One of the key people from the Soviet military responsible for the rocket work was Marshal Mikhail Tukhachevsky. It seems that at the point there were major purges of the General Staff of the Red Army, including Tukhachevsky, it probably threw the rocket program back quite a bit. Was this the case?

**Rauschenbach:** Not at all. Why was Tukhachevsky in charge of the rocket program? Not because he was an enthusiastic proponent of rockets. He was responsible in the General Staff for new types of armaments. He was responsible for tanks, airplanes, every new form of weaponry. He did, however, understand the important role of rockets. This he was aware of. Ivan Kleimenov was the director of the [Scientific Research Institute of Jet Propulsion, established in 1933] and his deputy was Georgi Langemak, also a German, and the scientific adviser of the institute. They worked closely with Tukhachevsky. This was quite natural, but because of this, they were also shot. But the work of the institute continued as if this had never occurred.

**Q:** Did you have any contact with the Germans who were brought to Russia after the war to assist the Soviet rocket program?

**Rauschenbach:** No. It had been proposed to Korolev to accept the German scientists into his institute to work together with him, and he rejected the proposal. He said he didn't need any German consultants. It was quite different in



*Author Boris V. Rauschenbach (left) with Hermann Oberth during the latter's 1982 first and only visit to the homeland of his longtime Russian correspondent Konstantin Tsiolkovsky. Despite his advanced age and ill health, Oberth considered it vital to pay homage to Tsiolkovsky's memory.*

America. There the Germans were brought into the program. In Russia they were excluded; they spent time shooting off the V-2s. Then they didn't need the Germans any more, and they went back to Germany. We had no German team.

**Q:** But weren't there certain areas, as referred to by Kurt Magnus in his recently published book *Raketensklaven*, where the Germans had some very important insights for the Soviet program? The Soviet program had been primarily with solid-fuel rockets, for instance, the famous Stalin organ, whereas the Germans had concentrated on liquid-fuel rockets, which was important for space travel. Was not this experience important for the Soviet program?

**Rauschenbach:** First of all, our solid-fuel rockets were primarily used as artillery. These were better than the German rockets. The Germans tried to copy our rockets, but they were not successful. They had all the ingredients, but they couldn't copy it. The best artillery rockets during the Second World War were the Russian rockets. Therefore, we didn't need any experts in that area.

Liquid-fueled rockets were a German creation. But we also had our own liquid-fuel rockets. They were primarily used for airplane rocket-assisted takeoffs, acceleration, etc. We had good liquid-fuel rockets, which were very safe to work with. Therefore, the German rocket motors were not so needed.

In addition, the people who had come to Russia from Peenemünde were not the best people. My colleagues who

worked with them said that they knew less than the Russians did. If Wernher von Braun had come, it would have been a different story. The others were at a rather low level. The only one of importance was a collaborator of von Braun, Helmut Groettrup. He's the only one who really understood something about these rockets. He helped develop a rocket, the R-14, which was a next generation of the V-2. But nobody was really interested.

**Q:** For what work were you elected a member of the Academy of Sciences?

**Rauschenbach:** There were a number of things: First, it was my work in guidance and control of Soviet space vehicles. But during my work with ramjets, which are not space vehicles, of course, I developed a new physical theory. This is the second reason. There was also a third reason, which unofficially also played a role in my election. I have written books on art as well, which is unusual for someone like me. So I succeeded in getting the votes from the rocket people for my work on rockets, from the physicists for my physical theory, and from the arts people for my work on art. But the chief reason was for my work in rocketry.

**Q:** How has your biography of Oberth been received in Russia? Are a lot of people reading it?

**Rauschenbach:** Yes, the first edition is now sold out. We must print a second edition.

**Q:** How many did they print originally?

**Rauschenbach:** Not many, about 1,000 books.

**Q:** In the United States, there has been no biography of Oberth in English for 40 years, I think. The German biographies of Oberth were never translated. There was only a little book, almost a children's book, by Helen Walters, who did a series of biographies on von Braun, Oberth, and others.

**Rauschenbach:** In our country, too, there was no biography of Oberth. I wrote it because I felt that it was absolutely necessary.

**Q:** Oberth's work was known in the Soviet Union, I believe, in the 1930s.

**Rauschenbach:** No, already in the 1920s. [Oberth's first book] was already published in the nine-volume space encyclopedia by Nikolai Rynin at the time. In the encyclopedia, the chief parts of Oberth's 1923 book were translated. The Rynin books are also available in English. In Russia these days, they are very hard to come by. There were too few of them published. And the English translation is good.

In the eighth book, which deals with the theory of space flight, there is a major section about Oberth, including a small biography of Oberth, a photograph of him, and most of that section has been taken directly from Oberth's own work. So, by the end of the 1920s, we had an Oberth book in

Russian. The next work by Oberth would not come until 1948. This was a translation of his second book, *Ways to Space Flight*, and this I have translated myself. This was in fact the first Oberth book in a non-German language. I was the first.

**Q:** It is really amazing. That 1929 book was not translated into English until 1972.

**Rauschenbach:** And in Russian in 1948. And it was a very difficult task because Oberth's book contained incredibly many mistakes. Perhaps you don't know the story. There were many mistakes, letters and numbers left out, small inaccuracies. I had to make more than 100 corrections in the text. So the Russian edition is better than the German.

**Q:** Maybe the English is also wrong?

**Rauschenbach:** It is possible, since they probably took it from the original German. It was so difficult since I had to derive all the formulas anew. Even with only one or two printing errors, it was necessary to derive all of the formulas again. But Oberth was not responsible for these mistakes. The blame lies with [Oberth's assistant Alexander B.] Shershevsky, because Oberth had no time to proof-read the work. So he asked Shershevsky to do it. But Shershevsky did nothing. He just paged through the book. So the book came out with all the small mistakes. Oberth was totally shocked about it. For this reason my book is better than the original German edition.

**Q:** Let me ask you more generally about the scientific tradition in Russia. In spite of long periods of relative economic backwardness, in certain scientific fields Russia has always been foremost. There seems to be a clear continuity, for instance, from people like Dmitri Mendeleev, Vladimir Vernadsky, through Tsiolkovsky. How do you see the significance of this strong scientific tradition for Russia's development?

**Rauschenbach:** Earlier, Russian science, perhaps because it wasn't so bound to industry, always tried to solve global questions. This we find with Tsiolkovsky, Vernadsky, and others. This is typical for Russia. Today the situation is much worse because, during the last couple of years, we have received hardly a penny. Many are leaving for the West. Many start to buy things and then sell them, to speculate. Many scientists try to become merchants. They become speculators. Today the situation is very bad. If the situation does not quickly change, then within a couple of years, Russian science will be dead.

**Q:** We also noticed when we were in St. Petersburg last year that the level of literacy and interest in reading are so high compared to the United States. You see people on the subway or waiting in line always have a book with them, and they are reading. This you will not see in the United States. At

best, people will be reading a newspaper.

**Rauschenbach:** Some years ago, people called Russia a reading nation. For instance, I have my young granddaughter here with me. She sits upstairs in the house here and reads a book with mathematical problems. She calculates up there and comes running down when she has solved a problem. It is the only book that she has taken with her from Moscow. It's like a playful book about mathematics for young people. Every day when she has time, she'll sit with the book, and then suddenly, she comes running, saying, "Grandpa, I have figured it out!" And that's typical for Russia, for the old Russia, maybe five years ago. Today, I don't know. Probably today the young girls are reading comic books. My young granddaughter here, she reads serious books, perhaps because both her father and mother are mathematicians, and children like to imitate the parents.

**Q:** This is also what's been lost in the United States in the last 20 years. After 1969-70 in the United States, you also had a different kind of space program. It was much smaller, with no long-range goals. In the last few years, many engineers and technical people who worked in the defense industry have lost their jobs. In my thinking, they should now be working on a program to go to Mars, but instead, they're driving taxis.

**Rauschenbach:** Unfortunately, there is no money either here or there. A Mars program would be a big program. You could have people working on it for 10 or 15 years.

**Q:** At the beginning of the space age, everybody said that they would go to the Moon and then, of course, the Russians had problems with the N-1 rocket. And von Braun and Arthur Rudolph were able to build the Saturn V and this was a success. Starting in about 1965, when it was not a sure bet that the Soviets would be first, cosmonauts and other people in the Soviet space program were saying, "We never planned to send people to the Moon." And then, starting about three years ago when things became more open, American reporters went to Russia and were shown closed-off rooms where some of the equipment had been developed for just such a program.

**Rauschenbach:** We had three lunar programs: one unmanned and two manned. The unmanned program was conducted in a grand manner. The two others were manned. The one program was called the L1. It was a program which could be made without the big N-1 rocket. It had advanced very far, and one year before Apollo, we could have orbited the Moon. But this program required big sums of money, and there were, therefore, delays and postponements. We could have done it, but we couldn't do it in time. There were also others who wanted to do the Moon project. [Vladimir] Chalomey wanted to do the program himself. There were rivalries. There were other constructors, other institutes, other plants which were interested in doing it themselves. It was

so stupid, like a kingdom which disintegrates into feudal strife.

Therefore, the program was stopped. Not for technical reasons. If everything had been done as we envisioned and everything had been pulled together as planned, it would have worked. The program was almost completed. We had the spaceships, we had the equipment. And this was arbitrarily ended.

**Q:** When was this?

**Rauschenbach:** It could have been done in 1966 or 1967. It could have been done, but it was never done. And the third program was the L3, which was to be done with the N-1 rocket. People have talked about many flaws with that rocket, and these are all true. But the main problem was entirely different, and this was the delayed beginning of the project and the insufficient financing. This was the only real problem with the N-1 program. We received money for the N-1 when we had *completed* the project. Even after it had already flown. People did a lot of talking, but they gave no money. We inquired about the money. The Central Committee said the money would be coming, but no money came. Later we received perhaps a third of the promised sums. But quite late.

**Q:** And this was after Korolov had died?

**Rauschenbach:** Not only after he died; even while he was alive. I am of the opinion that we should never even have begun the project because they knew they had no money. The government knew that they didn't have the money. To us they said, "The money will come soon." But our sketches couldn't fly. Industry had to get to work. And there was nary a penny to the industrial production side. Or, more exactly, they gave us a preliminary payment and said the rest would be coming. Looking at the situation, I was convinced that the Americans would get to the Moon first. I saw what we were doing and how things were going with the Saturn. The other problems with the N-1 were really minor. If everything had begun two years earlier, we could have succeeded. The problem was "too little, too late." And I am convinced that it was incorrect to even begin the program under those conditions. They knew they didn't have the money.

**Q:** One year ago the United States and Russia began a collaboration in space. What do you think about that program?

**Rauschenbach:** It was a fact that both countries were putting in more and more money into the space program. Therefore, collaboration has become necessary. It will be much cheaper. Put simply, if the United States builds a large space station and the Russians do likewise, mankind as a whole has spent twice as much money as necessary for a space station.

**Q:** What would you propose as a goal for the U.S.-Russian collaboration? A manned Mars mission, perhaps?

**Rauschenbach:** No, no, no, no! Rather, experiments for in-

dustrial production in space. A Mars mission would not play an important role. We know today that special industry can be established up there. In zero gravity things could be produced which would be impossible to produce here on Earth. Perhaps we could do preliminary experiments toward such a project in order to create the new technology for such a project. And I mean not only technology in the traditional sense, but also medicine, synthetic products. That's the first thing.

Secondly, projects related to the ecology. But not a Moon or Mars program. Any programs in space must be connected to Earth-bound interests. Things must be done for people here.

**Q:** But what about further in the future? If we succeed in doing this in 10 years, what would we aim at 20 or 30 years down the road?

**Rauschenbach:** You know, I believe that predictions from professionals are not very good. It's much better for the novelists. If you look at a magazine from the beginning of this century, and look at what the scientists have said and what the novelists have written, you will find that the novelists have been correct and the science professionals have been wrong. And this is understandable, because the professionals are tightly bound by the present, and they could hardly imagine that which a novelist could create with ease. Since I'm no novelist, I have some anxiety in predicting the future.

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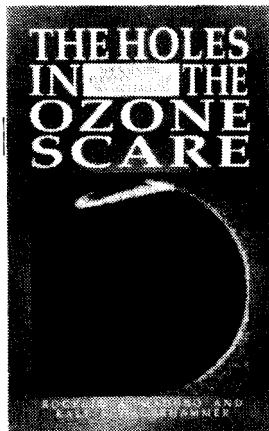
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## Science Policy

# U.S. magnetic fusion budget in doubt

by Mark Wilsey

On May 27, scientists at the Princeton Plasma Physics Laboratory (PPPL) in New Jersey fired up the Tokamak Fusion Test Reactor (TFTR) and produced 9 megawatts, setting a new world record for fusion power. The result surpassed their previous record of 6.2 MW, set last December. Some who follow the fusion program are expecting fireworks of another kind on Capitol Hill this summer, as the debate over the future funding of fusion research heats up.

Tokamaks are large donut-shaped machines used to study the fusion process. They use magnetic fields to heat and compress hydrogen until the atoms fuse, forming helium and releasing large amounts of energy. Testifying before the House Appropriations Subcommittee on Energy and Water Development on April 11, Ronald Davidson, director of PPPL, noted that more than 60 million people throughout the nation saw reports of Princeton's tests in December. They "were reminded of the promise that fusion offers our energy-threatened world," he said. The tests at PPPL have provided a backdrop for the discussion of the U.S. fusion energy program in various forums over the recent weeks.

William Reddan, vice president of the engineering consulting firm Parsons Brinckerhoff, also testified at the April 11 hearing: "There is no question that fusion works. We see the Sun and the stars, which we know are powered by the fusion process. . . . What we do not know yet is how to harness this source." Indeed, harnessing thermonuclear fusion has been the decades-long dream of researchers, because it would provide a virtually inexhaustible power source, from an abundance of fusion fuel found in the hydrogen isotopes of seawater.

At April 21 hearings on fusion policy, the Subcommittee on Energy of the House Committee on Science, Space and Technology heard John Holdren, professor of energy and resources at the University of California at Berkeley, on future world energy needs. Holdren outlined two scenarios; he termed one "business-as-usual," the other "best-plausible." In the first case, world energy demand nearly triples by the year 2050; in the second case, the demand doubles. Holdren's numbers are based on specific sets of assumptions. The starting point is 1990, with a world population of 5.32