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Chapter 11

The Personality of the Rocket Pioneer Professor Hermann Oberth*

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On June 24, 1894 Hermann Oberth was born in Hermannstadt (Sibiu), Transylvania. His father was the rather conservative surgeon Dr. Julius Oberth, well known for his professional skills far beyond the borders of Transylvania. His mother, Valerie, was the daughter of the freethinker and fighter for social justice Dr. Friedrich Krasser. According to his mother Hermann inherited many of the characteristic traits of this grandfather. Money, fame, and the usual amenities of life meant little to him, while knowledge, truth, and personal accomplishments were paramount. Typical for this is his answer to a question from students about what career to choose. He said: "Every young person should first think how to make this world better, more just, and beautiful. Only then should he select a career with which he feels he might best accomplish these goals."

In the picturesque little town of Schaessburg (Sigisoara) he grew up to adolescence. Already as a small boy he was fascinated by machines. But at that time Transylvania had little to offer in terms of technology, essentially only the powerful and noisy steam locomotives. These, therefore, became the objects of his fascination, but their black color disturbed his esthetic feelings. So, one day, the four-year-old boy was seen at the railroad station carrying a pail of white paint and a brush, attempting to improve the looks of those black monsters.

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Another episode of his early youth may also be characteristic. In a letter to her absent husband his mother wrote: "... Tonight Hermann came reluctantly to me and said: Mother, I would like to tell you something, but I'm afraid, because you always say self-praise stinks! Go on, I said, I shall close my nose. After a short hesitation he said: The first in the class had made an error in his computation, but he noticed it and corrected it himself. The other students, however, trying to tear him down insisted he had not noticed the error and had corrected it afterwards. Hermann as the second best in class would have moved into first place, but when the teacher asked his opinion Hermann said: 'No he did not make the mistake.' Hermann was very proud that he had told the truth in spite of the fact that he would have gained through a lie, and also that other boys hated him for spoiling their scheme. He was flattered that the teacher trusted his word. Isn't it so, mother, he asked: 'One must not lie to remain trustworthy ...'"

Unfortunately, this love for truth, and his belief in the fairness of his compatriots, has cost him dearly in later life. For example, he told of a co-worker of his, Rudolf Nebel, who took one of his ideas, had it patented, and sold the patent for 75,000 Reichsmarks to the German Government.

Inspired by Jules Verne's books *From the Earth to the Moon* and *Journey around the Moon*, Oberth began as an eleven-year-old high school student to occupy himself intensively with the possibility of spaceflight. He seriously questioned the technical approach of Verne, namely, of using an oversized cannon shell to reach the Moon. He reasoned that the human body could not withstand the enormous increase of gravity, at the instant, when the cannon was fired, a point that Verne totally ignored. Hence, a projectile was needed that gradually reaches the escape velocity, at a rate of acceleration that the human body can endure. After much thinking, calculations and experiments the young scientist, only 15 years old, came to the conclusion that only rocket propulsion could accomplish this task. Oberth acquired the mathematical ability for these calculations, one which far exceeded the level taught at school, by self-study.

Soon he recognized that black powder, at that time essentially the only rocket propellant, was deficient in energy, and with it a rocket could never be built that was capable of escaping the gravitational pull of the Earth. Consequently he was looking for more energetic propellants. A combination of liquid hydrogen/liquid oxygen (lox) for space travel and kerosene or alcohol for rockets with lesser tasks was his choice.

At the time of his high school graduation (25 June 1912) he had come to the conviction that space-travel was technically feasible.

In 1913 Oberth started with the study of medicine at the university in Munich, which was interrupted by the outbreak of World War I. Oberth was sent to the Eastern front, was wounded in 1915 and, after recovery, spent the rest of the war as a corporal in the army medical service. In his spare moments he occupied himself with plans, designs and computations. First it was space medicine, then a long-range missile. One of his designs (1917) was a 25 m long,

5 m wide rocket, propelled by 70% ethanol/lox, which, according to his calculations, should be capable of hurling a 10 ton load over a distance of about 500 kilometers. He tried to interest the Department of War in his missile but was rejected for the following reason by the army weapons expert: "It is well known that rockets do not fly further than 7 km."

On July 18, 1918 shortly before the end of World War I, Oberth married the attractive and jovial Mathilde Hummel, who, unlike him, was practically minded and very pragmatic in her ways. Four children were born in this happy union.

In the fall of 1918 Oberth resumed his studies. He went back to medicine at the University of Budapest, but switched the following year to physics, which he studied at the universities of Klausenburg and Goeftingen, and in 1921 at Heidelberg. From 1920-1922 he spent more time in libraries than in listening to lectures. During that time he compiled in a mathematically concise and comprehensive form what he had already worked out as a high school student and later in the medical corps. This included the realization that with the then-available propellants the Moon or planets could only be reached by multistage rockets. Oberth approached the famous aerodynamicist Ludwig Prandtl (1875-1953), whose lectures he had attended at Goeftingen, to judge his work. Prandtl was impressed and returning the manuscript said: "You got something there, don't let yourself get discouraged by anyone or anything!" That was the first, and for Oberth so very important, recognition by a great scientist.

In the spring of 1922 he presented the report as a doctoral thesis at the University of Heidelberg. It was not accepted, since there was nobody there that could judge it. For astronomers it was too technical, for mechanical engineers and physicists too fantastic, and for the medical faculty too far from reality.

Remembering the nice words of Professor Prandtl, Oberth decided to publish this report under the title *Die Rakete zu den Planetenraeumen* (The Rocket into Interplanetary Space), albeit at his own cost.

The first edition (1923) was soon sold out. It initiated many discussions about spaceflight and caused a flood of publications. It reassured those that believed in its possibility, and encouraged the ones who wanted to help. The Russian scientist K. E. Ziolkowski (1857-1935), whose first theoretical work about space travel ("The Exploration of Space by Means of Jet Propulsion") appeared already in 1903, began to publish additional papers. "Your merits are forever valuable, I am enthused having young followers like you!" wrote Ziolkowski in a letter to Oberth. In 1928 Oberth was awarded the first Robert-Esnault-Pelterie-Hirsch prize of the French astronomical society which the aviation Pioneer Robert Esnault-Pelterie, impressed by Oberth's book, doubled to 10.000 Francs. Oberth also exchanged letters with Professor Robert Goddard of the United States, whose experiments led (1919) to the publication "A Method of Reaching Extreme Altitudes" and on March 16, 1926 to the start of the first rocket using liquid propellants.

In 1928-1929 Oberth was hired as technical consultant by the UFA to advise in the production of the silent movie *Frau im Mond* (Woman in the Moon) by Fritz Lang. This gave him the opportunity to experiment with liquid engines, and led to the first successful engine tests in Europe. But, perhaps, a more important result of these endeavors was that Riedel, Engel, and von Braun became members of his team, people that later became important rocket designers, and eventually brought the idea of spaceflight to fruition. Wernher von Braun wrote later: "The experiments of Oberth constituted a new advance into territory unknown to science. They became the cornerstone for the rocket development in Germany, from which leads a straight line to the large rockets, spaceships, space-probes and satellites."

Unfortunately, these ground-breaking tests were of little benefit to Oberth. For lack of funds, and being an alien, he had to leave Germany and return to his home country Transylvania. In 1931 his mother wrote to a niece living in Scotland: "I can't tell much news from Hermann. The launching of his rocket failed because of lack of funds. We are not in the position to give him and his family the money needed to stay in Germany. Perhaps, he is not sufficiently practically minded and lacks the engineering skills to convert his ideas. Although he is a great scholar, he is a loner and lacks the ability to lead and work together with others. Presently, he is in Mediasch and will resume his teaching career in the fall. His idea, however, marches on. Other men shall reach the goal of the launching of a liquid rocket, men, that may possess more money, more luck, more connections and more courage. Alas, that is the fate of most of the inventors. He wants to sell his patents, the results of his experiments with fuels, metal alloys, and nozzle designs, but I'm afraid he has by this time already divulged too much so that others can continue where he left off without paying him a dime."

Until 1938 Oberth lived in Transylvania (Romania). Not before 1937 was he remembered in Germany, when he was invited to attend a conference at the ministry of aviation. Even then he was not informed about the status of German rocket development, presumably, because he did not possess German citizenship. In 1938 he was called to the technical university of Vienna. In 1940 he moved to the technical university of Dresden. At both locations he worked for the Heeresversuchsanstalt (army ordnance test station) on various theoretical aspects of rocketry, particularly the design of fuel pumps.

In 1941, after receiving his German citizenship, he moved to Peenemünde. Since the developmental work on the A4 (V2) was already concluded, he was given the task of evaluating all foreign and domestic patents with respect to their applicability to rocketry.

In December 1943 he was sent to Reinsdorf bei Wittenberg where he was to develop a solid-fueled anti-aircraft rocket. This task was based on an earlier (1935) design of a rocket that used as propellant a mixture of ammonium nitrate and powdered charcoal, and whose trajectory was controlled by radio signals.

Because of the virtual impossibility of obtaining materials in those late stages of World War II, little progress was made, and was terminated by the advancing Soviet army.

World War II took its toll on the Oberth family. In 1942 the oldest son, Julius, was reported missing at the Russian front, and 1944 his daughter Ilse, who worked in an Austrian laboratory that did work for Peenemünde, was killed in an accident.

Immediately after the war sheer survival was the only occupation of most people. Thus, Oberth cultivated his vegetable garden, split firewood, and did other similar jobs. Not before 1948-1950 was he able to obtain work as an engineer in Switzerland for one of his early fans, who operated a small factory making fireworks. Then, from 1950-1953 he got a research and development contract for a small solid propellant rocket from the Italian Navy in La Spezia, Italy. Between 1955 and 1958 he became a member of the German team, headed by von Braun, at the Redstone Arsenal in Huntsville, Alabama. There he was engaged in trouble shooting engineering designs, and theoretical work involving problems of docking, attitude control, and other problems of spaceflight. After reaching the age of 65 he had to retire. He chose to return to Germany, in order not to forfeit a teacher's pension that was granted to him by the Federal Government but required him to live in the country. Except for a short stint (9 months) in 1961 as a technical consultant for Convair in California, Oberth retired from active participation in space programs, and devoted his time entirely to writing and occasional lectures. The first years of retirement he spent primarily writing popular scientific articles and books about space-related topics, but in his later years turned increasingly to philosophical works. He died on December 28, 1989, feeble in body, but yet in full possession of his mental faculties.

When one tries to judge Oberth's contributions to the space effort, he is amazed to find practically all of the space accomplishments of the American, as well as Russian, technology not only predicted but clearly described in the book *Ways to Space Travel*, published in 1929. This includes satellites on near, and far, Earth orbits, space-stations, space-telescopes, the space suits necessary for space-walks, etc. The latter are a little bit more clumsy than the modern ones, more like the equipment worn by deep sea divers, as Oberth obviously at that time couldn't foresee the advances made in the last 5 decades by material science. The correctness and value of his work is attested amongst others by the fact that 95 technical solutions and designs of his were incorporated into the A4 (V2) missile.

Asked how he was able to make such accurate predictions, Oberth said: "Whenever I get a new piece of information, or when I have a new idea, then my first question is not what supports this idea, but rather what is contradictory? Then I check whether the contradictory arguments really apply. Only if I cannot come up with any counter arguments, I accept the information and/or idea and

use it as a building stone in the theory. In all my publications I used this method."

One of the few ideas of Oberth that has not yet been realized, but may prove to be of major significance, is the space-mirror. It is described in the book mentioned above. Basically, it is a huge mirror of reflecting material orbiting around the Earth that reflects additional sun light onto the Earth's surface, thus providing a source of energy. In Oberth's original concept the reflecting mirror surfaces are constructed from a thin foil of sodium, again for the very reason that aluminized Mylar foils were unknown in 1929. The various uses to which such a space mirror could be put are very large. Most likely, if built, its first application would be to generate energy.

Oberth's contribution to spaceflight from the viewpoint of its history may be summarized as follows: His book *The Rocket into Interplanetary Space* was the first publication where scientifically satisfactory arguments were supported by precise and quantitative calculations. They irrefutably showed the feasibility of large long-range rockets, and the possibility of traveling to the Moon. For the latter, at least, he introduced the concept of multistaging. It is noteworthy that the gifted Russian rocket-designer, Sergei Koroljow, considered this idea as particularly important. In 1934 he wrote "Without scrutinizing Oberth's designs more closely, which otherwise might show less practical advantages and more problems to build than Oberth envisages, it must be emphasized that his idea of a multistage rocket for high altitude flight is principally of great importance."

Gartman characterized Oberth's role in the pioneering days of rocket development as: "in Russia Ziolkowsky thought about and described a liquid-propellant-rocket, while Oberth in Germany calculated and designed them."

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