History of Rocketry and Astronautics

Proceedings of the Fiftieth History Symposium of the International Academy of Astronautics

Guadalajara, Mexico, 2016

Pablo de León, Volume Editor

Rick W. Sturdevant, Series Editor

AAS History Series, Volume 48

A Supplement to Advances in the Astronautical Sciences

IAA History Symposia, Volume 36

AAS Publications Office
P.O. Box 28130
San Diego, California 92198

Affiliated with the American Association for the Advancement of Science
Member of the International Astronautical Federation

First Printing 2017

ISSN 0730-3564

ISBN 978-0-87703-641-8 (Hard Cover)
ISBN 978-0-87703-642-5 (Soft Cover)

Published for the American Astronautical Society
by Univelt, Incorporated, P.O. Box 28130, San Diego, California 92198
Web Site: http://www.univelt.com

Printed and Bound in the U.S.A.

Chapter 5

Aurelius Bisail—First Rocket-Powered Model Airplanes in Vienna, Austria, Summer 1928*

Karlheinz Rohrwild†

Abstract

Due to the influence of the Opel-Rak 2 experiments at Berlin in May 1928, the Austrian "Flugtechnischer Verein" established the "section for high-flying research." The purpose of the section was the study and development of the reaction drive for high flying airplanes and spaceflight.

Being a member of this society, A. Bisail was mainly in charge of the youth model airplane courses. As an advanced model builder, it was his task to construct, build and fly the first Austrian rocket powered model airplanes in Vienna in summer 1928. New biographical data of A. Bisail allows to prove this story by period of time, Newspaper articles and picture proof.

1. Introduction

The press in Vienna reported about the test flight of a model rocket airplane.

Neue Freie Presse wrote:

---

* Presented at the Fiftieth History Symposium of the International Academy of Astronautics, 26–30 October 2016, Guadalajara, Mexico. Paper IAC-16-E4.1.6.

† Hermann-Oberth-Raumfahrt-Museum, Feucht, Germany.

Test flight of a model rocket airplane.

In the Danube flood plain. Vienna, May 26.

On Friday morning the first test flight of a model rocket airplane took place in the Danube flood plain in all quietness. Mr Aurelius Bisail had built the model at the Gliding Club of Vienna Technical University together with the Österreichische Flugtechnische Verein (Austrian Flight Engineering Association) with the cooperation of Messrs. W. Reichsfeld and L. Wondrak in the form of a self-supporting high wing aircraft in light metal. The propellants were custom-made 24-sized rockets provided by the pyrotechnical firm Sirius. These rockets were fitted centrally below the precisely balanced plane and generated a speed of 150 km per hour, which was enormous for a model and then caused a small accident during the first trial.

The parties made the model operational again with the assistance of Direktor Müller and Ingenieur Frey of company Sirius and a committee member of the Flugtechnische Verein. After taking into account the experience made during the first flight trial they attempted a second test launch and this resulted in a perfect straight-line flight. Over the first one hundred meters the rocket's thrust was effective and thereafter it started to glide somewhat steeper. The trials were affected quite negatively by a rather strong wind.

This trial showed that the problem of rocket flight is impacted by an enormous number of different factors: such as the rocket's position in relation to the airplane's longitudinal axis, the wing's angle of attack as well as the weight that must be determined under totally different aspects than for any of the former regular models due to the intensive acceleration.

This article was published on Saturday, May 26, 1928, which means that the trial itself took place on Friday, May 25, 1928, and thus only two days after Fritz von Opel's record race at Avus in Berlin. The important data on the actors named are:

> Mr **Aurelius Bisail** had built the model at the **Glidingr Club of Vienna Technical University** together with the **Österreichische Flugtechnische Verein** with the cooperation of Messrs. **W. Reichsfeld** and **L. Wondrak** in the form of a self-supporting high wing aircraft in light metal...with the assistance of **Direktor Müller** and **Ingenieur Frey** of **company Sirius** and a committee member of the **Flugtechnische Verein.**

The following Austrian dailies published reports about Bisail's trials:

- *Neue Freie Presse*, No. 22879, Vienna, Saturday, May 26, 1928, Page 1
- *Reichspost*, Vienna, Saturday, May 26, 1928, no. 146, Page 6
- *Vorarlberger Volksblatt*, Saturday, May 26, 1928, Year 63, no. 121, Page 6
- *Tages-Post*, Linz, Sunday, May 27, 1928, no. 123, Page 1
- *Vorarlberger Landes-Zeitung*, Friday, June 1, 1928, Year 65, no. 127, Page
- *Sonntags-Anzeiger für Bregenz und Umgebung*, Sunday, June 3, 1928, Page 3

- *Vorarlberger Tagblatt-Bregenz*, Friday, June 8, 1928, Year 11, no. 130, Page 3.

Photos of the trials were published in the following Austrian media:

- *Allgemeine Automobil-Zeitung* 1928 Jul 1, Page 61
- *Österreichische Illustrierte Zeitung*, June 24, 1928, Year 38, Issue 26, Page 3
- *Volksbote* 1928 Jun 23, Year 33, Number 25, Page 3
- *Wiener Bilder*, June 17, 1928, Number 25, Page 4.

The following is reported about the group's objectives:

Vorarlberger Tagblatt-Bregenz, Friday, June 8, 1928, Year 11, no. 130, Page 3

> **Lunar rocket without powder** Three young Viennese technicians Messrs. Reichsfeld, Bisail, and Wondrak are building a model for rocket airplanes. They consider powder to be generally unfit as a propellant and are therefore experimenting with other types of fuel. Thus they are planning to design a suitable rocket engine which could use liquid or gaseous fuels. They will also use small model planes to test out these devices. These experiments will need airplanes that travel through the air in an almost horizontal line and are able to land without damaging the engine.
>
> Meanwhile their tests with powder powered rockets shall provide more input for further design aspects. They will take care to use a powder load that burns down as slowly as possible to keep the speed to a minimum. This will later be followed by parallel tests with parachute rockets rising vertically into the air which will then use the new engines driven by different fuels than powder. Once they will have gained the required experience they intend to research the higher strata of the atmosphere by carrying along registration equipment.

The Slovenian press also reported about the tests in Vienna:[1]

- EDINOST, V Trsta. v četrtak, 31. maja 1928, Leto VI., Page 2
- JUTRO, Ljubljana, torek 12. Junija 1928, Page 3
- SLOVENEC, Leto LVI, V Ljubljana, v torek, dne 12. Junija 128, Page 4
- SLOVENSKI NAROD, Leto t a Jtro. 135., v Ljubljani, v četrtek 14. Junijo 1928
- *Jlustrirani Slovenec*, 29. VII. 1928, 4. Year, Number 31, Page 246 illustrated report).

The content of the Slovenian press reports is almost identical to those of the Viennese press with one exception: the Slovenian press refers to Bisail's Slovenian origin and that Aurelius Bisail is Zlatko Bisail.

At IAC 2003 in Bremen,[2] Dr. Bruno Besser reported on the Austrian pioneers in rocketry and spaceflight, thus he also mentioned Aurelius Bisail and an

addition by S. Sitar in the book *Beseda o Hermanu Potoöniku in njegovem delu.*[3] The latter also lists the dates of the different flights as follows:

- RMF 1 May 24, 1928
- RMF 2 June 15, 1928
- RMF 3 July 19, 1928

All of these flights took place in Vienna. The first two tested model rocket airplanes and a white mouse traveled along on the third test flight.

The illustrated report of *Jlustrirani Slovenec* is particularly important, because it is the only one that shows photos of both flight models.

II. Photos of the Flight Trials

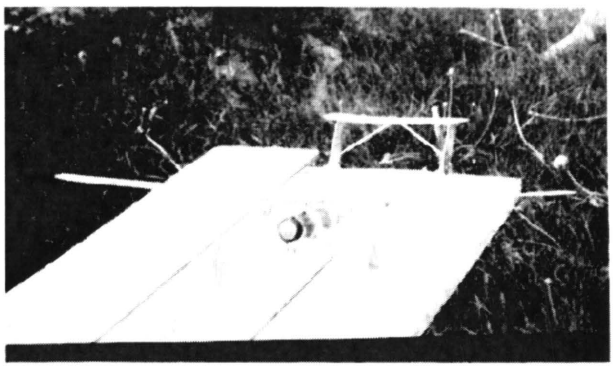

Figure 5–1: Rocket airplane model RFM I on May 25, 1928.*

The only photo of RFM I, which took flight successfully several times on May 25, 1928, reaching a top speed of 50 km/h is shown in Figure 5–1. In the end, it had an accident and was completely destroyed. The wingspan was 800 mm. The high-wing plane was made of a thin aluminum sheet. The 24-caliber rocket was clamped in a bracket below the wing and above the propellant charge one can see a tare weight on what (probably) is a threaded rod. The model was launched from a wooden board runway.

The photos of this biplane version, also made of thin aluminum sheet, have always been published with the results of RFM I. As for the RFM I model, here again, the area behind the rocket propellant was empty. The entire structure was clearly designed more robustly and the rocket engine was placed between the biplane's wings. Again a "tare weight" can be spotted on the fastening of the rocket engine. The man identified by x is Aurelius Bisail.

* http://www.dlib.si, *Jlustrirani Slovenec*, July 29, 1928, Year 4, Number 31, Page 246.

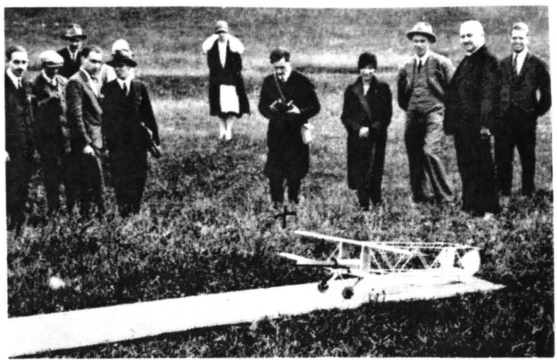

Figure 5–2: Rocket airplane model RFM II on June 15, 1928.*

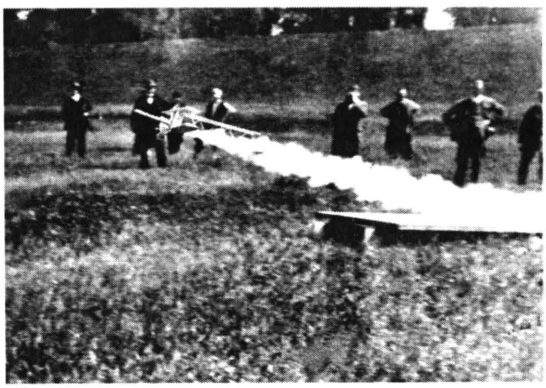

Figure 5–3: Take off of RFM II on June 15, 1928.†

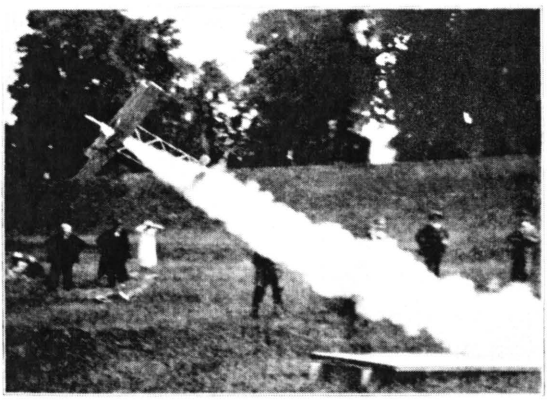

Figure 5–4: RFM II starting to tilt.‡

---

* http://www.dlib.si, *Jlustrirani Slovenec*, July 29, 1928, Year 4, Number 31, Page 246.

† http://anno.onb.ac.at, Österreichische-National-Bibliothek, *Allgemeine Automobil-Zeitung*, July 1, 1928, Page 61.

‡ http://anno.onb.ac.at, *Österreichische Illustrierte Zeitung*, June 24, 1928, Year 38, Issue 26, Page 3.

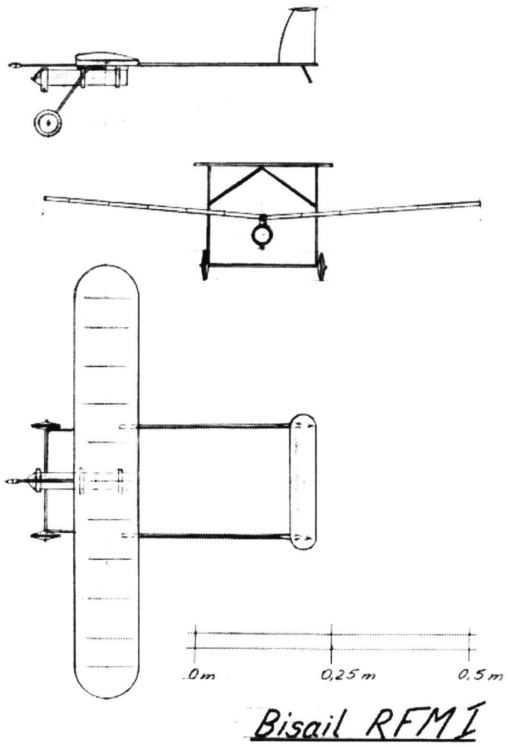

Figure 5–5: Drawing of RFM I by Martin Frauenheim 2016.

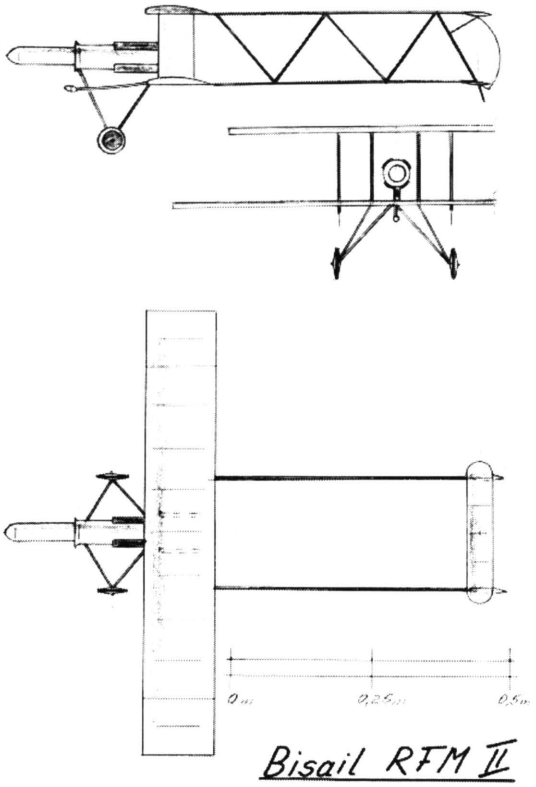

Figure 5–6: Drawing of RFM II by Martin Frauenheim 2016.

III. Detailed Descriptions of Organizations/Personalities

Österreichische Flugtechnische Verein

The Österreichische Flugtechnische Verein (Austrian Flight Engineering Association), which is described as one participant in the trials in the article of *Neue Freie Presse*, did not publish anything about these tests in its magazine *Flug*. However, the 6 June 1928 issue carries the following item on page 2 in the column titled "Official Announcements":

> **Department for Altitude Research.** The Österr. Flugtechnische Verein established a "Unit for Altitude Research" on June 6 this year. The purpose of this department will be to study the development of jet force for altitude craft and space flight as well as starting collections and giving lectures. President Pittner assumed the chair of this unit and a resolution was taken to cooperate also with researchers abroad working in the field.[4.5.6]

Immediately following this paragraph is this information:

Model construction course: Every Friday at 6pm at the premises of Österr. Flugtechnische Verein: A. Bisail.

Lecture course: "Introduction to Aerodynamics" starting at the end of August held every Monday at 6pm at the premises of Österr. Flugtechnische Verein, lecturer: L. Wondrak.

Sirius AG

Neue Freie Presse wrote:

Test flight of a model rocket airplane in the Danube flood plain...

The propellants were **custom-made 24-sized rockets** provided by the pyrotechnical **firm Sirius**...

with the assistance of Direktor **Müller**[8] and **Ingenieur** Frey of **company Sirius**...

The company seat was at Weiffenbachstrasse 180, which is near Hubertus Damm next to Reichsbrücke, right behind the line of trees on the photographs, where Donau Park is located in today.

Figure 5–7: *Flug*, 1932.*

Walter Reichsfeld Dipl.-Ing.

Walter Reichsfeld, born on August 30, 1903, in Vienna, Roman-Catholic, resided at XIX. district, Vienna, Cobenzlgasse 42/6, as of November 1, 1930. From 1921/22 to 1925/26 he was a student of electrical engineering at the Technical University in Vienna and graduated by taking the first state examination on February 29, 1924.[9] He married his wife, Sofie, née Rongier (born on February 2, 1909) on May 10, 1931, and they transferred their residence from Vienna to Weidling near Vienna on June 27, 1931. From September 29, 1932, to November

* Zeitschrift *Flug*, 1932, Issue 1, Back cover.

2, 1932, he and his wife were again registered in Vienna at XIX. district, Gebhartgasse 4/4. From February 2, 1932, to November 5, 1932, they lived at VI. district, Vienna Windmühlgasse 30/1/4 and moved to VIII. district Tigergasse 33/2/8 on November 7, 1932, and then again transferred to Weidling near Vienna, Rathgasse 22, on July 3, 1933. They returned to XIX. district, Vienna, Hubeschgasse 5,7, 2/7 from April 24, 1934, until May 5, 1936. They divorced on April 27, 1936.

Walter Reichsfeld was again registered in Vienna from May 15, 1948, until May 8, 1950, at XIX. district, Vienna, Nordbergstrasse 6/5, this time with his new spouse Magda, née Deppich (born on July 24, 1921). After June 6, 1950, they lived at VI. district, Vienna, Linke Wienzeile 130/8, on March 16, 1960, they moved to a different floor in the same house—Hochparterre/7. On May 11, 1968, they moved to XIII. district, Vienna, Speisinger Strasse 55/3/2/3. There are no further registration data.[10]

After dying at age 80, Walter Reichsfeld was buried on September 1, 1983, in Döbling Cemetery at Hartäckerstrasse 65 in Vienna, in the tomb of his wife's family. Magdalena Reichsfeld died on December 26, 2007, at age 86 and was buried next to her husband on January 9, 2008.[11]

Ludwig Wondrak, Dipl.-Ingenieur

Ludwig Wondrak's parents were registered in Vienna, III. district, Kölblgasse 18/3/14 as of November 8, 1910. His father Ludwig, was born on August 25, 1869, in Langenbruck/Bohemia was registered at this address with his wife, Leopoldine (at the time of the report in 1910 she was 33 years old). The child, Ludwig, had come to Vienna at age 8½. Ludwig Wondrak, born on March 3, 1902, in Vienna and a Roman Catholic subject to the jurisdiction of Vienna, studied mechanical engineering at Vienna Technical University from 1921/22 to 1929/30 and took the second state examination on December 9, 1933.[12] The registration records show him as an engineer as of May 16, 1934. His registered residence remained at his parent's address until October 14, 1940. On August 2, 1941, he married Eleonora Aich (born in Vienna on July 13, 1893). As of August 7, 1941, the couple was registered in Vienna, V. district, Rüdigergasse 27/12. He was designated as a company engineer. The next change was registered on March 17, 1948, when he was described as technical manager. From September 17, 1948, until April 03, 1950, the couple lived in the same apartment, but as divorcees. After April 5, 1950, Wondrak was registered as a divorced engineer in Vienna, III. district, Kölblgasse 18/14 until May 18, 1957, when he moved to apartment 18/3/14 in the same house with his new wife, Gisella, née Herdt. He was now registered as Dipl.-Ing. for Mechanical Engineering. On September 5,

1958, the couple moved to Vienna, V. district, Margaretenstrasse 139/25.[13] Ludwig Wondrak died on October 5, 1993, in Vienna.[14] A certain Gisella Wondrak, born on November 10, 1919, died at the age of 81 on May 26, 2001, and was buried on Vienna Central Cemetery at Simmeringer Hauptstrasse 234 on June 25, 2001.[15]

Zlatko A. "Aurelius" Bisail

Zlatko A. Bisail was born on March 13, 1905,[16] in Görz (Gorizia, Gorica), Italy, as the son of Aurelio and Rosalia Bisail. He was Roman Catholic and attended primary school in Görz province. At the outbreak of WWI, the family first moved to Ilirska Bistrica, a village in what is today Slovenia's southwest, and then on to Ljubljana, now Solvenia's capital. In both towns, he attended secondary school and after passing his examinations in 1922, he went to Vienna to enroll in the courses for mechanical engineering and shipbuilding at the Technical University.[17] His permanent address in Vienna from October 28, 1922, to July 10, 1925, was III. district, Hafengasse 16/1/8 under the name Aurelius Bisail, first as single technician, later as university student, subject to the jurisdiction of Görz, i.e. as an Italian.[18] On November 17, 1922, he took up his studies as a regular student at the Technical University. The studies ended on October 21, 1929, without him taking the first or second state examinations. He sat for the last individual test on January 27, 1932.[19] While attending university, he lived at different addresses in Vienna and in the summers, he returned to his hometown of Görz and his regular residence at Via Bertolini 15. He stayed in Vienna during the following periods and at the following addresses:

Figure 5–8: Ing. cand. Zlatko Bisail.*

- October 16, 1925—July 19, 1926: 13, Linzer Strasse 371/2/14
- October 13, 1926—July 27, 1927: 4, Wieder Hauptstrasse 10/16/2/142
- October 26, 1927—April 1, 1928: 4, Weyringergasse 13/11
- April 30, 1928—July 27, 1928: 4, Margaretenstrasse 56/2/2/20
- September 24, 1928—June 30, 1931: 5, Margaretenstrasse 56/2/1/20
- July 7, 1931—July 2, 1934: 6, Sonnenuhrgasse 1/3/17

* http://www.dlib.si, *Jlustrirani Slovenec*, July 29, 1928, Year 4, Number 31, Page 246.

On January 21, 1934, he married Hildegard Gabriele Ernestine Balzar (born on July 12, 1905, in Vienna). A note in the registration records mentioned his name Zlatko for the first time. On July 2, 1934, the couple moved to Novi Sad in Yugoslavia.[20] For the short period from May 24, 1937, to June 2, 1937, Bisail was again registered at Sonnenuhrgasse 1/3/17, but then returned to Yugoslavia. For this period, the Vienna registration records list him as Aurelius Josef Bisail, born on March 13, 1905, in Görz, married, Roman Catholic, technical employee.

The couple came from Semlin, Croatia, Kukuljevicg. 22 and registered again in Vienna at VI. district, Sonnenuhrgasse 1/3/17 on December 15, 1943. Vienna's registration records do not contain any further entries after that date.

Adolph Lehmann's General Address Book of 1934 listed Ms. Erna Balzar, private, at Sonnenuhrgasse 1 in VI. district.[21] Until 1931, this lady had run a tobacco and stationary shop.[22]

He built his first model airplane with his father at age six, and this enthusiasm for model building and model airplanes was to accompany him all his life. Before WWII, he worked in Yugoslavia, taught courses for model airplane building, organized exhibitions, designed airplane models, and wrote several technical books on model airplane building. After the war, he worked at a nautical college in Koper and taught descriptive geometry, technical drawing, mechanical engineering and model building.[23] In 1958, he published the first biography of the Slovenian aeronautics pioneer Edvard Rusjan. After his retirement, he returned to Gorizia/Görz and dedicated his time to his inventions. His special interests were wind engines on a vertical axis. He died in Görz on February 26, 1987.[24]

Zlatko Bisail also was an active member of the Slovenian community in Vienna. For instance, he sang the baritone voice for "Holy Mary" at the Catholic-Orthodox Church of St. Anne as a member of the "Slovenian Community Choir" on St. Vitus Day (commemorating the fallen soldiers of the battle of Amselfeld (today Kosovo) on June 28, 1389. The mass was also attended by visitors from the consulate including the Consul General.[25]

Aurelius Bisail filed a patent (no. 124558, class 2b) in Austria for "Machines shaping and filling dough" on June 26, 1929. The patent protection period started on September 15, 1930, and it was issued on September 25, 1931.

IV. Results—Contribution to Rocket Engineering

In 1957, Zlatko Bisail gave his own account of his work on rocket engineering. Dr Sandi Sitar was kind enough to make this paper available:

Studies on jet propulsion

When studying a large number of traditional drafts of gas turbines, which were already abundant half a century ago, it occurred to me in early 1927 that it must be practically possible to utilize the reactive force (rebound) of the gases ejected from the nozzles directly and exclusively to propel the aircraft. This would make the turbine rotor and the air-screw obsolete, i.e. two engine elements that already then posed a number of problems.

It is true, that several experienced experts like Professor Goddard in America, Prof. Oberth in Germany, Dr. Hoefft in Austria as well as others, were working on the same issues at the same time, however, their ambitions were greater, already then they wanted to find a suitable rocket engine to fly into space. In such considerations only a rocket engine would be viable, i.e. a device generating its thrust with on-board—liquid or solid-propellants which would render it independent of the air or rather of oxygen. The experts' work concentrated on theoretical studies and calculations as well as some popular articles on this matter, except for Prof. Goddard who allegedly had succeeded already then to reach considerable altitudes with the gunpowder driven projectiles he was using at the time.

Quite obviouly this was indeed a major achievement considering the global state of the art at the time.

Compared to these projects the concept of a jet engine of whatever design, i.e. a device still using the air's oxygen to burn fuel, was more realistic and already feasible with some design tricks. An airplane could reach much higher altitudes and faster speed with such an engine and at the same time this form of propulsion would remain quite economical.

These conclusions then meant the end of the idea and led to the draft of a star-shaped jet turbo engine with an even number of cylinders. I chose this design solution, because I was able to combine a compressor for a gas mixture with fuel heads and cylinders and the heads filled by direct action on the mixture with the pressure of centrifugal force. Each cylinder head ended in a nozzle similar to a laval nozzle and could be rotated centrally along the cylinder's axis. In this way the reaction force of the escaping gas distributed into two components, the smaller of which rotated the engine, while the larger component exerted pressure in the direction of the turbo engine's rotation axis. Hereby the outer surface of the heads and nozzles should be formed into short screw blades protruding from the motor hub. This would on the one hand ensure suitable cooling of the engine, i.e. the heads and nozzles, and on the other hand a forceful intake of the flowing air by the engine which would then mix with the mass of glowing exhaust gases. A large tube-like nozzle was fitted around the engine to get the maximum out of this double effect, i.e. engine cooling and volume increase of hot gas. There should be an electric ignition and outside assistance for the launch. At high rotational speed.

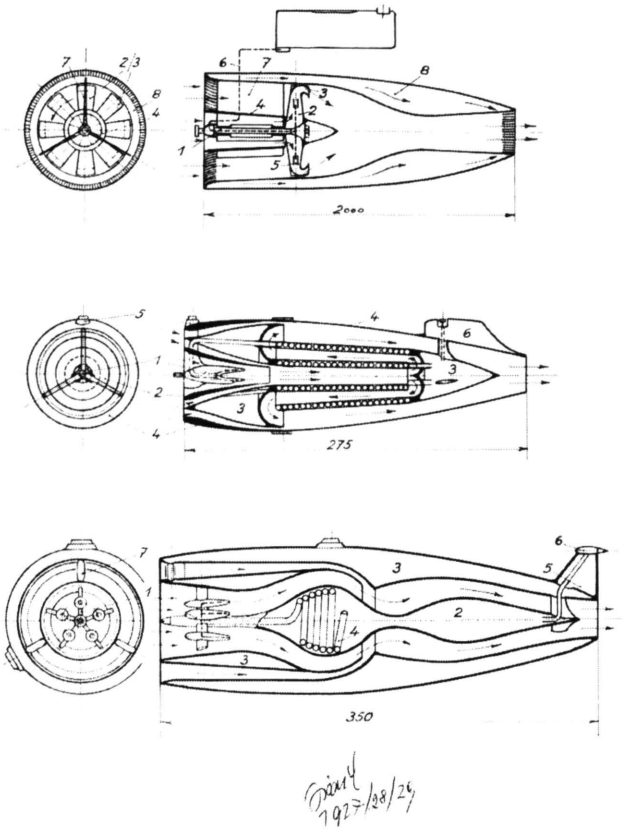

Figure 5–9: Jet engine designs by Zlatko Bisail, 1927 to 1929.*

It goes without saying that this concept was too daring for that time and age and therefore this draft (probably like many others then) remained confined to the paper it was drawn on and to the mind of its creator. Certainly it would have required a lot of money while having only limited prospects of any direct success. The author was quite aware of this and therefore concentrated his later efforts on less sophisticated and cheaper methods of experimenting with models. At any rate, the later development of jet engines confirmed that this concept would probably have been viable, because they consist of the very same elements up to this date, in particular the huge turbo compressor driven by a gas turbine.

In order to simplify such a jet engine and adapt it to model planes I designed a burner without petrol vapor and high pressure in which a longer nozzle is surrounded by a petrol tube pressure vessel that directly absorbs the heat and ensures consistent fuel evaporation. In the experiments at Gorica with very limited means the vapor jet was unable to take in a sufficient volume of air ant the burner did not perform as expected, although it

* Zlatko Bisail, Studies on jet propulsion, 1957.

overcame the friction of the base and clearly indicated that it wanted to get off the table. What was wrong were the dimensions of the three nozzles which were not sufficiently coordinated. Working on the improvements then took until the beginning of fall 1927 and I had to stop, because the vacation was over and I had to return to Vienna.

In April 1928 Fritz von Opel appeared with his automobile in Germany which he propelled with a battery of strong powder rockets. The aircraft mechanic Max Valier had talked Opel into these experiments and they used rockets which were made for them by the pyrotechnical product factory of Ingenieur Sauder. This car drove for the first time on April 11, 1928. It was built by Opel's employee Ingenieur Volkhart who also tested it: he reached a speed of 100 km/h in eight seconds.

I was so greatly motivated by Opel's success that I decided to stop the time-consuming experiments with a petrol engine for the time being and instead to concentrate on first experiments with traditional powder rockets.

In the course of May I built a small model, called RFM 1 (Rocket Flight Model) with a 800mm range, in my private room in Vienna, of which my landlady was not amused. But still, the secret I was working on had been kept confidential. On May 28, 1928 I made my way to the factory for pyrotechnical products called "Sirius", that was then located on the Danube in so-called "Bretteldorf," I took along my completed model carefully wrapped up in paper. Two of my colleagues accompanied me on this difficult way and during the walk I shared with them the secret of the content of the paper package. The factory's director understood very soon what it was about and very generously made available to us his entire range of rockets. After thinking long and hard and firing several rockets I decided for the 24mm caliber. To be sure, all of these rockets were rather primitive and did not meet even the most basic requirements of thermodynamics. However, they served their purpose for the first tests. They only burn for three or four seconds. The photo shows the model's shape and the way the rocket was attached below the wings. The first attempt of an actual launch took place on the wide bank of the Danube in front of the factory.

The model was positioned on a launching board and was ignited with a fuse that can be seen on the photo. The first flight started and ended with an enormous looping and luckily the model returned to the ground almost undamaged. I slightly reduced the rocket's inclination for the second start and then the model flew a relatively straight line for a distance of about 300 meters at an average speed of about 150 km per hour. However, the model was totally overloaded and thus considerably damaged during the landing on uneven ground. But still, we risked a third flight after a makeshift repair, but this flight ended in a steep curve and the almost complete destruction of the model. It was not quite up to a speed of more than 40 meters per second.

Already on the next day the Viennese daily "Neue Freie Presse" carried a note on the trial on the cover page and also all Austrian and European newspapers summarized the news by saying: the first model of a rocket airplane did fly. The reporting was objective.

Encouraged by such cheap advertising the directors of the "Sirius" factory immediately offered me to continue my work and trials at their workshops. I welcomed this offer and immediately set out to design and build a new biplane, the RFM II. One of the colleagues previously mentioned helped me with this work. We mainly concentrated on experimenting with rockets, because I understood that those available were unsuitable for my requirements. Thus I succeeded in compiling another rocket supported by the pyrotechnical engineers of the factory, which generated uniform pressure and burnt for 16 until 17. As can be appreciated on the photograph the model was completely made of aluminum, sheet metal and tubes. The rocket was attached between the wings and positioned in a tube that permitted the adjustment of the inclination. The grid-like body ended in a directed horizontal area.

The model was completed on June 15, examined and prepared for the first launch with a new rocket. Right after its ignition the model took off at the right speed, rose at a soft angle to 20–25 meters and flew for a distance of about 400 meters at high speed, then, when the effect from the rocket was spent, it sank back to the ground with some minor damage, because of the model's weight and the poor condition of the ground. This flight was unexpectedly uniform and beautiful and practically fully proved that it is possible to use a jet engine in a traditional airplane as well. The experts from the Technical University, from aerospace industry and the Sirius factory that were present were full of praise of this successful and most interesting experiment. For the second start we fitted the model with the same type of rocket, however with a stronger charge. At high speed it took the model up to about 50 meters. As the wings had been somewhat warped already, an asymmetric rise resulted and made the model turn in a steep spiral while rising, almost rotating around its own axis. When gliding at slow speed later on it steadied again and returned to the ground in large circles. It was damaged again during landing and therefore we dispensed with further experiments on that day. I later reused this same model for several other flights to test modified rockets to be used as propellants for a new model. These rockets were still 24mm caliber, 430 mm long, fitted with metal nozzles and loaded with a defined load. In trial launches we achieved fight distances of more than 1,200 meters. Such a rocket weighed 350 grams and bore a load that almost corresponded to its own weight. The third rocket model RFM–III was a high wing plane and its body was closed at the front. At the bow there was a small compartment for load and the first two passengers: two white mice. Two rockets of the type mentioned fastened to one another were attached to the body. Again the form of attachment allowed the adjustment of the rockets' inclination, which is a major factor for this type of highly accelerated propellant to ensure the right launch and an acceptable form of flight. The two rockets were ignited in sequence. Range of the model: 1.8 m; wings: 38 dm2, weight when rockets were full: 2.10 kg. When the rockets were spent the weight dropped to 1.70 kg. Thus the model was loaded with 55 grams/dm2 at the start and with 45 grams/dm2 during flight.

The experiment with this model took place on July 19, 1928 at the same place. After its ignition the launching rocket that was at the bottom and the stronger of the two, sent the model up to an altitude of about 30 meters in a steep line, then entered a wide circle along which it continued until the second rocket fired. The latter pressed the model down to the ground at increased speed, but very soon it righted itself again, continued its flight at low altitude and then suddenly crashed not far away from the launching point. The smoke tail that had covered the model's tail throughout the flight made it impossible to see while the model was still in the air that the central part of the tail area made of aluminum tube and metal sheet had melted down and destroyed the tail part. Unexpectedly the exhaust gases still were too hot at that point and had a corresponding effect. This only flight lasted no more than thirty seconds and could only be called successful in that the model continued to fly also with a rocket that had been fired later in the air. The two white mice survived the whole disaster safe and sound and were quite happy to race back into their mouse hole as soon as we released them from their cramped dark prison. Except for the tail the model remained almost undamaged and it would not have taken a lot to repair the tail. But we had no time anymore, because I had to return to Gorica.

The continuation of such experiments was not very promising from a technical perspective either. Although they were small and modest my three models proved that completely new concepts and design approaches were required for airplanes with jet engines and that regular gunpowder rockets were unsuitable for such experiments.

Almost all papers, including the "New York Times," reported about these experiments and published their photos. In Austria the photographs were published in the following papers and magazines: Wiener Bilder, Volkszeitung, Automobilzeitung, Welt-Bild, Österr. Illustrierte, Atlantik etc. In Ljubljana the Ilustrirani Slovenec [Illustrated Slovenian] of July 29, 1928.

Several months they arrived at the same results in Germany as well, when they tested the rocket engine with larger models with wing spans up to 4 metres and rockets of a larger caliber which were probably made by Ingenieur Sander.

Factory Sirius in Vienna later tested and manufactured 27 caliber rockets for hail prevention. When equipped with the required explosive this rocket reached an altitude of 1,000 metres.

In the following years I concentrated on another type of design work. I only returned to the jet engine in the winter of 1931/1932 in the form of a "flying wing" or an airplane without body or fuselage. As member of the Glider Club of the Technical Department of Vienna's university I designed a large test model of a flying wing with a range of 5 meters and symmetrical profile. This model, called S-13, was to serve the group at first as a model for building a motor sports plane. However, I intended to fit it with a suitable body later on and to test the petrol engine I already mentioned above and had meanwhile improved. As the photo shows the S–13 had really been

built by February 1932 built and the results we achieved with it were published in the magazine "Flug" 1932.

The new engine was also partially completed and would probably have lived up to expectations. But after the department was expanded, our glider club lost its rooms and the workshop which made it impossible to continue any but the most minimal construction work. For some time I hoped to be able to complete the assembly in some private workshop, but these hopes were also frustrated in the course of time. And thus this remained an interesting piece of unfinished work.

December 27, 1957 Bisail Zlatko

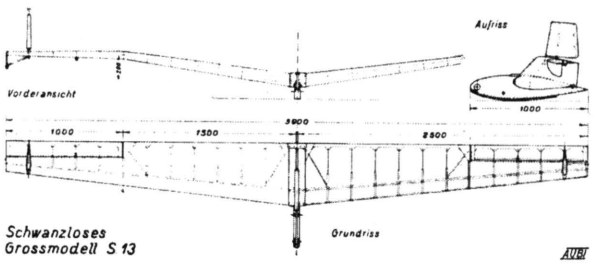

Figure 5–10: Proportions and size of model S 13.*

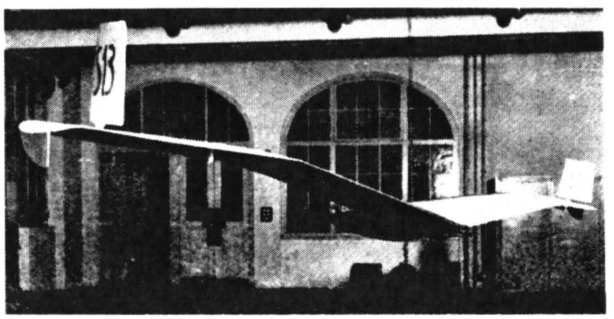

Figure 5–11: Large airplane model S 13.†

V. Discussion

Why did the successful flight trials with a rocket airplane model in Vienna remain unknown for such a long time?

The German print media did not report this event back then, because Fritz von Opel's tests dominated the news. Even the photo caption in *Der Blitz* of Nuremberg does not mention the researchers' names, only the location, Vienna. The

* *Flug* 1932 February, Number 2, Page 10.
† *Flug* 1932 February, Number 2, Page 11.

trials were reported in several Viennese dailies and magazines as well as in Slovenia, but Scherschevsky was the only one who deemed theses news important enough to report about them.[26] While Valier had made reference to such trials in his two issues of *Raketenfahrt* in 1928 and 1930, he did not report about these trials, nor did Willy Ley in his publications. Even Robert W. E. Lademann of the German "trade press" did mention the "promising" rocket flight trials in Vienna only briefly without any details.

This means that the technical publications of the time did not really report anything substantial about these events. Not even the estate of the Viennese rocket and spaceflight pioneer Guido von Pirquet contains any trace, although there are a large number of newspaper clippings relating to spaceflight.

At the 37th History Symposium of the International Academy of Astronautics in Bremen in 2003, Dr. Bruno Besser described the Austrian rocket and spaceflight pioneers and also mentioned the name of Aurelius Bisail. His paper was published in AAS History Series, Volume 34. He refers to a paper of a certain S. Sitar in a Slovenian publication about Hermann Noordung. Dr. Besser was quite clear, though, that this reference could not yet be confirmed by anything else.

Only after the digitization of entire archives, such as those of the Austrian National Library in Vienna, did new opportunities arise and a specific search uncover such "chance findings."

VI. Conclusions

Zlatko Bisail was a quite well-known and reputed builder, designer, and author in the field of model airplanes in his home country, Slovenia. His early trials with rocket airplane models are also familiar there. This is mainly due to the aerospace historian Dr. Sandi Sitar from Ljubljana who honored Bisail's work in several papers.[27]

For instance, the monthly *Flug* published a series of articles on the construction of different types of airplane models in the column "Der junge Modellbauer" ("The young model builder") starting in the April 1929 (number 4, page 12) issue and ending in the July 1930 issue (number 7, page 11). Titled "FLUGMODELLE IN THEORIE UND PRAXIS" ("Theory and practice of flying models"), this series of articles was published as a brochure by the magazine publisher of *Flug*, H. Pittner, Wien III, Traungasse 11.

Figure 5–12: 1931.*

Figure 5–13: Aurelius Bisail.†

Acknowledgments

My special thanks go to the following persons without whose cooperation or support this chapter would not have come about:

Dr. Michaela Laichmann and Mr. Denk
Magistrat der Stadt Wien, Magistratsabteilung 8, Wiener Stadt- und Landesarchiv

Mag. phil. Dr. phil. Juliane Mikoletzky
Vienna Technical University, Head of University Archive

Martin Frauenheim
ehem. Bgm. Hagen a.T.W., expert on Tiling

Hans-Joachim Lanksch
München, Sworn translator for Slovenian

Ursula Mock
Proof reading

Elke Limberger
English translation

* Aurelius Bisail, FLUGMODELLE IN THEORIE UND PRAXIS, Verlag Zeitschrift *Flug*, H. Pittner, Wien.

† Ibid., page 50.

Appendix

Following Bisail's Traces: The Flight of a Rocket Airplane Model in Slovenia

The student of the famous Kyffhäuser Technical Academy in Frankenhausen, Pepi Halbwidl, who hails from Maribor and is the son of the owner of the well-known restaurant and hotel "Alte Brauerei," Mr. Andreas Halbwidl, successfully launched a rocket airplane model at "Drei Teich" on August 4, 1928, at 9:00 pm. The rocket airplane model was built by him and took off successfully after being fired, it reached an altitude of 25–27 meters. When another rocket fired the model started to fly in a curve, probably because a fixing had come undone and forthwith crashed into the pond. The experiment met with much interest in Maribor and was the first of its kind in this country, following the well-known trials in Vienna, Magdeburg, Rhön, and in Frankenhausen.[28]

References and Notes

[1] http://www.dlib.si.

[2] B. P. Besser, "Pioneers form Other German-Speaking Countries: Austria," in *History of Rocketry and Astronautics* (Proceedings of the Thirty-Seventh History Symposium of the International Academy of Astronautics – Bremen, Germany, 2003), Otfrid G. Liepack, editor, AAS History Series, Volume 34, IAA History Symposia, Volume 23, ISSN 0730-3564, ISBN 978-0-87703-563-3 (Hard Cover), ISBN 978-0-87703-564-0 (Soft Cover) (San Diego, California: Published for the American Astronautical Society by Univelt, Inc., 2011), pp. 541–553. (paper IAC-03-IAA.2.4b.02 presented at the 37th History Symposium of the International Academy of Astronautics as part of the 54th International Astronautical Federation Congress, Bremen, Germany 29 September – 3 October 2003).

[3] S. Sitar, "Beseda o Hermanu Potoöniku in njegovem delu," in *Hermann Potoönik, Problem vozenje po vesolju*, p. 245 (Ljubljana: Slovenska Matica, 1999), pp. 211–239, especially pp. 235–236.

[4] also see: Johann Pittner (Dec 17, 1887—Sep 16, 1956) in Wikipedia: https://de.wikipedia.org/wiki/Johann_Pittner.

[5] *Neue Freie Presse* June 9, 1928, No. 22892, p. 20, Central European Economy, No. 240 announced the following: ... The Austrian flight engineer and current president of the Österreichische Flugtechnische Verein, Ingenieur Pittner, hat auf Grund von Studien und Versuchen schon 1915 einen, vorerst für Flugtorpedos zu verwendenden Raketenantrieb zum Patent angemeldet und beschäftigt sich auch weiterhin mit dieser Frage. Anm. d. Red.

[6] Walter M Hopferwieser, *Pionierraketenpost und kosmische Post* (Pioneer Rocket Mail and Cosmic Mail), Active Intermedia Verlag, Vienna, 2016, pp. 199–200: Johann Pittner – Johann Pittner, chairman of the Österreichische Flugtechnische Gesellschaft (note Rohrwild: should be 'Verein'), filed a patent for a rocket airplane on Dec 07, 1915. He resumed his research on liquid propelled rockets in 1927. In 1932, he intended to shoot a mail rocket from Austria across the Danube to Theben in Czechoslovakia and back again. Trials with a 1.15m solid-propellant rocket with small side wings for stabilization started from a catapult were successful. On May 31, 1933, he received the permission of the Regional Presi-

dent of Bratislava and on June 13, 1933 that of the postal directorate of Bratislava. But the project still fell through. The vignettes made for these two flights were sold for the benefit of an international aerospace library after World War II.

[7] Also see Dr. Bruno Besser's paper.

[8] *Wiener Allgemeine Forst- und Jagd-Zeitung* (November 19, 1920, Year 38, Number 47, p 294) mentions Dir. Eugen Müller (Vienna) describing him as a member elected to the administrative board of the listed company Sirius, formerly Hermann Weiffenbach.

[9] Archives of the Technical University of Vienna, E-mail from Mag. phil. Dr. phil. Mikoletzky dated June 6, 2016.

[10] Magistrate of the City of Vienna, Magistrate Department 8, Vienna City and National Archive, MA 8, B-MEP-453998/2016.

[11] http://www.friedhoefewien.at/.

[12] Archives of the Technical University of Vienna, E-mail from Mag. phil. Dr. phil. Mikoletzky dated June 6, 2016.

[13] Magistrate of the City of Vienna, Magistrate Department 8, Vienna City and National Archive, MA 8, B-MEW-454027/2016.

[14] Vienna Registry Office, III. district, registration number 1179-1993, Wiener Landstrasse.

[15] www.friedhoefewien.at, Grabsuche.

[16] Görz on the river Isonzo formed part of Austria until it was occupied by Italy in 1918 and finally annexed in 1919. At the end of WWII, parts of the city were occupied by Yugoslavian partisans and therefore divided by the Paris Peace Agreement of 1947.

[17] www.primorci.si/osebe/bisail-zlatko/589/.

[18] Magistrate of the City of Vienna, Magistrate Department 8, Vienna City and National Archive, MA 8, B-MEW-551228/2015.

[19] TUWA main listing of regular students for the 1922/23 academic year, registration no. 989 dated November 17, 1922.

[20] After WWI the area around Novi Sad became part of the newly established kingdom of the Serbs, Croats, and Slovenes which called itself Kingdom of Yugoslavia after 1929. https://de.wikipedia.org/wiki/Novi_Sad.

[21] Wien Bibliothek digital, http://www.digital.wienbibliothek.at, Adolph Lehmann's General Address Book of Vienna, Vol. 1, 1st Part. Inhabitants of Vienna 1934, p. 37.

[22] Wien Bibliothek digital, http://www.digital.wienbibliothek.at Adolph Lehmann's General Address Book of Vienna, Vol. 1, 1st Part. Inhabitants of Vienna 1931, p. 44.

[23] Koper is Slovenia's only port city and is directly to the south of the Italian port of Trieste.

[24] www.primorci.si/osebe/bisail-zlatko/589/.

[25] http://www.dlib.si, SEOVEHEC, Leto IVI., V Ljubljani, v torek, dne 3. julija 1928. Page 2.

[26] A. B. Scherschevsky, *Die Rakete für Fahrt und Flug*, 1929, Verlag C. J. E. Volckmann Nachf. GmbH, Berlin-Charlottenburg said on pages 95 and 96: "On May 26, (1928) first tests with a small rocket plane (range 0.8m) of the academic glider club Segel-Akaflugvereins of Vienna Technical University were made on the Danube's flood plains. The fully metal airplane, structural type Ing. Frey, was equipped with a rocket of the pyrotechnical com-

pany Sirius. During the trials the model flew at a speed of about 150 km/h (= 41.7 m/sec). It was said that the model crashed completely after having performed a number of flights."

[27] Ibid., see references.

[28] http://www.dlib.si
Domovina. Ljubljana, August 9, 1928, Year 11, no. 32, Page 8.
Slovenec. Ljubljana, August 7, 1928, Year LVI. 187, Page 4.
Ponedeljek, Ljubljana, August 6, 1928, Year 2, no. 32, Page 3.