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Chapter 1

The History of the UFA Rocket*

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Introduction

The UFA rocket represented the first test in constructing a rocket with a modern objective aim. Hermann Oberth succeeded in convincing the directors for the construction of the first rocket to use liquid propellant during his consulting for the UFA film "Frau im Mond." The contract between Oberth, the UFA, and Fritz Lang was made out on July 7, 1929, and it meant that Hermann Oberth would have 10,000 Reichmarks [RM] at his disposal from this point. The contract was valid until 2020, and Oberth had to swear his work to silence at this time.

As a result of this, Oberth developed a rocket and instructed IG Farben in Bitterfeld to construct the rocket, because they had developed the material Elektron and also the necessary welding techniques. But those techniques were so new that the construction of the rocket was delayed, and the deadline of the launch and the day of the premiere of "Frau im Mond" could not be kept on schedule.

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The UFA Contract

The contract was signed on July 7, 1929, by Fritz Lang, the UFA directors Lehmann and Correl, and Hermann Oberth.[1]

Oberth received studio 3154 for his tests.[2] At the beginning of the second week in July, Oberth already employed his first assistant, Alexander Borissowitsch Scherschewski, whose nickname was "Schura."[3] He was paid a weekly wage of 150 RM. Oberth knew Scherschewski from his book publication in 1929, *Die Rakete für Fahrt und Flug*.[4] But it soon turned out that Scherschewski was no help for Oberth, so he dismissed him at the beginning of November.

Oberth now began with a series of experiments: precision measurements on the Doppeldochtbrenner. However, that work was delayed until July 31, 1929, because the Berlin firms were reluctant to take on special production, and moreover it was a holiday period.[5] The experiments should then have been tackled the week after August 26, 1929. First of all the tests with the Doppeldocht were to take place at normal air pressure, and from September 2-3, experiments under pressure of up to 30 atmospheres, then (if this should be necessary) experiments with sensitized fuel, if not, spray experiments.[6] Those were CH_4, C_7H_8, C_8H_{18}, and gasoline + O_2, as well as gasoline and N_2O_4. Finally it turned out that CH_4 and O_2 were the best combination.[7]

The Doppeldochtbrenner was very similar in its construction to a welding torch.[8] Those first experiments helped to obtain new knowledge about the injection of the fuels and the burning reaction of the fuels.

The experiments were delayed until the end of August, and since it had become well known that Oberth was constructing a rocket with liquid propellant for the UFA, Oberth was now under attack by the experts on liquid gas.[9]

First, Oberth started to examine if gasoline and liquid oxygen would burn efficiently at all, because the experts for technical gases had predicted that in the experiment of burning liquid oxygen and gasoline, everything would explode. Whereupon Oberth started with a series of experiments to disprove this, by injecting a very thin, burning beam through a long tube in a receptacle, which was filled with a few liters of liquid oxygen. This receptacle stood in the middle of the studio. The gasoline which was put in was ignited by the flame, but without exploding.[10] The proof that liquid oxygen and gasoline would burn without an explosion was evident.

The Explosion at the UFA Grounds

The experiments with the Doppeldochtbrenner that were tackled in the week after August 26, 1929, showed that they would not burn well. This was because the wick for the liquid oxygen got steamed up after approximately 9-10 seconds of perfect work. The flames started to crackle, and in the end, the wick for the liquid oxygen was totally blocked.

However, Oberth was successful in clearing up those problems, and, on September 3 or 4, 1929, there was actually a flame produced, which leaped approximately 1 meter for 1 minute, in spite of the small burning area of 5 qm/cm, and it consumed, in one minute, 4 kg of fuel. However, the temperatures were so high that the injection plate finally cracked, so that the gasoline could combine with the liquid oxygen. As he recognized that, Oberth jumped at once to extinguish the fire. But it was too late. This resulted in a terrible explosion, in which the largest piece left of the apparatus (approximately 3 cm long and 6 cm thick) centrifuged away and hit Scherschewski, seriously injuring his right calf.[11] Oberth himself was hurled 4 feet away into the wall and this incident could have created serious injuries, had it not been for the film scenery of the UFA.[12] Both of his eyes were hurt by clinker wool which was flying around (This was used for the isolation of the metal receptacle), and one eardrum was split. The ophthalmologist, Prof. Dr. Fehr of the Charitè, hoped to save at least the left eye, and he operated, removing 12 splinters of glass from the eyes. Both eyes were saved, and the split eardrum also healed. The doctor also predicted a nervous shock, called a traumatic neurosis and leading to nervous symptoms, which could have continued up to 3 years. This could have been enough to stop the work, but Oberth worked on. For 3 days no experiments took place. Not to lose too much time, theoretical research took place, and 7 days after the explosion Oberth started working again. After 2 weeks Oberth was almost fully recovered, and the work continued with undiminished speed.[13]

He performed these experiments with Scherschewski, who had a camera with a quick film spool, and he had an unusually strong electrostatic generator with big Leydener bottles which produced very bright sparks. With this equipment you could photograph sparks.[14] Investigation began to determine the cause of the explosion; they let oxygen drop into gasoline past a flame, to which they added town gas, or they mostly dropped gasoline into liquid oxygen.

This demonstrated that, where the drop struck the liquid, the flame ended up under it. Afterwards, the drop burned further, and the produced gas pressed the drop flat. Finally it created a ring which fell apart into separate drops. Because of the cooling of the gasoline with liquid air, it turned thicker, and they

could now produce drops up to a diameter of 1 cm, which were burned and turned into dust in a fraction of a second.

Oberth named this discovery "self-tearing of burning drops" and applied for the patent on October 16, 1929 (patent number: DRP 549 222). This self-tearing principle underlined the Spalt- and Kegelnozzle.[15]

He was successful in recording sparks photographically during the course of events in a slowly working composition (i.e. heavy oil and watered chlorine acid); apart from that he established that this course of events quickly resulted in gasoline and oxygen.[16] At this time Oberth also worked on expulsion tests. In his patent he described a device with which he sprayed a small quantity of gasoline on liquid oxygen. The excess pressure resulting from the burning of the gasoline was to bring the liquid oxygen out of the tank in the combustion chamber.

At first, Derjwar-receptacles of 1x2 liters and 2x5 liters were used for transportation and storing of the liquid oxygen. However, in the course of years, all of them broke, and they turned to using metallic receptacles. The liquid oxygen was received from Heyland: at first for free, later for cash.[17]

On September 25, 1929, Albert Sander of the foreign news agency wrote a letter to Oberth per pneumatic dispatch system, to his apartment in the Kant Strasse 56a in Berlin-Charlottenburg. A trade official from Potsdam had said that he would come to Babelsberg for a visit. On this occasion, Oberth should receive an explosive allowance, if he met the conditions set by the police. For this purpose Oberth was to make sure that, on this morning of September 26, 1929, at 9 a.m., everything that should not be seen by the official in his laboratory on UFA grounds was removed from sight.[18]

Oberth was not there the next morning, so the trade official was met by Scherschewski. The trade official took this as an intended impoliteness and left the UFA grounds. Oberth was at important negotiations in Berlin. He had to look after the affairs by himself, because his assistant had no knowledge of the material.

Time and UFA pressed, his assistant was no help, and Oberth started to smoke again, and finally he consumed 40 cigarillos daily.[19]

Oberth also acquired colleagues from UFA's Max Langgut, who held engineering degrees, and a development engineer named Alfred Krantz.[20] Other colleagues would later join the team; their names were Mr. Brandmayer, Mr. Seidler, and Mr. Baumann.[21]

Four days after the explosion, Oberth put a little advertisement in the newspaper in hope of finding a mechanical engineer or aircraft engineer for his assistant. Weeks later, on September 20, 1929, he received mail from a man of his age, who placed himself at Oberth's disposal as a Moon traveler.[22] His name

was Dipl. Ing. Rudolf Nebel. He introduced himself to Oberth on the UFA grounds and he was finally hired on October 18, 1929, for a wage of 100 RM.[23]

The press officer, Willy Ley was not actually a member of the Oberth group, he had initially assisted the group, but he was one who helped Oberth with his writings. Willy Ley was often on the UFA grounds, and he reported about the development of the shooting of "Frau im Mond," and later also about Oberth's tests. Ley was often present when Oberth started with his tests. He urged Oberth's UFA members to continue working, because of the first hand results which were state of the art. He was a top notch premier reporter of the decade, because what and how he reported in the newspapers about the progress of Oberth's work, was objective and technically accurate. Ley also brought a lot of other young people to Oberth, like Rolf Engel in the year 1929, and also Wernher von Braun the following year.[24]

Klaus Riedel joined the group at last. He earned himself extra income as an icecream vendor, in addition to his studies; and he came, with his sales tray, to the part of the UFA grounds where Oberth's laboratory was.[25] Riedel was interested in Oberth's tests and became a member of the group at the beginning of October.[26] He had the best technical training of the three, and he was the man whom Oberth had needed for months, a man of the discipline.

Rolf Engel came to Oberth at the UFA grounds, at that time still as a pupil, and he offered Oberth his cooperation. So Engel helped Oberth during his vacations and on many afternoons after his school lessons.

Two weeks after the explosion, Oberth was successful in burning the Spaltnozzle. Oberth described the Spaltnozzle as a rocket motor, on which gasoline and oxygen were injected into a flat, narrow hole which was lined with asbestos (stout 4 mm).[27] This apparatus processed at a space of not quite 10 cm^3 100 g liquid oxygen and 30 g gasoline in one second, and it would have burned much more, if Oberth had been able to give it "more to eat."[28]

Later, at an official burning test on July 23, 1930, on the grounds of the Chemisch-Technischen Reichstanstalt in Berlin, Plötzensee, the Spaltnozzle supplied a thrust of 2.5 kg.[29]

After he had given proof with his Spaltnozzle that his propellant combination would also burn in a cramped space, he could turn from the heavy bulky construction to an elegant model. The Kegelnozzle burned 7 days later and had a weight of approximately 1.5 kg and a length of 25 cm. It consumed approximately 280 g of liquid oxygen per second and 80 g gasoline.[30] The relation of the volumes was 1:3,1. The injection of the liquids was effected through centrifugal injectors.[31] Oberth constructed a new test apparatus for 20 liters oxygen and 10 liters gasoline. The liquid supply was very variable. He could operate it by hand from close by. The Kegelnozzle worked at a pressure of approximately

1 atm up to every pressure. For safety, a blende was screwed on the nozzle (length 20 cm). He calculated that it could produce approximately 300-400 kg thrust, but he was sure that it could reach up to 80 kg repulsion.[32] Inside, the Kegelnozzle was painted with Schamotte.[33] In the days of UFA it was run with a working pressure of 5 to 10 atmospheres normally. The working pressure, declared Oberth, was 15-18 atm, and the nozzle had a relation po / pd = 18.[34] The Kegelnozzle was a reliable motor, because it actually never exploded during the tests at the UFA.[35]

On the grounds of the Chemisch-Technischen Reichsanstalt in Berlin, Plötzensee, the Kegelnozzle reached, at the mentioned burning test on July 23, 1930, in the first 50.8 seconds a repulsion of 7 kg, then over the next 45.6 seconds a thrust of 6 kg. The maximum thrust was registered by 7.7 kg, 1.0 liters gasoline and 6.6 liters liquid oxygen were consumed. The velocity which was streaming out, was calculated at 756 m/sec. The head of the government council, Dr. Ritter, issued an official examination certificate for this test result on November 5, 1930, diary No. 3528 I/30,[36] which made a big impression on the authorities, and this finally smoothed the way for the rocket airport, Berlin. Both nozzles, the Spalt and the Kegelnozzle were produced several times.[37]

The Rocket

At the beginning of October, they started the construction of the UFA rocket. First, a model 1.5 meters long and without wings was constructed. This could have been a cardboard model which later acquired wings. It was used for aero-dynamic experiments, and they launched it with a solid rocket propellant to test the stability of the rocket. Parachute tests were later run with this model.[38]

Another model of the rocket was 1.9 meters long and had wings. This model was probably the real UFA rocket. It had an unloaded weight of 9.8 kg, and the propellant weighed approximately 10 kg (16 liters of propellant).[39]

A third model was 2 meters long (2-2.2 meters). This was probably the wooden model of the UFA rocket, which was constructed to show something to the insistent journalists. It was painted with silver-bronze and looked very real.[40]

For the first product, it was already a modern construction. It would reach a height of 50 km. These 50 km were an estimated value of Oberth. He even maintained the 50-70 km in a telegram to Sander of the UFA, so Oberth was not totally responsible for those 70 km estimates which the UFA had previously broadcast to the world.[41]

The Cell

The cell was made of Elektron, an aluminum magnesium alloy which had a special weight of only 1.8 kg/dm^3. This material was produced by IG Farben in Bitterfeld, and it was at that time brand new. The welding techniques for Elektron were developed along with the construction of the UFA rocket. But with the choice of this building material, delays arose for the completion of the rocket. Its aerodynamic form and stability were tested by fall tests of reduced-size scale models. Various forms of wings were also tested, like the sections No. 409, 410, and 411. In the end, section No. 827 was chosen for the cell and section No. 417 of the Kaiser-Wilhelm-Institute of Göttingen for the caudal fin.[42]

The cell was produced so that the tanks were the cover of the rocket at the same time. Oberth intended liquid methane to be the fuel for the upper tank (temperature –160°C and special weight of 0.46 kg/cm^3), for the lower tank he intended liquid oxygen. Oberth projected different ways to bring the fuels into the combustion chamber. He wanted to make a combustible material swim on the liquid oxygen (perhaps wood) or to burn down a chemical explosive (pyrotechnic powder) in the gasoline tank, or to inject a small amount into the other component, as he described in the DRP 549 222. The detonating device should activate electrically at a given time. Oberth knew that the gas pressure of the boiling liquid itself was not sufficient for the propellant aid.[43]

The landing should occur with a parachute. First they made their own tests with self-constructed parachutes. One of these, the plate-parachute, was developed by Scherschewski, but they turned to already existing models, which were usual with solid-fuel rockets. The descent rate should be 5 m/sec.[44] There are pictures of the landing of the UFA rocket, with the parachute opened, taken in the spring of 1930, with a hollow cardboard model of the rocket (refer to model rocket with parachute at the lecture evening in the post office No. 24 in Berlin, on Friday, April 11, 1930). Kurt Heinisch had thrown the rocket with the already open parachute from a high chimney in Döberitz. The pictures were taken for the exhibition at the department store, Wertheim, and they were sold as picture postcards.[45]

The motor of the UFA rocket, also named Zylindernozzle, copied a lot of the Kegelnozzle of the DRP 549 222. If you picture in your mind, the one opening of the nozzle, and you rotate this nozzle around the other opening, you get the basic form of the Zylindernozzle. It was produced several times. Eight injecting nozzles brought the gasoline and the liquid oxygen into the combustion chamber. The injection resulted with the counter current principle, like the

Kegelnozzle. The combustion chamber was lined with the fireproof material, "Steaktit-Magnesia."[46]

Serious issues now arose, because Oberth had started with the work again 7 days after the explosion and because the time and pressure to succeed got greater and greater. In the middle of November, Oberth was at the end of his tether; he was totally weakened and had to rejuvenate himself with a little peace and rest. On November 17, 1929, Oberth left Berlin to recuperate in Norvi Virbas, Serbia. And Oberth raised, on November 15, 1929, the weekly wage of Nebel from 100 RM to 150 RM.[47]

To date he had spent RM 12,130. For the construction of the rocket the obligations were approximately 4,000 RM. The UFA 10,000 RM were augmented by 7,500 RM from the *New York Times*, for the publication rights in America, a total of 17,500 RM. This amount was not totally used up at the time.

One day after Oberth's departure, Nebel told the UFA that Oberth was now gone and could not give him money. He, Nebel, should get in touch with the UFA, and if he received their money, Oberth would give him a free hand. Nebel was now asked by Dir. Lehmann, if he could build the rocket by himself. Nebel said yes, and he received the money. So, he arranged that his colleagues should return, and the work was started again.[48]

Oberth did not enter into further obligations after November 11, 1929. He had to leave Berlin with a clear conscience. The UFA itself did not pay many of the bills at once, but left them unpaid. It was very difficult for Oberth to see the current financial situation correctly, because he did not look after the financial side. This was the task of the UFA and not his task.

On the basis of a newspaper report regarding the imminent launch of the rocket on December 4, 1929, Oberth returned to Berlin to be present at the launch.[49] In the meantime, based on Lehmann's assent, Nebel had made further expenditures which, together with Oberth's expenditures and the unsettled bills of the UFA, raised the cost of the UFA rocket to a total of 20,146.47 RM. Moreover, there were further unpaid sums of 6,035.40 RM.[50] This considerable extra amount was placed at Oberth's disposal by the UFA very obligingly. However, in the same letter, the UFA states that each party to the contract is only liable for the invested assets of the contract dated July 9, 1929. The obligingly furnished means were to be financed out of Oberth's own pocket.[51]

Initially, the firing of the UFA rocket would proceed as planned, on the day of the premiere of the film "Frau im Mond." The film premiered in the UFA film palace, Berlin, Zoo, on October 15, 1929. The UFA press office reported that the rocket was to start from the Greifswalder Oie on October 19, 1929. The Greifswalder authorities refused a start from the Oie, because such a start of the rocket could be risky for the lighthouse on the island. The authorities

heard about the start from the Oie on October 19, 1929, from the daily newspapers.[52]

Oberth must have known about the problems with the Greifswalder authorities earlier, because he had already written the Berlin Reichsverkehrsministerium on October 3, 1929, that he wanted to start his first "test rocket" between Seebad Horst and Scheffin, between the 10th and 20th of October 1929. The Greifenberg proper authorities had given their consent, which they had passed on to the Oberregierungsrat Münst.[53]

The First Test Rockets

The test rocket, also called carbon rod rocket, was to be 10 meters high and would have had a diameter of 10 cm. It was to have a terminus impetus and stabilizing wings below. In the tank receptacle there would be a long carbon rod. This was surrounded by liquid oxygen. Both substances should have burned equally, but this was not to be the case, and there was great disappointment at this result. For that reason, the rocket was never constructed.[54]

A temporary solution could not keep the premier launch on time. Now there was time to fix small malfunctions, so the right rocket could be built. The working hours that lay before them were long, hard and very intense.

In the beginning of December 1929, the parts of the UFA rocket were completed at IG-Farben in Bitterfeld. Nebel drove to Bitterfeld on December 3, 1929, to pick up the finished parts of the rocket. He wrote to Oberth at Norvi Virbas in Serbia the same day. Oberth had gone there after November 17, 1929, to restore his bad state of health. Nebel informed Oberth that the rocket was to be launched in a few hours. The decision had been made not to use liquid methane as a fuel, because it could only be obtained in Oberhausen. Moreover, the "Reichsbahn" did not want to transport it. To pick up the liquid methane by car was even more dangerous, because the liquid methane could not be sealed due to vaporization. So gasoline was used as fuel, as it was easily obtained at every gas station. It was ejected through CO_2-cartridges out of the propellant receptacle into the combustion chamber. The pressure generated in the oxygen tank still caused problems. The necessary pressure was reached at the start, but the pressure broke down subsequently. Nebel wanted to launch the rocket, even though it would explode at the start. They wanted to get out of the affair without losing face.[55]

The constructed rocket was to be tested in the "Bremse," by Nebel's idea. The "Bremse" was nothing but a test facility, which was to look as follows: the finished rocket filled with gasoline was to stand upright on the launching platform, at the top there was to be an upholstered mounting, in case of emergency

a prop with a blank space. In this position the rocket was to be launched. A pressure gauge socket was to measure the thrust. Nebel hoped to finally predict the altitude of the rocket. Ley told Oberth in his letter of December 1, 1929, not only about his doubts about that plan, but he even wrote that "they had made a major mistake," because they had calculated the work pressure of the propellant receptacle at 4 atm.; the pressure of the combustion chamber, however, was to be at 30 atm.[56]

Now Oberth was in Berlin again. He watched the work with mixed feelings. Oberth stayed at the hotel Metropol in Stettin the night of December 19, 1929.[57] He had gone to Stettin to talk about the launch date with the local authorities.

The time had probably come in the last 2 weeks of December. The rocket was to start. Rudolf Nebel, Klaus Riedel and two more members of the UFA-team were present. Oberth was not present at the start, because Nebel had convinced him that he had more important things to do. Oberth himself had not attached too much importance to the test launch, which was not open to the public. Oberth could not guarantee the functioning of the rocket, as Nebel had changed it so much in Oberth's absence.

In those days of December it was to start! It was a test in secrecy, because they did not want to make fools of themselves in public. The rocket stood on the platform, filled with gasoline. They activated the electrical detonation from the bunker. The rocket engine detonated and the rocket climbed. It accelerated out of the 4 meter high platform and exploded 8 meters up in the air. It fell to the ground not far away from the starting point. Its tanks were ripped open, the cell was destroyed.[58]

What had happened? How could it have happened that way? Prof. Oberth, who was the most able scientist of his time in the field of the new rocket technology, had calculated and constructed this rocket. Did he fail to get the world's first rocket engines to run? Oberth was brilliant in theory, but he had no practical experience to back him up. Also, in so far as personnel management was concerned, he was still inexperienced. Oberth, who had seen his theories, formulas, and projects through, even against the opposition of German scientists opinion, and mostly without help, could not also be a brilliant organizer and PR man.

On November 17, 1929, Oberth had stopped working and had left Berlin.[59] He wanted to recover in Norvi Virbas from the traumatic shock, the consequence of the laboratory explosion. After receiving the letters from Ley and Nebel, and because of a newspaper report on the upcoming launch of the UFA rocket on December 4, 1929, Oberth returned to Berlin on about December 9, 1929.[60] Meanwhile, his assistant, certified engineer Rudolf Nebel, had to take

all necessary measures to start the rocket, with the permission of the UFA director Lehmann. Nebel himself changed the rocket considerably.[61]

Nebel turned to gasoline as fuel, because he could not get liquid methane. The experiments for the pressure production, which Oberth instructed Nebel to do, Nebel passed on to Scherschewski. He, in turn, did not execute the assigned task, so that Nebel himself had to do the experiments. Nebel did not succeed in reaching satisfactory results, whereupon he turned against Oberth's orders to use Siphon-cartridges, which were opened mechanically for the production of pressure. The cartridges were installed in the gasoline and liquid oxygen tanks. This showed that the pressure in the gasoline tank could be kept at a constant level and at any pressure.[62] However, the gaseous CO_2 from the Siphon-cartridges cooled off so much within a short time, that it liquefied and lost its gas pressure. Thus, the supported pressure was supplied through the vaporizing liquid oxygen, and initially through the Siphon-cartridges. The supported pressure collapsed after a short time, so that the support was stopped. Therefore, Nebel turned to experiments with gaseous nitrogen which, in the end, was also used in the rocket; in this case the effects were similar to those of the experiments with the Siphon-cartridges.[63] He also wanted to try it with helium. To avoid the difficulties which arose due to the low temperature of the liquid oxygen, Nebel tried to use nitrogen pentoxyd as the supporter, for which he spent RM 1,000 without reaching success. For that reason he had established a test plant with the Kegelnozzle at the Bavarian nitrogen works.[64]

The weak point was the support of the fuels. In the short time which Oberth had left after his return to Berlin at the beginning of December 1929, Oberth could not solve this problem anymore, because the UFA had categorically demanded a start in December.[65]

Now Nebel was only trying to bring this matter to an end. He thought it would be best to let the rocket explode at the start. As soon as it had left the launch pad, the demands of the UFA were fulfilled. Also, the UFA had to reckon with setbacks at such a new thing, and they had to be satisfied, thought Nebel. He also convinced Klaus Riedel, who had the most able mind on this team, as far as the practical implementation was concerned. The at that time 18 year old pupil, Rolf Engel, who helped Oberth in his spare time, was also introduced to this plan. Yet there were also legitimate reasons for this decision: the UFA demanded the start in December, but the difficulties with the oxygen support could not be solved in the remaining time. The pressure in the oxygen tank was enough at ignition, but it collapsed later, so that the oxygen support was interrupted for a few moments. The gasoline was supported through the CO_2 cartridges, with constant pressure into the combustion chamber. The rocket engine would at least have spluttered, even had it not exploded immediately. If it

had only spluttered, the speed would have diminished, and it would have inevitably deviated from its course, because the launching platform was the only provided stabilizing gadget. It would have been a disaster of immeasurable extent if the rocket had hit the ground. Maybe it would also have hurt people or even killed them. It would have exploded anyway. Wasn't it safer to let the rocket explode near the ground, where it could not cause any damage?

Those reasons led Nebel to carry out his plan to activate, through the electrical ignition, a simultaneous gunpowder charge with a short delay of time, to let the rocket explode.

Rudolf Nebel and Klaus Riedel installed the gunpowder charge on the rocket, while Rolf Engel distracted Oberth with major problems of space travel.[66]

Whether Oberth heard about the failed test or not, was nowhere recorded. If yes, he surely did not know the extent of the damage. Anyhow, he went to Mediasch a few days later, on December 21, 1929.

He was disappointed with the results of the work. He probably did not expect a happy end any more. Nebel himself had changed the rocket too much for Oberth to still believe in it.

The UFA not only accused Oberth of not supporting the launch of the rocket, but even of trying to prevent it. Oberth himself rejected this strongly.[67]

The UFA did not want to invest more in the rocket. The film "Frau im Mond" was the most successful UFA silent film of all times, even without advertisement from the rocket. Even well known movies like "Metropolis" or "Der blaue Engel" were not as famous. "Frau im Mond" brought in the considerable amount of 8 million RM.[68]

Oberth's experiments had failed, according to the UFA. Now they tried to keep the damage as low as possible. The money which had been granted to Nebel was now demanded from Oberth. Oberth wrote, in 1933 in Werner Brügel's book *Männer der Rakete*: "It must be said in this connection that, the UFA advertisement about a rocket flying 50 km high, took place against my will; and that led to me leaving Germany because my business partners destroyed me, not only emotionally, but also financially." Hermann Oberth never found out that the explosion had been planned.[69]

The Following Period Until June 1930

The UFA was no longer willing to support the rocket cause. They did not need Oberth anymore, he could not do anything. Oberth had put his last money into the project. Impoverished, he went back to Siebenbürgen, to spend Christmas with his family. On the day of his departure from Berlin (December 21,

1929), he gave Nebel a power of attorney to continue work on the rocket, if the UFA wanted it. He also gave the UFA a power of attorney to keen up the work in his inclination. In the following period, Nebel talked to several authorities, officials, departments, and influential people.[70] He asked for money for the rocket experiments, and, in return, he offered the start of the UFA rocket. Oberth himself tried to get funds for further experiments as well.

On January 17, 1930, Oberth reported to Nebel that he intended to exhibit the "little rocket" at the Leipziger Fair from March 30, 1930 to September 30, 1930. The "Internationale Pelzfachausstellung" (IP) wanted the rocket.

As a result, the "Verein für Raumschifffahrt" (VfR) [space ship travel club] decided to buy the rocket. Ley, and also Winkler, had written Oberth on this matter, and he basically had no objection to the sale to the VfR. However, he advised against selling, because first, the rocket retained all the mistakes of a first work; second, because he did not have enough time at the UFA to construct well throughout; and third, because the rocket was changed too much during his absence. It would be better to build a new rocket for the same amount of money, instead of trying to improve the old one.[71]

The IPA soon withdrew from its intention to buy the rocket, but Mr. Horstmann intended to exhibit the rocket at several places until December 1930 for RM 2,000. Nebel got in touch with Mr. Lauff from Magdeburg to finance the rocket further with his help.[72]

Horstmann now pressed for the completion of the contract with Oberth, in order to have the rocket as an exhibit in 1930. Nebel was very angry about the contract with Horstmann, because he needed the parts which were at IG Farben in Bitterfeld. He himself had finished negotiations with the Reichswehrministerium [defense department] on March 4, 1930, and this contract at the examination department provided a launch of the rocket on March 12, 1930, at 10:30, for a payment of 5,000 RM.[73]

There had already been a meeting in the offices of the VfR regarding the rocket, on Sunday, March 2, 1930. They decided to raise RM 1,000, by means of a short term loan, to ransom the rocket in Bitterfeld. This loan was raised from equivalent contributions by the following VfR members: Winkler, Wurm, Goslich, Ley, and Nebel. The VfR had taken possession of the rocket during the course of the negotiations between Oberth and Horstmann, and thus they got it out of Oberth's reach. Oberth, indeed, granted Horstmann a period of time until March 10, 1930, to decide, but he had to find out himself that the rocket had been in the hands of the VfR since at least March 10, 1930. Thus, his negotiations with Horstmann were invalid. The VfR was now in possession of the parts which were still in Bitterfeld.[74]

Nebel demonstrated the rocket, or its separate parts, on March 12, 1930, as agreed to, and he received the 5,000 RM granted by the defense department. He had taken up work on the rocket again. Nebel believed he would be finished with it within two weeks after March 21, 1930. Two weeks later, he wanted to launch the rocket. Oberth complained about the meager information from Nebel about the events, because Nebel had only received the money from the defense department through Oberth. Besides that, the distinguished businessmen Oldenburg, a major general, and the German Bucharest envoy, Mr. van Mutius, had interceded for Oberth. Now Oberth wanted to know from Nebel how he intended to solve the nozzle question, how the pressure production in the tanks was, and whether he had tested the cardboard rocket successfully, or whether it had proved to be unstable. Oberth also wanted to know whether it was true that the rocket had been exhibited at Wertheim. In spite of discrepancies and the previous hesitation, Oberth gave Nebel a new power of attorney, effective on April 1, 1930.[75]

Nebel wrote his very detailed opinion about the matter, with Horstmann to Oberth, on March 3, 1930. The defense department had hinted that it would be enough to start the rocket without an explosion. Later on, a further developed version was to fly 10 km far with an accuracy of 30 meters in diameter.[76]

Oberth replied to Nebel that they could probably not expect any more money from the defense department in the future, because the construction of a rocket of 10 km range and a scattering of only 30 meters was, for Oberth, totally impossible.[77]

According to his letters to Oberth, Nebel was now rebuilding the rocket. He prepared several invoices, which were to show Oberth the progress of the experiments, since he was the leader of these experiments. Oberth was thus informed about the course of the experiments, about which he had complained to Nebel. According to Nebel's letter, the rocket was to be ready to start in the middle of April. Nebel had not carried out the experiments with the cardboard rocket, because of the stability test for which Oberth had asked (they were not carried out until April 7, 1930). Nebel wanted to test the rocket in the "Bremse," since this had not been done up to then. He did pressure experiments with electron receptacles to that time, which raised the pressure up to 10 atm.

He had not done the Brandertest yet, which he was already supposed to have done at the UFA during Oberth's absence in November 1929. Instead, he turned again to the support of nitrogen pressure gas. We can question if Nebel had tackled the Brandertests at all. The nitrogen tank was not in the oxygen tank anymore, but above it. This lengthened the rocket by 25 cm. As Nebel did not get an answer from Oberth to his letters of March 31, 1930, April 7, 1930, and April 20, 1930, he told Oberth that he would stop his activities, and he canceled

any further launching dates of the UFA rocket. He said he would only work again if he received detailed instructions, preferably from Oberth in person. Oberth's letter had already been sent on April 17, 1930, and again, the letters had crossed because of the long distance. On April 29, 1930, Nebel wrote to Oberth about all the experiments he had already done. He only did the Brandertests.[78]

The ready to start rocket was presented at a lecture evening in the Post lecture hall on April 11, 1930, and at the exhibition in the department store Wertheim starting on May 26, 1930. The exhibition took place on the occasion of the German Air Travel Week.

Oberth came to Berlin on May 20, 1930. Oberth and Nebel had a discussion, which ended with a serious warning for Nebel. There was neither a ready to start rocket, nor a real rocket. Nebel had presented the wooden model of the UFA-rocket to the visitors of the exhibition, the one which was constructed for aerodynamic tests. Also the tests, about which he had written Oberth, did not take place. Instead, Nebel was already able to send the drafts of his minimum rocket, with instructions, to Johannes Winkler on April 17, 1930. Oberth, however, was not supposed to find out about this. In the meantime, Oberth was fobbed off with the explanation that the tests could only be done in Stettin ("Stanze"), because the test equipment was there, Kegelnozzle etc., and the cardboard rocket could also be launched only there. The minimum rocket was to be completed on Monday, May 5, 1930.[79]

Oberth was supposed to work in Berlin on the overhauling of the Spaltnozzle, of the Kegelnozzle and of the Zylindernozzle, and he was also to launch the Mirak.[80]

Concluding Remarks

The last launching date of the UFA rocket was at the end of April 1930. Afterwards, it disappeared from the news. It was only rarely talked about. From time to time, new launching dates appeared, but their source was the gossip factory. The rocket, the wooden model, was in the hangars of the rocket airport for a long time, and it was allegedly taken to Moscow at the end of the war, according to Nebel. However, so far any investigations into the matter have been unsuccessful.

But the tests at the Chemisch-Technische-Reichsanstalt went down in space travel history. They furnished the official proof regarding the technical feasibility of the combustion chamber and, therefore, paved the way for the rocket airport in Berlin, which became the origin of all further developments.

The key man there was Klaus Riedel, since he was the technical leader of the rocket airport.

Someone else who had his first success there was Wernher von Braun. Yet, the origin of space travel development in Germany were the tests at the UFA premises, from there history took its course.

For Oberth, the situation was not the best. The damage done to Oberth's reputation through the negligence of the UFA and Nebel, who took advantage of Oberth's name, was immeasurable. In the future, many doors remained shut for Oberth. Also, later he was to play a minor role.

Only in Peenemünde did Oberth reappear, mainly to solve the future problems of the young space travel technology. One of these problems was the calculation of the stage separation. However, Oberth did not draw a single part of the A4.

Wernher von Braun had also brought his old teacher to Huntsville in the middle of the 1950s. History repeated itself, and Oberth was again occupied with calculations needed in the future about satellites and Moon trajectories. This time, he was not to work on a rocket, either.

Oberth's success was only to come again at the end of the 1950s. He was to work on the development of the Atlas, as advisor, under the supervision of Dr. Höppner. With his ideas, he drove some of the young engineers to despair. The Atlas had a revolutionary design, just like the UFA rocket earlier. The Atlas was developed at the end of the 1950s and it is still flying today. Thus, it is the only one of the "modern" large rockets which is still in use.

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Text translated into English by Birgit Mayer.

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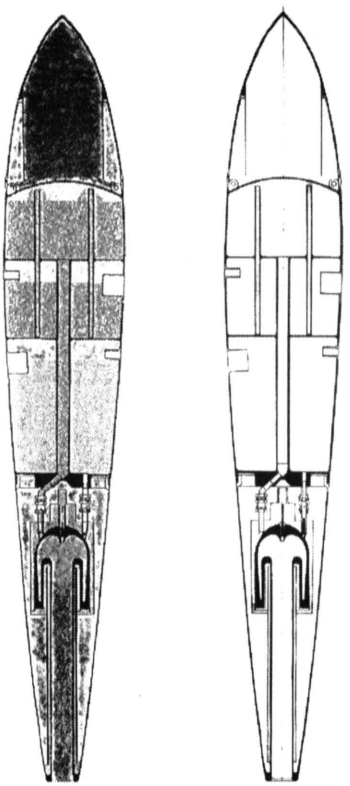
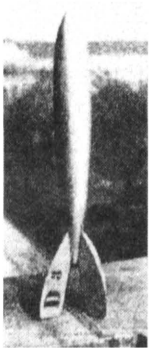
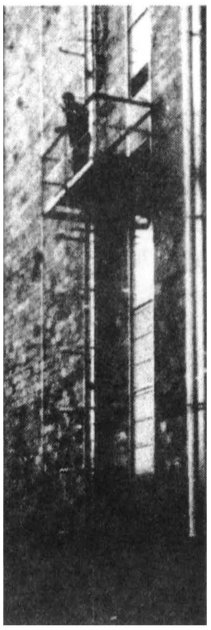
Illustrations





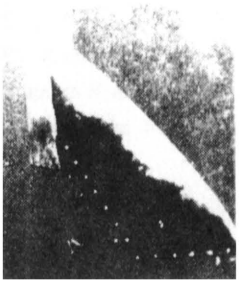
Aerodynamische Versuche

Aerodynamic experiments



Verschiedene Flossenformen

Different forms of fins



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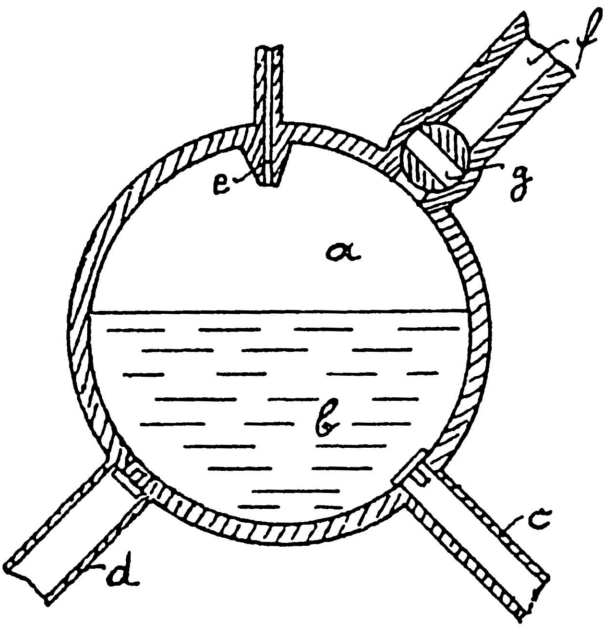

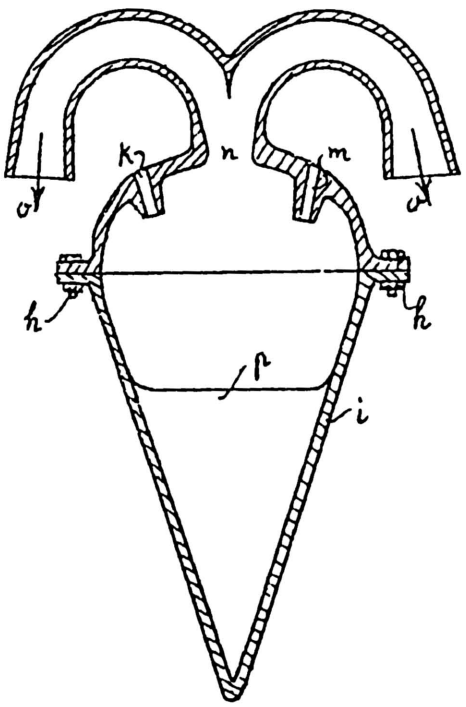

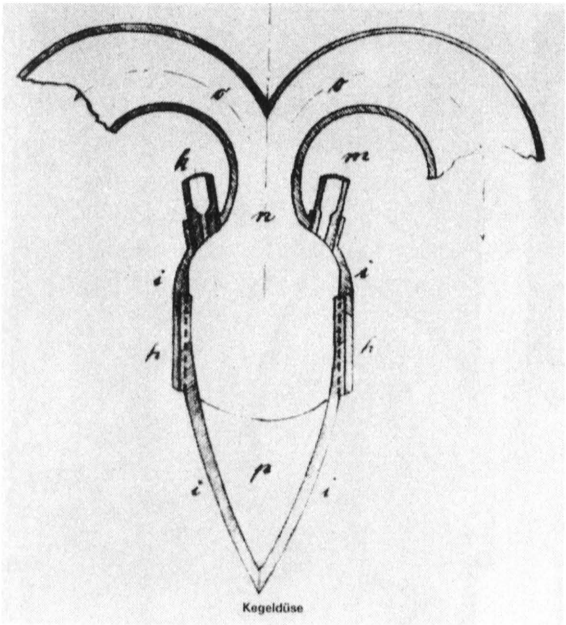

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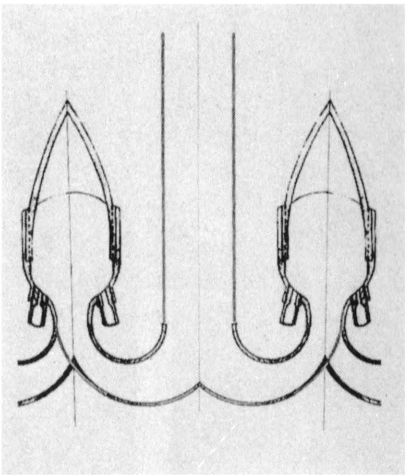
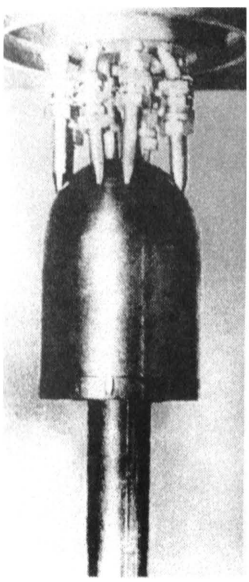
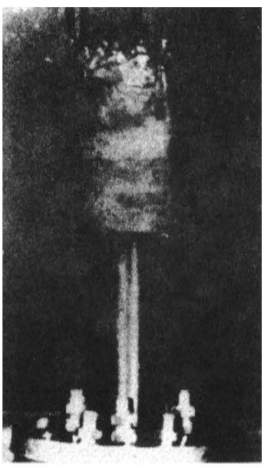
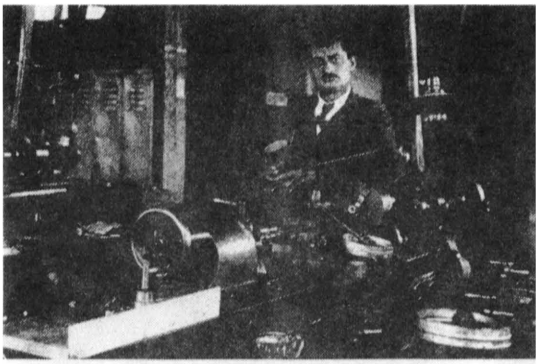


Zylinderdüse



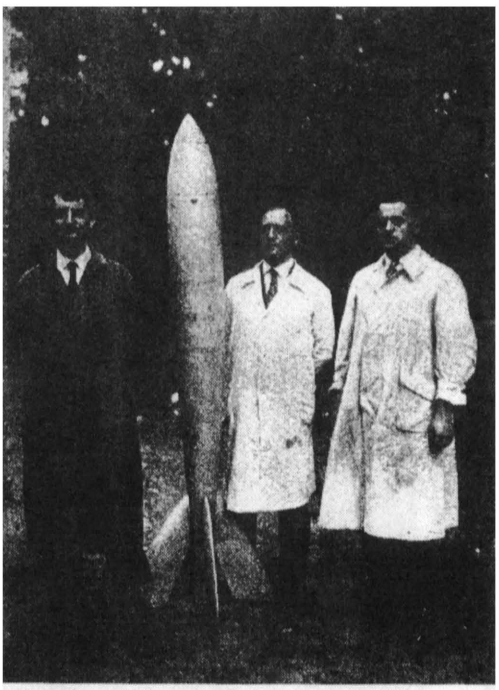


Hermann Oberth 1929



Hermann Oberth 1929

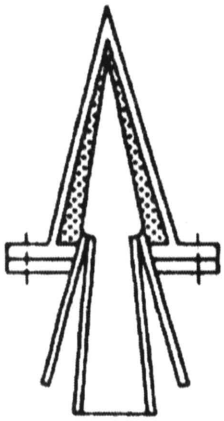
Rudolf Nebel

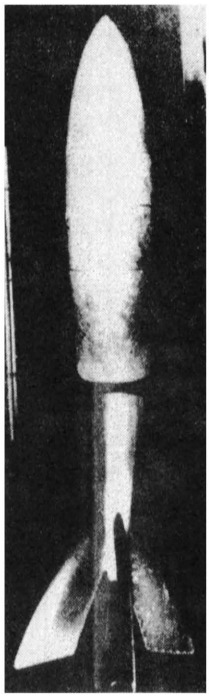


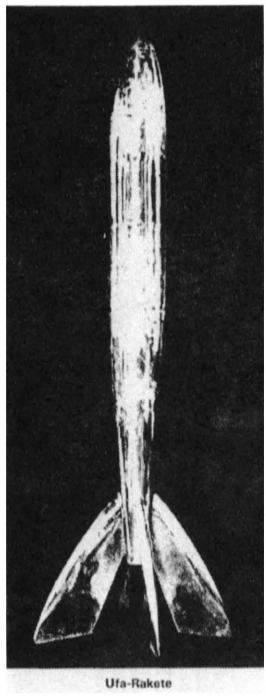
Hermann Oberth, Rudolf Nebel, Klaus Riedel

Spaltdüse

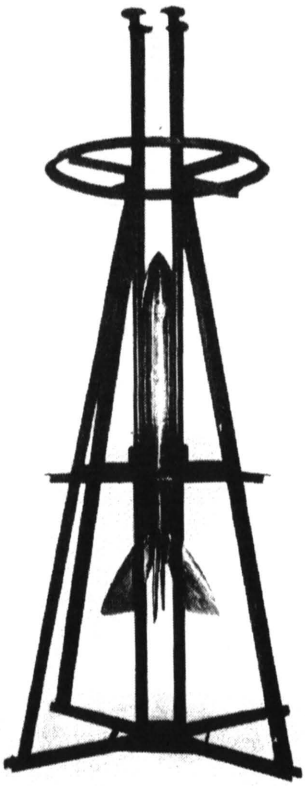
Kegeldüse



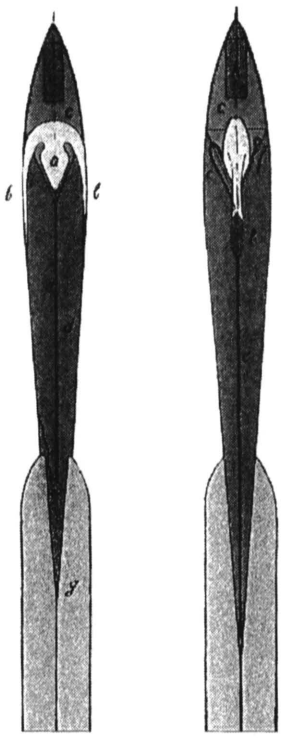




Ufa-Rakete



Mediascher Rakete



M. I:II

HERMANN-OBERTH
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