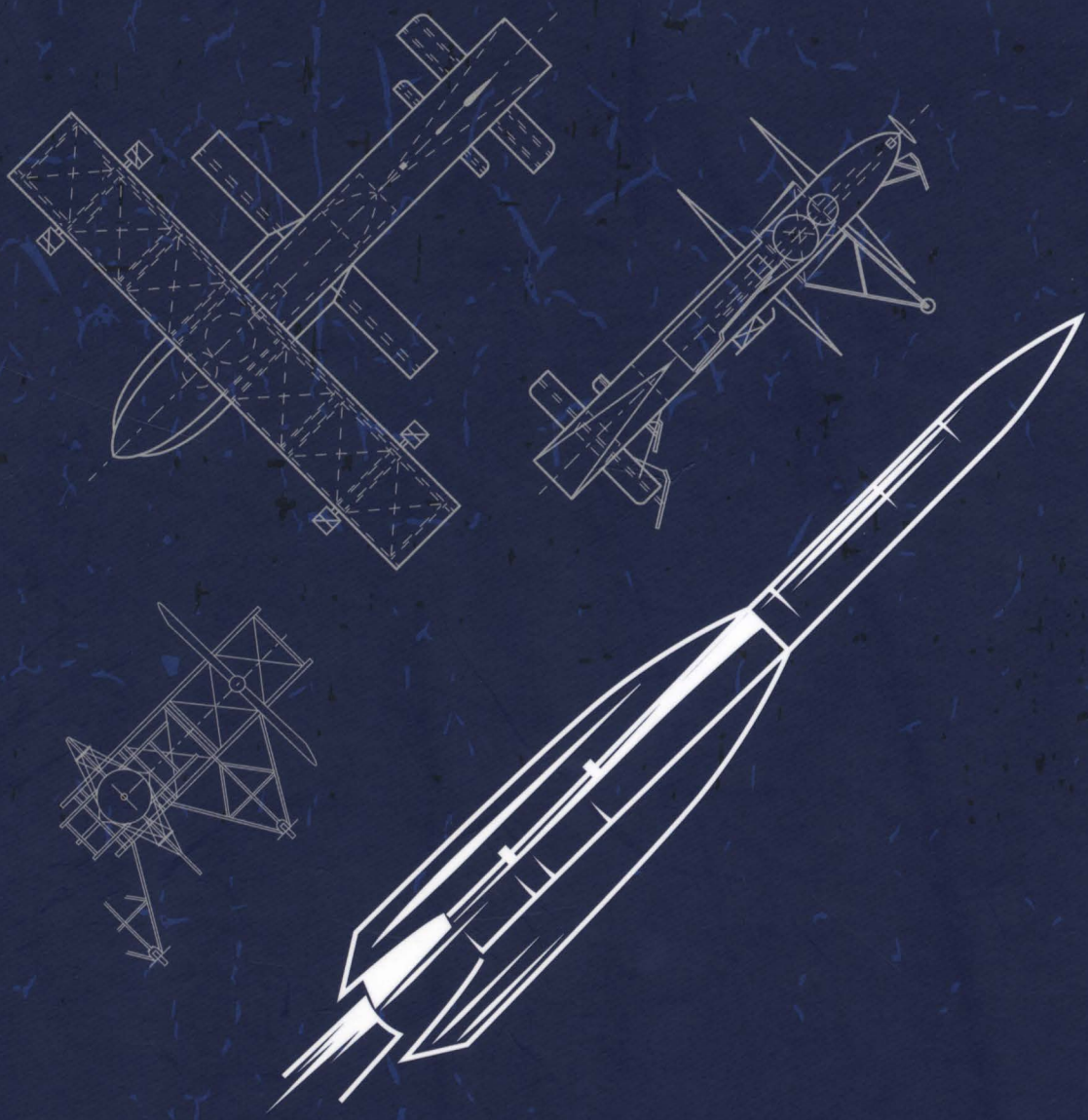

GÜNTHER SOLLINGER
ALĪDA ZIGMUNDE

FROM AIRPLANES TO ROCKETS – FRIEDRICH ZANDER AND EARLY AVIATION IN RIGA

RIGA TECHNICAL
UNIVERSITY
— 155 —

In 2017 the Research Centre for Engineering History of Riga Technical University assisted in the preparation of this monograph dedicated to the memory of FRIEDRICH ZANDER, a graduate of the Riga Polytechnic Institute and Honorary Member of the Riga Technical University, whose 130th year of commemoration happened at the time Riga Technical University celebrated its 155th anniversary.

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FROM AIRPLANES TO ROCKETS – FRIEDRICH ZANDER AND EARLY AVIATION IN RIGA

Scientific Monograph

Approved by RTU Scientific Council in 2018

RTU Press
2018

Sollinger G., Zigmunde A. **From Airplanes to Rockets – Friedrich Zander and Early Aviation in Riga.** Scientific Monograph. Riga, RTU Press, 2018. 184 p.

This study is dedicated to the memory of Friedrich Zander (1887–1933), an internationally well-known graduate of the Riga Polytechnic Institute (RPI), presently Riga Technical University (RTU). The study focuses on Zander's family background and student years at the RPI, on first steps taken towards his intense involvement in rocketry and spaceflight later in life. Zander's professional efforts, his ideas, calculations and practical suggestions have made significant contributions to the space sciences. In addition to noticing previous research, the study is based on material found in the collections of archives, libraries and museums. Part of the documents used are published for the first time.

This book is intended for students of the engineering sciences, engineers and others in Latvia and abroad interested in the history of aeronautics and space engineering seen from a global perspective.

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The monograph is published in accordance with the resolution of RTU Scientific Council of 15 January, 2018, minutes No. 04000-3/1.

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ISBN 978-9934-10-999-7 (print)
ISBN 978-9934-22-039-5 (pdf)

Content

INTRODUCTION

In 2017, Riga Technical University celebrated its 155th anniversary. The institution, founded in 1862 as Riga Polytechnic School, was the first higher polytechnic institute established in the Russian Empire, which then included the present territory of Latvia. At that time, higher technical education in Russia was offered at seven other institutes, all oriented towards the educational needs of specific professions. The Mining Institute in St. Petersburg (founded in 1773), for example, and the St. Petersburg Military Engineering School (founded in 1810) both offered highly specialized curricula. In contrast, the Riga Polytechnic offered a wide range of studies including mechanical and chemical engineering, architecture, agriculture and economics.

In 1896, the Polytechnic was reorganized and called the Riga Polytechnic Institute (RPI). In 1915, because of the war, the institute was evacuated to Moscow. In 1918, most of its inventory was used in the establishment of a new polytechnic institute in Ivanovo-Voznesensk, only some few items being returned to Riga. In October 1918, when Riga was occupied by German forces, the government in Berlin decided to establish the *Baltische Technische Hochschule* (Baltic Technical University). After the end of the war, the Germans having withdrawn, Latvia declared its independence from Russia on 18 November 1918. A few months later, on 8 February 1919, the government of at that time Soviet Latvia established the *Latvijas Augstskola* (Institute of Higher Education of Latvia). After the ejection of this government from power, the Republic of Latvia founded a new institution of higher education, which from 1923 onwards was called the University of Latvia. This university was established on the premises of the former RPI, its curriculum including studies in the humanities along with programs in the natural sciences and technology previously offered by the RPI. Thus, a friendly coexistence of the humanities and natural-technical sciences came into being, a cohabitation, which lasted until 1958 when the latter section became an independent branch, a change which in effect re-established the former RPI. In 1990, this branch became today's Riga Technical University.

In 2017, on the occasion of RPI's anniversary, we vividly remember its long history, founding members, faculty and other staff, alumni and students. The history of the Riga Polytechnic / RPI, which started way back in the mid-19th century, continuing through the upheavals of the 20th century and moving into the 21st century, is well worth remembering not least because of its faculty and graduates, their work and lasting achievements.

Friedrich Zander[1] (1887–1933), an internationally well-known pioneer of rocketry and spaceflight, is one of RPI's alumni. Zander's scientific reputation has been widely acknowledged not only in encyclopedias and reference works but also by Latvian historians [1]. During the first three decades of the 20th century, Zander's dreams from early childhood about the universe and its mysteries would turn into scientific calculations and technical suggestions, making valuable contributions to the understanding and eventual conquest of space.

Science, including the engineering sciences, is moving forward at an accelerating pace. Generations of scientists have made their marks since Zander's days, the names of early pioneers starting to slip back into the dark corners of history. This development was partly halted in Zander's case by the naming streets and public spaces in his honor, by awards and other activities instituted to remember him and his work. Today, according to a public survey from 2004 carried out by the journal *Latvijas Avīze*, one finds Zander on a list of the 100 most famous persons having lived in Latvia.

Each historical period has its own characteristics, its culture marked by people and institutions. Zander's achievements, his role in the early development of the space sciences, have come to public awareness only at the very end of his short life, public honors having to wait until after Stalin's death in 1953. In the late 1950s and early 1960s, space came into the focus of public attention not least due to the launch of *Sputnik* and other space exploits. Soviet scientists who were involved in these endeavors were not left aside. Zander, who since 1915 had worked in Russia and later the Soviet Union, was honored by scientific establishments, both at home and in other countries. He received notice in various scientific publications, amongst others by the Academician Professor *Jānis Stradiņš* from the Latvian Academy of Sciences, who was personally acquainted with Zander's sister Margarete Zander-Jürgenssen (1898–1974) [2]. Zander's life and work has been noted in Russian, Latvian and other studies, amongst others by Dimitry Silmanovitsch [3], Jaroslaw Golowanow [4], Helij Salahudtinov [5] and Leonid Kornejev [6].

The study of Friedrich Zander's early life and work includes an analysis of his development qua young inventor and scientist in relation to his later work directed towards the conquest of space. Central to this approach was a thorough search in archives, looking for material illustrating his social environment and scientific studies, as well as his participation in the scientific and technological debate of his days. In the end, we are presented with a rocket engine, a man-made object which

[1] Friedrich Zander is often spelled Fridrikh Tsander. In Latvian: *Frīdrihs Canders*; in Russian: *Фридрих Цандер*. In this text, the spelling *Friedrich Zander* will be used.

allowed moving outside the Earth's gravitational force. The engine developed by Zander and his team in Moscow, successfully tested shortly after his untimely death, prepared the way for the *Sputniks* of the 1960s and for other achievements of Soviet and later Russian rocketry. Issues about moving into space raised by Zander were far ahead of his time. For example, his ideas and experiments of growing vegetables in conditions encountered in space are again today part of a programme carried out by the *International Space Station* (ISS) and its Mars-project.

The conquest of space has been closely related to aeronautics. This relationship is specially highlighted in the present study by an account of aviation-related activities in Riga before the outbreak of World War I, when airplanes were brought to the city, first flights carried out before spell-bound specators, and airplanes and aero-engines built in local workshops and factories. Trial and error – characteristic to the beginning of all development – were present at all times. Zander was in the middle of these changes, studying at the RPI, following flight demonstrations, studying aero-engines and step-wise formulating his own ideas about taking-off the ground. Alas, his aspirations went far beyond flight heavier-than-air.

Closer to our own days, the American *Space-Shuttle* was catapulted into orbit by rockets, returning to the Earth as a glider. Latest developments in space include journeys beyond the athmosphere planned by *Virgin Galatic*, whereby an ordinary airplane carries a rocket-plane to high altitude from where the latter moves onward powered by its own rocket-engine, eventually returning as a glider. Scientists and engineers have never stopped dreaming about space. One of them was Zander, whose legacy will not be forgotten.

The idea to present an updated summary of Zander's early life and aviation in Riga in English appeared in 2014 on the occasion of the 100th anniversary of his graduation from the RPI. This initiative resulted in the present study. In addition to standard reference works, it is largely based on material found in the Latvian State Historical Archives, the History Museum of Riga Technical University, the Friedrich Zander Museum of Space Exploration of the University of Latvia and in other libraries.

This tome attempts to shed new light on the historic figure of Friedrich Zander, his early family life and studies at the RPI, as well as to portray some of Zander's influential contemporaries engaged in aeronautics and spaceflight. The early years of the 20th century experienced the breakthrough of flight heavier-than-air on a wide front, airplanes attracting the close attention not only of scientists and technicians but also of the wider public. Russia's former Baltic provinces, including Latvia, were not immune to this development. One finds many publications about Zander, amongst them a study by the Latvian

Academician *Jānis Stradiņš*. To add to this debate, the present study tries to underline the role played by early flight in Zander's awakening interest in space. Some of the documents, for example ones about the members of an aviation circle founded by Zander and Gumal Knopp, or about the discussions concerning aircraft amongst members of RPI's faculty, are presented here for the first time. Close attention was paid to the accounts of events published in local newspapers, an invaluable source of information for the period in question.

Traditionally, accounts about Zander have focused on his contributions to Soviet rocketry and to spaceflight in general. This study tries to point to a tentative relationship between rocketry and flight, shown by Zander's understanding at an early stage that the Earth's gravity disallowed spaceflight by airplane. The solution, which in time emerged from this understanding, was to overcome gravity by means of a rocket, the astronauts returning to Earth by an airplane-like glider. In this novel set-up, the airplane turned into a vehicle for space exploration.

Zander's early years in Riga were set in an environment fascinated with the airplane and its conquests. Zander & Knopp's aviation circle stood thereby at the very beginning of a development with Riga more or less overnight turning into a regional aviation center. While stunt-pilots catered to the general air-mindedness of Riga's citizen, local workshops and large factories took-up the production of airplanes and aero-engines, at first based on foreign models and in time using indigenous designs. Aero-engines manufactured by Kalep's factory *Motor* were thereby the first Russian-designed and produced engines. This promising development was abruptly halted by the outbreak of war and the relocation of Riga's industrial base to the inner parts of Russia. After the war had ended, many of the factories, their engineers and work forces, and also the RPI and other institutes of higher learning, never returned to what by then had become independent Latvia. This development, shortly outlined in the present study, in addition to having constituted an important element of Zander's social environment, is worthwhile studying by itself.

Friedrich Zander, an outstanding *Polytechniker* (Poly-Technician) and RPI-alumnus, is also remembered as a citizen of Riga. Zander was born in 1887, a few weeks before the 25th anniversary of the Riga Polytechnic, his alma mater. In 2017, we celebrated the 130th anniversary of his birthdate. When Zander entered the RPI in the early days of the 20th century, he enrolled in the Department of Mechanical Engineering. In 2015, this department was renamed and is presently called the Faculty of Mechanical Engineering, Transport and Aeronautics.

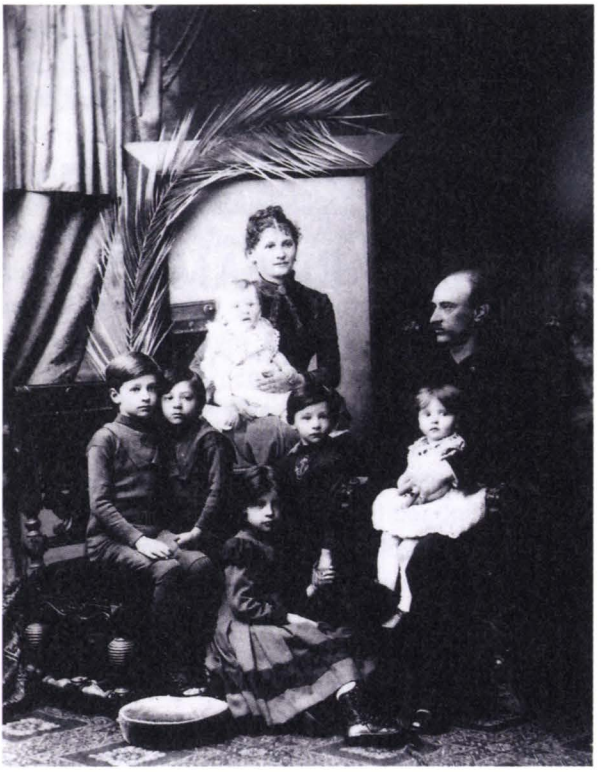
1

THE ZANDER FAMILY

Friedrich Zander comes from a Baltic-German family with roots in Courland. His grand-grandparents Gottfried David Zander and Caroline Charlotte Reinecke lived in *Kandau* (presently Kandava). At the beginning of the 19th century, Gottfried David was a *Handlungsmakler* (commercial agent) in Riga where his children were born; one of them was Constantin Johann Friedrich (1827–1897), a commercial agent like his father. Constantin Johann Friedrich started as an apprentice in Riga and later worked abroad – in Antwerp, Bremen and Hamburg. Between 1868 and 1887, he was a part-owner of the firm *Mitchell & Co* in Riga, from 1875 to 1891 also taking the post of Deputy Director of the Riga-Tukum railroad. In 1868, Constantin was appointed Director of the *Rigaer Börsenbank* (Stock Exchange Bank); ten years later, in 1878, he was elected Alderman of Riga's Great Guild. In 1870, Constantin became Vice-President and one year later President of the Council of the Stock Exchange Bank, an influential post which he kept until 1888. Constantin was a man of manifold interests. In 1878, he joined the Riga City Council. In 1887, he was elected President of the Theatre Committee of the Great Guild, and in 1890 he took over the post of administrator, inspector and patron of the church of St. Martin. In 1890, he became the inspector of the St. John's church [7]. Besides, he was a committee member of the Professional School for Girls as well as the Association of Young Ladies in Riga [8].

Constantin was greatly interested in education and its effect on children including his own. He married Paulina Eleonora Jatzlau (1818–1901) from Kamenz in Saxony; the wedding ceremony was held in St. Petersburg. On 21 November 1854, the couple's first son Arthur Georg (known as Arthur), the father of Friedrich Zander, was born. Constantin's

1 Friedrich Zander's grandfather Constantin Johann Zander (1827–1897).



2 The family of Arthur Zander.

brother Robert Zander (1824–1856) worked in Russia and died shortly after Arthur was born.

Arthur Zander's education started at a private institute established by August Wilhelm Buchholz (1803–1875), later moving to the Gubernatorial Gymnasium in Riga [9]. In 1874, Arthur enrolled in the Faculty of Medicine of the University of Dorpat (presently Tartu), graduating in 1881 [10]. After graduation, he moved to Vienna to widen his professional experience. On his return to Riga he opened a medical practice in *Sassenhof* (presently Zasulauks) where his father owned a property. Arthur's first wife Helene Gottschalk (1853–1889), born in Dresden, grew up in a family of musicians. She died at the early age of 36, leaving behind five young children, among them Friedrich Zander. Arthur's second wife Bertha Conradi (1870–?), charged with taking care of these children, was the daughter of a pastor and educated as a teacher. The couple married in late 1897. On 12 September 1898, Bertha gave birth to Margarete, Friedrich Zander's half-sister.

All of Arthur's children received a thorough education, later in life moving into widely different professions. The oldest son Kurt (1882–1946) and the daughter Margarete Zander-Jürgensen (1898–1974) became painters while Friedrich, the youngest son, turned to mechanical engineering. The talented Robert (1885–1905) did not realize any of his dreams – he died in a train accident at an early age.

The Zander family was well known in Riga, actively partaking in the social life of the city's well-educated and well-off society. Arthur was a member of the *Musse* association, an exclusive German club, which organized dances, masquerade balls and concerts [11]. *Musse* also had its own library and reading room. In 1890, Arthur joined the *Rigasche Gartenbau-Verein* (Riga Gardening Association) founded in 1876, an association with well-known personalities among its members such as, for example, the Riga-born Africa explorer Georg Schweinfurt (1836–1925) [12].

When talking about Dr. Zander and the Gardening Association one can still muse about the outskirts of Riga in those days, with private gardens full of vegetables, chicken, ducks and geese running around. This pastoral idyll Friedrich's half-sister Margarete describes in her memoirs of 1966. Next to the house of the Zander family at *Bartschen Strasse 1* (presently *Frīdriha Candera iela 1*), she wrote, there was a mountainous lot with a garden pavilion overgrown with grapevine on top. Around it was a children's playground, fruit trees, patches with vegetables, stables and enclosures for chicken [13]. In his spare time,

3 Friedrich Zander and his sisters Hertha and Helena (1910s).

4 Former residence of the Zander family at *Bartschen Strasse 1* (presently *Frīdriha Candera iela 1*) in Riga-Zasulauks.

Dr. Zander often used to visit his garden, a peaceful activity useful also for the household kitchen, partly explaining his membership in the Gardening Association. Arthur had a large family to support, with privately grown vegetables constituting a welcome contribution to the household – there was no need to go to the market to buy potatoes or dill. For today's younger generation, living in the outskirts of Riga seems outmoded – in Zander's days, when people reached their destinations by horse-drawn coaches instead of noisy and environmentally unfriendly motor vehicles, it was perfectly normal, even fashionable.

Dr. Zander enjoyed a busy life, never staying idle. In 1899, he joined the *Gesellschaft für Geschichte und Altertumskunde der Ostseeprovinzen Russlands* (Association for the History and Antiquity Studies of the Baltic Sea Provinces of Russia) founded in 1834, an association, which published historical studies and kept a collection of objects in its museum [14]. Several members were alumni of Dorpat University, among them Arthur Zander. Membership was not constricted to persons with academic backgrounds, but attracted enthusiasts from all strata of society like pharmacists or entrepreneurs interested in the history of their homeland. On the occasion of celebrating the association's 50th anniversary, Dr. Zander's father Constantin, who had taken an active part in its activities and social life, was among the congratulants, a tradition both his children and grandchildren, including the grandson Friedrich, would uphold [15].

Dr. Zander cared not only for his patients, he also engaged in research and published articles about hygienic issues, for example about healthy footwear in the *Berliner Schuhmacherzeitung*. In the Association of

Practical Physicians in Riga, where he was a member, Arthur held lectures about shoes and their impact on orthopedic and other medical problems [16]. At home at *Bartschen Strasse* he kept artwork and a collection of butterflies. In his free time, he often dealt with different problems in the natural sciences, in this respect also acting as the de facto Head of the Department of Natural Sciences of the *Riga Dom-Museum* (Museum of Riga Cathedral) [17].

Another member of this museum was Emil (Alexander) Zander (1857–1912), Dr. Zander's half-brother. Emil, a graduate of the Riga Polytechnic's Department of Commerce (class of 1876), at first worked at *Mitchell & Co* in Riga, a firm part-owned by his father, before in 1898 becoming Director of the *Aktien-Gesellschaft der Hefefabrik, Branntweinbrennerei, Sprit-Rektifikation und Destillatur A. Wolfschmidt,* a distillery [18]. Over the years, this firm gained widespread recognition by winning several gold medals and other prizes at international expositions. Emil, who was a member of the *Fraternitas Baltica* (founded in 1865), died unexpectedly in August 1912 while visiting Frankfurt am Main in Germany. Emil was the son of Constantin Zander's second wife Paulina Eleonore.

Constantin Zander had expressed the wish that after his death, and the death of his wife Paulina Eleonore, a trust fund should be set-up based on a capital stock of 50 000 Russian Rubles (RR) taken from his heritage. Thus, on 3 July 1901, Arthur and his half-brother Emil approached the *Riga Waisengericht* (Orphan Court), which in the Livonian governorate (province) was responsible for handling such matters, for the fund to be established. The idea behind the affair was to let Arthur and Emil, and their widows and children including Emil's stepdaughter Bertha, enjoy the proceeds of interests [19].

Dr. Zander, who had six children, inherited the residence at *Bartschen Strasse* in Sassenhof, where the family stayed until 1913 before moving to *Ernestine Strasse No 1a* (presently *Ernestīnes iela*). Arthur quickly enlarged the building by adding another floor. The trust fund, in turn, was to be administered by a council of three with one member coming from the Zander family; the latter was barred from receiving any of the proceeds. Emil Zander was chosen for this position as he had no children of his own; instead, his share was to go to his stepdaughter. Emil died in 1912. By that time, the fund had grown to RR 52 725.11 [20]. When Dr. Zander died in 1917, his widow received a small allotment. Because of the war, part of the fund's capital had been confiscated by the government, and the rest invested in war bonds. After the war had ended, the Zander family, luckily enough received its money back, the fund not having been forced into liquidation. The years following World War I, however, experienced the effects of the 1917 Russian Revolution,

including a rapid devaluation of the currency, and in 1920 the emergence of a new state, the Republic of Latvia. As a result, by the end of 1924 the fund's capital amounted to a mere Lats[1] 1 017.96 – the sum that remained after those unruly years. In 1938, Arthur's widow Bertha and Emil's stepdaughter each received Lats 40.60 (presently about € 60).

On 19 October 1938, the official Latvian bulletin *Valdības Vēstnesis* announced that the Zander Fund had been liquidated [21]. De facto liquidation finally took place in 1939 when the remaining capital was distributed. Thereby, Arthur's widow Bertha received Lats 138.23 and three bonds (each with a nominal value of Lats 100), while Margarete Zander-Jürgensen received the share reserved for her brother Kurt who had renounced his part in her favor; Margarete received Lats 138.22 and three bonds. Finally, Emil's stepdaughter Bertha Tilling received Lats 38.22 and four bonds [22].

In 1939, following the Hitler-Stalin pact which divided Eastern Europe into spheres of influence, those members of the Zander family who had remained in Riga were «repatriated» to Germany, never to return to Latvia. Today, the descendants of the family are spread across different countries including Germany, Russia and France.

The turns and twists of history which uprooted Eastern Europe during the first half of the 20th century, the tragic events and hardships which effected entire populations during the course of two world wars, had profound effects on individuals and families living through those events. In those difficult times, members of the Zander family have made significant contributions not only to Riga and Latvia but also to mankind's age-old striving for travel into space: Friedrich Zander, a prominent member of this family, will be remembered for his pioneering work in the space sciences.

[1] Lats=Latvia's national currency.

2

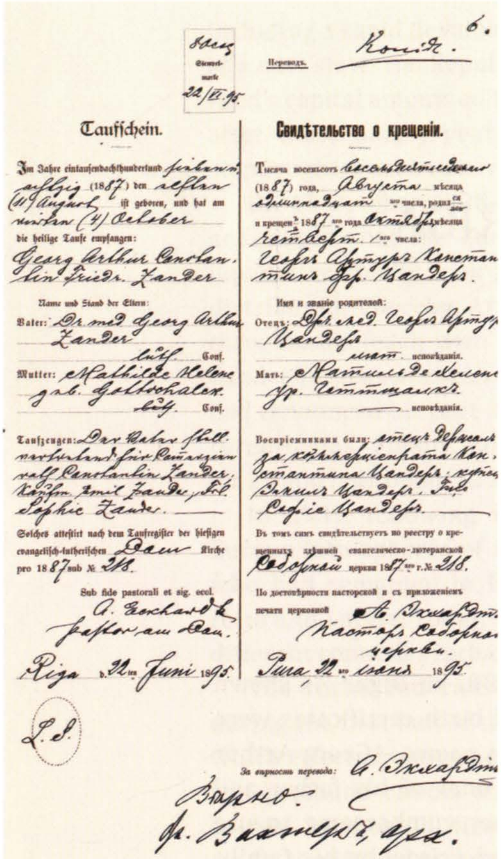
FRIEDRICH ZANDER IN RIGA (1887–1915)

2.1 Childhood and School Years

Friedrich Zander was born on 23 August 1887 in Riga.[1] As shown by his baptism document (at that time no civil birth certificates were issued in Russia) he was given several Christian names – Georg Arthur Constantin Friedrich, names in line with the ones of his father and grandfather [23]. As it would have been rather cumbersome to use all names in everyday life, he was simply called *Friedel* by his family, shorthand for Friedrich; in official documents he was registered as Friedrich. On 16 (4) October 1887, Friedrich was baptized in Riga Cathedral with three godparents attending the ceremony. In former times, three to five godparents were the norm: boys usually had two men and one woman in attendance, and girls two women and one man. Godparents fulfilled important social roles. Should both parents die by whatever misfortune, godparents were to take over the responsibility for the child. One of Friedrich's godparents was Emil Zander, his father's half-brother and an alumnus of the Riga Polytechnic; his second godfather was his grandfather Constantin, with Sofie, Emil's wife, standing in as godmother.

Friedrich spent his childhood in Sassenhof, a suburb of Riga located on the left bank of the river *Düna* (currently Daugava). Friedrich, playing with his brothers, sisters and other children his age, took an early interest in the futuristic novels by Jules Verne (1828–1905) and

[1] The date corresponds to the date in Gregorian calendar, which according to the Julian calendar (the official calendar at that time in Russia) corresponds to 11 August.



6\.

Stempel-marke 22/VI. 95.

Переводъ. Копія.

Taufschein.

Im Jahre eintausendachthundert und siebenundachtzig (1887) den elften (11) August ist geboren, und hat am vierten (4) October die heilige Taufe empfangen:
Georg Arthur Constantin Friedr. Zander

Name und Stand der Eltern:
Vater: Dr. med. Georg Arthur Zander luth. Conf.
Mutter: Mathilde Helene geb. [illegible] luth. Conf.

Taufzeugen: [illegible]

Solches attestirt nach dem Taufregister der hiesigen evangelisch-lutherischen Dom Kirche pro 1887 sub № 218.

Sub fide pastorali et sig. eccl.
A. Eckhardt pastor am Dom.

Riga d. 22. Juni 1895.

L. S.

Свидѣтельство о крещеніи.

Тысяча восемьсот восемьдесят седьмого (1887) года, Августа мѣсяца одиннадцатаго числа, родился и крещенъ 1887 года Октября мѣсяца четвертого числа:
Георгъ Артуръ Константинъ Фр. Цандеръ.

Имя и званіе родителей:
Отецъ: Д-ръ мед. Георгъ Артуръ Цандеръ лют. вероисповѣданія.
Мать: Матильда Елена [illegible] вероисповѣданія.

Воспріемниками были: [illegible]

Въ томъ симъ свидѣтельствуетъ по реестру о крещенныхъ Рижской евангелическо-лютеранской Соборной церкви 1887 г. № 218.

По достовѣрности пасторской и съ приложеніемъ печати церковной
Пасторъ Соборной церкви.

Рига 22 іюня 1895.

За вѣрность перевода: А. Экхардтъ

Вѣрно: [illegible]

5 Georg Arthur Constantin Friedrich Zander's birth certificate, date of birth 11 August 1887, Riga.

6 Building of the former *Riga Stadt-Realschule* (Riga City High School), where Zander graduated in 1905.

the works of the French astronomer Camille Flammarion (1842–1925) [24]. His interest in natural phenomena and technological issues was stimulated by both his father and teachers. Friedrich's father Arthur closely followed all advances made in astronomy and aeronautics, by the turn of the century also fixed-wing airplanes. Zander's library kept a number of Jules Verne's novels together with tomes about the universe, astronomy and different types of machinery. In addition, there were books and brochures regarding all kinds of flying apparatuses. The latest news about balloons, airships and airplanes published by local newspapers, mostly German, were discussed within the Zander family just like in Riga's society at large.

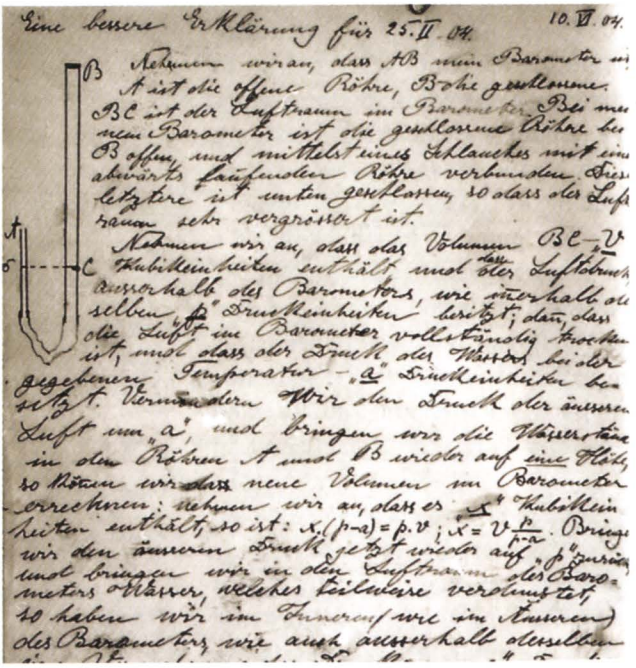
Friedrich took a new step in life when he left H. Langermann's private school and enrolled at the *Riga Stadt-Realschule* (Riga City High

School) situated at *Nikolai Strasse 1* (presently *Krišjāna Valdemāra iela*) [25]. Friedrich, like most other children, was not captivated by all subjects on the curriculum, instead showing a special liking for history and cosmology. These subjects were taught by Friedrich Westberg (1864–1920), who introduced Friedrich to the ideas and research of the Russian scientist Konstantin Tsiolkovsky (1857–1935). Westberg had built a simple planetarium where his pupils with the help of a telescope could observe the stars and other heavenly phenomena [26]. In his younger days, Westberg had extensively traveled in the Caucasus, Crimea, Turkey, Egypt, Palestine and Syria, sharing these experiences with his pupils. Westberg's older brother Paul (1862–1935), who also taught at the Riga City High School, had between 1888 and 1895 worked as private Assistant Professor at the Riga Polytechnic, lecturing in botany and zoology.

Studies at the high school lasted for six years, with classes being held in Russian. Aspiring pupils could continue their studies for another year without having to pay a fee, thus gaining admittance to institutions of higher learning like the RPI or the St. Petersburg Academy of Forestry. When studying for an extra seventh year, the pupils had the possibility to teach private lessons or help other students with their homework, earning some pocket-money in return.

From an early stage, Friedrich displayed a good understanding of mathematics. During afternoons, school having finished, he many times helped his brothers and sisters with their homework. The remuneration he received for this support he would use to buy materials needed for his experiments. In his spare time, in addition to taking care of his dog, he sometimes went shooting. During long and bright nights, joined by his younger sister Margarete, he was captivated observing the heavens [27].

Friedrich was fond of reading, literature which included Tsiolkovsky's well-known work *Exploration of Outer Space by Means of Reaction Devices (Исследование мировых пространств реактивными приборами)* [28]. His early interest in natural phenomena was actively encouraged by his parents. According to a note in his diary of 30 December 1904, his Christmas presents that year, in addition to a Dickens-anthology in German, included the following textbooks: Graetz, L., *Elektrizität und ihre Anwendungen* (1904); Bärstein, R., *Leitfaden der Wetterkunde* (1904); and Ostwald, W., *Die Schule der Chemie, Teil II* (1904) [29]. That same year, based on Plassmann's book *Himmelskunde,* which he had received on the occasion of his Christian confirmation, he calculated the time a star stayed above the horizon seen from the position of his home in Sassenhof, using trigonometric functions in combination with geographic coordinates [30].

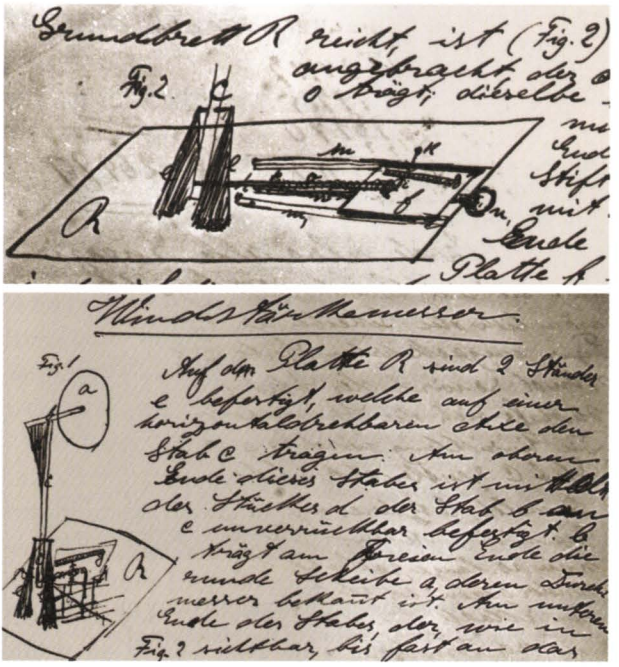


7 Excerpt from an entry in Zander's diary on 10 July 1904: Explanation on how a barometer works.

Later in life, during the 1920s and early 1930s, something happened he could have hardly imagined in his childhood – he became personally acquainted with Tsiolkovsky, who by that time was an internationally well-known scientist; together they would organize a scientific association focusing on spaceflight. On Tsiolkovsky's 75th birthday in 1932, Zander, together with warm greetings, presented him with a copy of his newly published book *Problems of Flight with the Aid of Jet Propulsion Machines*, acknowledging Tsiolkovsky's inspiring role in his own intellectual development. At Tsiolkovsky's request Zander edited Tsiolkovsky's collected works, which were published after Zander's death in 1934.

Thus, despite the heavy burden imposed by school work, which disallowed much spare time, Zander was reading highly specialized literature and applying mathematical models in his own experiments, activities which point to his early interest in natural phenomena, an interest which in time increasingly focused on space.

Friedrich Zander was not a revolutionary, his interest was science not politics. In August 1905, he was arrested for distributing political leaflets, an incident which had no influence on his future career: as it turned out, the evidence raised against him by the authorities was insufficient for indictment [31]. The year 1905 was marked by

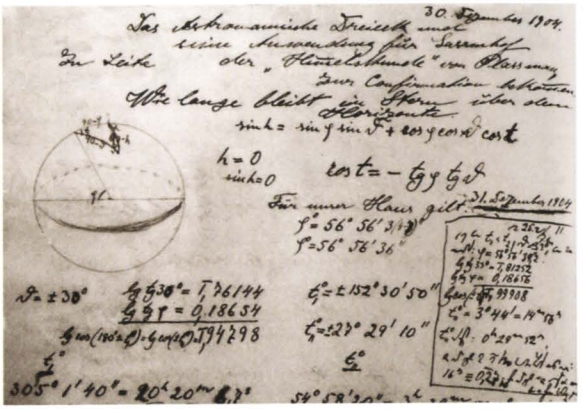


8 Excerpt from an entry in Zander's diary in 1904: Device for wind-speed measurement.

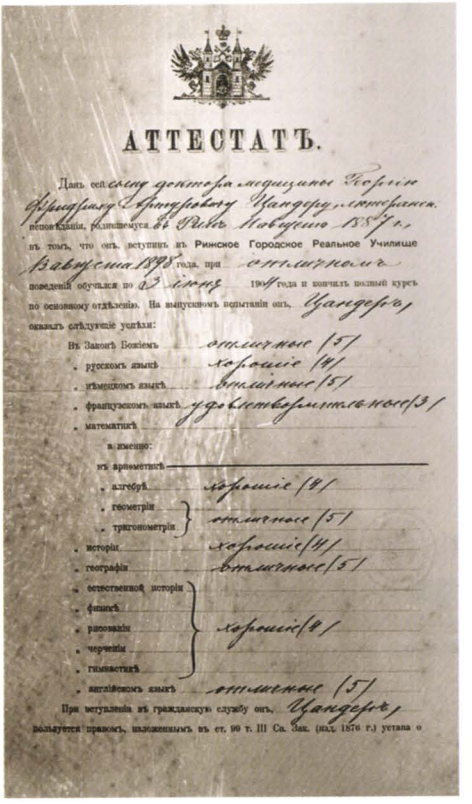
widespread revolutionary upheavals throughout the Russian Empire including the Baltic provinces, forcing the shut-down of the RPI. Possibly, Zander had been motivated by the revolutionary Jacob Dubelstein (1883–1907), whose mother worked at Dr. Zander's medical practice as a registrar. Jacob Dubelstein, as it was known, organized shooting exercises with Dr. Zander's sons including Friedrich [32].

In 1905, after having finished high school with excellent grades, Friedrich had to decide what steps to take next. As it turned out, he stayed in Riga. Given his interest in natural science and technology, his enrollment in RPI's Department of Mechanical Engineering came as no surprise.

Years later, in 1935, by one of those strange coincidences (by that time Zander's scientific contributions to Soviet rocketry were widely acclaimed), an aviation group called *Aviācijas pionieru pulciņš* (Pioneers of Aviation) was formed at his old school in Riga, now called the *2. Rigasches Stadtgymnasium* (Riga City High School No. 2) [33]. *Vilis Ozoliņš*, a physics teacher, was heading this group together with *Eduards Mazurs*, a graduate of the Faculty of Chemistry of the University of Latvia (class of 1930) teaching physics and chemistry. In addition to studying aeronautical literature, members of the group also built small-scale airplane models and kites. Had the members of this circle been aware of their famous predecessor, and his studies at their school?



9 Excerpt from an entry in Zander's diary on 30 December 1904: Duration of the visibility of a star over the horizon.



АТТЕСТАТЪ.

Дань сей сыну доктора медицины Георгія Фридриха Густавовича Цандера, лютеранскаго вероисповѣданія, родившемуся въ Ригѣ Лифляндской губ. въ 1887 г., въ томъ, что онъ, вступивъ въ Рижское Городское Реальное Училище Августейшаго имени въ 1895 года, при отличномъ поведеніи обучался по 3 іюнь 1905 года и кончилъ полный курсъ по основному отдѣленію. На выпускномъ испытаніи онъ, Цандеръ, оказалъ слѣдующіе успѣхи:

Изъ Закона Божія отличные [5]
" русскаго языка хорошіе [4]
" нѣмецкаго языка отличные [5]
" французскаго языка удовлетворительные [3]
" математики
въ томъ:
изъ ариѳметики
" алгебры хорошіе [4]
" геометріи } отличные [5]
" тригонометріи }
" исторіи хорошіе [4]
" географіи отличные [5]
" естественной исторіи }
" физики }
" рисованія } хорошіе [4]
" черченія }
" гимнастики }
" англійскомъ языкѣ отличные [5]

При вступленіи въ гражданскую службу онъ, Цандеръ, пользуется правомъ, изложеннымъ въ ст. 99 т. III Св. Зак. (изд. 1876 г.) устава о

10 Diploma from Riga City High School, received by Friedrich Zander in 1905.

11 Zander studying at his desk at *Bartschenstrasse 1*, Riga, early 1900s.

2.2 Studies at the Riga Polytechnic Institute

In 1905, after graduation from high school, Zander enrolled at the Riga Polytechnic Institute (RPI). That year, though, caused by severe political upheavals in the country, the institute was closed for most of the academic year. Zander in turn moved to Danzig-Langfuhr in East Prussia, where he continued his studies at the newly opened *Königliche Technische Hochschule* (Royal Technological Institute).[1] In 1907, he returned to Riga, where on 31 July 1914 he graduated from the RPI with a Diploma in Mechanical Engineering (Инженер-технолог) [34].

Not much is known about Zander's visit to East Prussia, his autobiography being all but silent on this subject [35]. The institute at Danzig-Langfuhr (established in 1904), similar to the one in Riga, offered four-year programs in six faculties: architecture, civil engineering, machine building and electronics, shipbuilding and marine engines, chemistry, and general sciences. In addition, there were special departments for commerce and agriculture [36]. Given Zander's interests one could imagine that he followed courses in civil engineering and machine & ship-building. By so doing he should have come into contact with Professor Johann Schütte (1873–1940), who lectured in ship-building and was one of over 60 professors and associate professors at the institute [37]. Along with attempts to establish a hydro-dynamics laboratory at the institute, efforts that failed due to high costs, Schütte at that time started to take his first steps in airship construction.[2] Another one of Zander's teachers interested in aeronautics was the mathematician Professor Julius Sommer (1871–1943), who in 1924 became Rector of the institute.

Another student of RPI's Department of Mechanical Engineering who in 1905 moved to Danzig-Langfuhr was Villehad Forssman (1884–1944), who later was to become one of the most prolific aeronautical engineers of early aviation (see further) [38]. If and to what extent Zander's and Forssman's aeronautical interest had been influenced by Schütte, Sommer and others during their stay in Danzig is difficult to establish. Nevertheless, hydro-dynamics as taught by Schütte was basic in the design of not only water-bound vessels but also aerial machines, be it airships, airplanes or rockets. As it turned out later, Zander's diploma paper from 1914 concerned the construction of the hulls of ships. It is

[1] Students from the RPI moving abroad in 1905 enrolled at various technical institutes, foremost in Germany: Danzig, Berlin, Halle, Leipzig, Karlsruhe, Dresden and Darmstadt.

[2] In April 1909, Schütte and the industrialist Karl Lanz founded the *Luftschiffbau Schütte-Lanz* which in time produced rigid-type airships made of wood, 20 of which saw military action during World War I.

Königliche Technische Hochschule zu Danzig.

Bescheinigung.

Herr Friedrich Zander

geboren den 11. August 1887 zu Riga in Russland

ist am 16. Dezember 1905 als ---

Hörer an der Königlichen Technischen Hochschule zu Danzig

zugelassen worden und hat nach Ausweis der vorgelegten Anmeldebögen die umstehend verzeichneten Vorträge und Übungen besucht.

Über die Führung des Herrn Hörers ist nichts Nachteiliges zur Anzeige gekommen.

Danzig-Langfuhr, den 29. Juni 1907.

Der Rektor

12 Certificate issued by the *Königliche Technische Hochschule* (Royal Technological Institute) in Danzig showing that Zander attended classes from December 1905 to summer 1907.

not known exactly how many RPI-students went to Danzig-Langfuhr in 1905, the institute's register from 1912 listing some 20; however, data about many students in the register is incomplete. Details about Zander's eventual relationships with Forssman are unknown. Still, both having enrolled in the same department at the RPI, and having moved to Danzig, should for all practical reasons mean that they met on a more or less regular basis. Of special interest regarding Danzig is also Gumal Knopp, who in 1909 together with Zander founded an aviation circle at the RPI, one of the first in Russia (see further).

The *Polytechnische Schule zu Riga / Polytechnikum zu Riga* (Polytechnic School in Riga / Riga Polytechnic), founded by German businessmen and burghers of Russia's Baltic provinces, started out on 2 (14) October 1862 with 15 pupils due to a lack of eligible applicants. Courses for prospective students were for many years thereafter taught at a preparatory school (1862–1892). After having completed preparatory classes, studies at the Polytechnic School commenced in 1863. From the start and until the mid-1890s, academic life at the *Polytechnikum* was based on its own constitution and administration, finances being

secured by contributions from the *Baltischen Stände* and *Ritterschaften* (Baltic Corporations), cities and municipalities, business associations, private individuals, and, not least – tuition fees. The tsarist government confirmed the institute's statutes in 1861, while starting to financially contribute to its upkeep only in 1874.

The basic understanding of the institute's founders was the ideal of academic freedom, study programs being decided by members of faculty, and students being allowed to follow classes on their own accord. This *Freiheit des Lehrens und Lernens* (Freedom of Teaching and Learning), a doctrine closely aligned with the ideals of higher learning followed by universities in Western Europe, stood in stark contrast with academic principles enforced at other Russian institutes. This ideal was closely reflected and personified in the composition of the faculty, the majority of professors until the late 1890s being recruited from abroad, mostly Germany. Distinct from other Russian institutes this meant that lectures, practical exercises, laboratory sessions, course literature, written examinations and diploma papers were all in German. This changed only in the 1890s together with the Russification movement initiated by central authorities when Russian became mandatory for teaching in class, thus forcing many professors and other staff-members to attend crash courses in order to be able to continue their work.

The institute in Riga, despite its diplomas not being officially recognized until 1896, enjoyed great popularity. The student population, recruited not only from the Baltic provinces but also other Russian regions, increased significantly over the second half of the 19th century: 16 students during the academic year 1863/64; 142 in 1873/74; 655 in 1883/84; 900 in 1893/94; and 2 088 in 1913/14. The 10 000th student enrolled in 1912 [39]. The majority of students, considering their confessional backgrounds and first/last names as shown by the student register, were ethnic Germans from the Baltics. In 1913/14, to take one year as an example, the confessional distribution of students was as follows: 1 255 Lutheran; 419 Greek-Orthodox; 228 Roman-Catholic; 136 Jewish; 50 others. That same academic year the number of students enrolled in RPI's different departments was as follows: 520 Mechanical Engineering; 378 Agricultural Department; 367 Commercial Department; 328 Chemical Engineering; 300 Civil Engineering; and 195 Architecture [40].

In 1896, the tsarist authorities ordered a reorganization of the institute. Thereafter it had to be called *Рижский Политехнический Институт / Rigasches Polytechnisches Institut* (Riga Polytechnic Institute/RPI). Newly enforced statutes stated that the institute sorted under the general supervision of the Ministry of the Enlightenment in St. Petersburg and the direct control of the official curator of the Riga

13 Main building of the Riga Polytechnic Institute, where Zander enrolled in 1905.

14 Portrait of Zander sporting a mustache during his student days at the RPI (early 1910s).

school distric [41]. The Council (*Совет*) of the institute, as before, mainly consisted of representatives from Baltic corporations contributing to the school's finances. It was allowed to elect the Institute's director from among members of the different faculties, while professors and lecturers, chosen by the committee of faculty, had to be approved by the authorities in St. Petersburg. Thus, despite being under general state supervision, the reorganized institute, unlike other higher technical institutes in the country, retained most of its identity and freedom of action. The reorganization in 1896 also meant that diplomas awarded by the institute had official status. One direct effect of all these changes was a sharp increase in student enrollment, a development which soon caused financial problems.

In 1899, the institute experienced its first student unrests, forcing the director to temporarily suspend classes. However, this was only a forewarning of more stormy times ahead. The political upheavals of 1905–1906 that engulfed tsarist society, and between 1905 and 1908 lead to the introduction of martial law in the Baltic provinces, included the outbreak of severe student riots at the institute, forcing the shutdown of all activities during most of the academic year 1905/1906 [42].

According to Article 17 of the revised statutes from 1896, students of RPI's Department of Architecture who had successfully passed their final exams received the Diploma of *Ingenieur-Architekt / инженер-архитектор* (Engineer-Architect), others the Diploma of *Architekt/архитектор* (Architect); students of the Department of Civil

Engineering received the Diploma of *Bau-Ingenieur / инженер-строитель* (Construction-Engineer) or *Baumeister/строитель* (Builder); students of the Departments of Mechanical and Chemical Engineering received the Diploma of *Ingenieur-Technologe / инженер-технолог* (Engineer-Technologist) or *Technologe/технолог* (Technologist); students of the Department of Agriculture received the Diploma of *Agronome erster Klasse / агроном I класса* (Agronomist of first category) and *Agronome zweiter Klasse / агроном II класса* (second category); and students of the Department of Commerce received the Diploma of *Kandidat der Handelswissenschaften erster Klasse / кандидат комерции I разряда* (Candidate of Commercial Sciences of first category) and *Kandidat der Handelswisenschaften zweiter Klasse / кандидат комерции II разряда* (second category) [43].

In order to receive their diplomas, students in mechanical engineering, Zander's subject, had to spend the best of four years passing numerous courses that were strictly organized on both an annual and weekly basis. The department's curriculum in 1909/1910, which with minor changes was valid throughout Zander's time at the institute, included the following courses [44]:

Year 1

a. Theology, obligatory only for students of Orthodox faith;
b. Higher mathematics I, Prof. Bohl;
c. Descriptive geometry, Assoc. Prof. Westermann;
d. Technical mechanics I, Prof. Hennig;
e. Physics, Assoc. Prof. Pflaum;
f. Chemistry, Prof. Trey;
g. Technical drawing, Assoc. Prof. Taube;
h. Geodesy, Assoc. Prof. Ehrenfeucht.

Year 2

a. Higher mathematics II, Prof. Bohl;
b. Technical mechanics II, Prof. Hennig;
c. Physics II, Assoc. Prof. Pflaum;
d. Practical exercises in physics, Assoc. Prof. Pflaum;
e. Civil construction, Prof. Kirstein;
f. Architectural forms, Assoc. Prof. Seuberlich;
g. Mechanical heat theory, Prof. Berlow;
h. Machine elements, Prof. Berlow;
i. Kinematics, Assoc. Prof. Feldweg;
j. Technology of metals and wood, Prof. Denffer.

Year 3

a. Measurement of machine dimensions, Assoc. Prof. Heintz;
b. Hydraulic systems, Prof. Clark;

c. Furnaces and boilers, Prof. Clark;
d. Steam engines, Prof. Schiemann;
e. Lifting apparatus, Assoc. Prof. Feldweg;
f. Machine design I, Assoc. Prof. Feldweg;
g. Mechanical technology, Prof. Denffer;
h. Electro-technic I and II, Prof. Ozmidoff;
i. Design of civil structures, Prof. Kirstein;
j. Sewerage, Prof. Jensch;
k. Accounting, Prof. Birkhahn.

Year 4

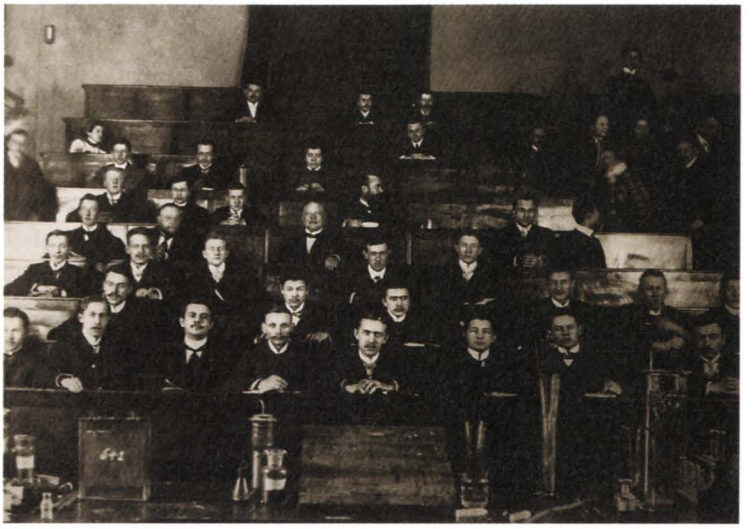
a. Analytical mechanics, Prof. Hennig;
b. Locomotives, Prof. Berlow;
c. Shipbuilding, Prof. Clark;
d. Mechanical-technical agriculture;
e. Machine design II and III, Prof. Clark;
f. Pumps and compressors, Prof. Schiemann;
g. Gas engines, Prof. Schiemann;
h. Fiber technology, Assoc. Prof. Milodrowski;
i. Heating and ventilation, Assoc. Prof. Heintz;
j. Electro-technics III and IV, Prof. Ozmidoff;
k. (Electro-technics V, not obligatory), Prof. Ozmidoff;
l. Hygiene, Prof. Schimansky;
m. Organization of technical enterprises, Prof. Denffer;
n. Construction law, Assoc. Prof. Friesendorff;
o. Political economy, Prof. Bergman.

Year 5

a. Technological studies, Prof. Taube;
b. Design of technical structures, diploma paper.

During their first year, students had to attend lectures lasting 22 hours per week, and to participate in practical or laboratory exercises lasting another 14 hours per week. During the following years, this heavy study load remained more or less unchanged, 18–26 hours per week spent in lectures plus 12–23 hours per week for different physical, chemical or other exercises. During Year 5, students were to concentrate on writing their diploma papers, an activity planned to take 32–36 hours per week [45].

During Zander's time at the institute, studies in mechanical engineering did not include any elements of aeronautical engineering; neither were there any courses in related subjects such as hydrodynamics, astronomy or meteorology. The focus of the program, in addition to offering basic disciplines such as mathematics, physics and chemistry, was on mechanical engineering and its relevance to



15 Zander (first row, 5th from left) attending a chemistry lecture of Professor Trey at the RPI.

different types of machinery, flying machines excluded. With some notable exceptions, RPI's program was similar to the ones taught at other technological institutes in Russia.

In pre-war Russia, first courses in aeronautics started in September 1909 when Nikolay Zhukovsky, who was teaching at the Imperial Moscow Technical School (*IMTU*), held lectures about the theoretical and practical foundations of aeronautics including the results of his own research [46]. Following ongoing developments in Western Europe – foremost in France and Germany – Russia's Prime Minister Stolypin initiated the establishment of aeronautical faculties at technological institutes in St. Petersburg, Kiev and Novocherkassk [47]. In 1910, once again on the initiative of the central government, courses in aeronautics were also introduced at the Polytechnic Institute in St. Petersburg [48]. By that same time, courses in aeronautical engineering were offered at five universities and six higher technical institutes in Germany [49]. The exclusion of the RPI from these advances might have different explanations, like a policy by the government to offer programs in aeronautics only at certain institutes, an increasingly difficult financial situation at the RPI which disallowed setting-up a new department, the academic backgrounds of faculty members at the RPI, or an unwillingness by outside experts to come to the Baltics.

Considering Zander's awakening interest in astronomy, aeronautics and spaceflight, of special interest are those members of faculty at the Department of Mechanical Engineering who were lecturing in subjects relevant for those topics. Thereby, one first notices Professor Piers Bohl

(1865–1921), a graduate of Dorpat University who had started at the RPI in 1895 and who since 1901 had been teaching higher mathematics. Possibly, Bohl also lectured in astronomy [50].

Hermann Pflaum (1862–1912), a Dorpat-graduate and since 1906 Deputy Adjunct Professor at the RPI was responsible for courses in physics, including practical exercises. It is noteworthy that Pflaum had graduated in astronomy, a subject of vital importance for anyone interested in space and related subjects. Chemistry was taught by Heinrich Trey (1851–1916), a Dorpat-graduate (class of 1877) who had continued his studies at Munich University, joining the faculty of the Riga Polytechnic in 1879. Since 1901, Trey held a professorship in chemistry. His son Friedrich Trey (1887–1965) was a physicist who graduated from Dorpat in 1910; between 1912 and 1915, he worked as an assistant at the RPI.

In addition to these basic subjects there were others relevant for space research such as geodesy taught by Viktor Ehrenfeucht (1864–1917), and kinematics taught by Reinhold Feldweg (1874–1931). Ehrenfeucht had graduated in mathematics from the University of Warsaw in 1887, continuing with his studies in Berlin and Freiburg. In 1891, he was appointed Associate Professor in Spherical Astronomy in Warsaw; from 1899 to 1907, he held the position of Associate Professor in Geodesy and Mathematics. In 1907, Ehrenfeucht moved to Riga to take the position of Adjunct Professor in Geodesy [51]. Feldweg had graduated from the RPI in 1899 with a Diploma in Mechanical Engineering. He started to lecture at the institute in 1905, in 1908 being appointed Adjunct Professor in Applied Mechanics including Kinematics.

Three more members of faculty can be briefly mentioned, their subject areas having had some bearing on Zander's further development, namely Richard Hennig (1861–1922) in technical and analytical mechanics, Michail Berlow (1867–1935) in machine elements, and Charles Clark (1867–1942) in hydraulics, machine building and related subjects.

During and after Zander's studies at the institute a number of RPI's faculty members, other members of staff and students were more or less directly involved in aeronautics. Further in the text these are listed in alphabetical order.

Karl Berg (*Kārlis Bergs*) (Riga, 1891–?) studied mechanical engineering at the RPI from 1910 to 1914. He emigrated to the United States of America in 1918/1919, where he designed an early version of an autogiro powered by two 50-hp rotary engines. In 1921, Berg's design was rejected in a military competition for naval aircraft, after which he destroyed both his model and technical drawings, making no further attempts in aeronautical engineering [52].

Ernst Birkhahn (*Ernests Birkhāns*) (Koltzen, Livonian governorate, 1872–Siberia, 1941) graduated from the RPI with a Diploma in Commercial Science in 1896. He continued his studies in Antwerp, Paris, Venice and Vienna, and was appointed Assistant Professor at his institute in 1900. Birkhahn died in 1941 in Siberia.

Martin Biemann (*Mārtiņš Bīmanis*) (1864–1946) graduated from the Riga Polytechnic with a Diploma in Mechanical Engineering in 1891. Between 1893 and 1920, he worked in Moscow as a sewerage specialist, first as an engineer and later as head of department. Biemann, who was acquainted with Nikolay Zhukovsky, is said to have made major contributions to the modernization of Moscow's drainage system. He died in Germany in 1946.

Paul von Denffer (Mitau, 1871–1959) graduated from the Riga Polytechnic with a Diploma in Mechanical Engineering in 1895, and held the position of Professor in Mechanical Technology at his institute since 1906. Later Denffer moved to Germany where he died in 1959.

Ernst Friesendorff (1873–?) received a Diploma from the Institute of Civil Engineering in St. Petersburg. From 1907 to 1910, he held the position of Assistant Professor in Construction Law at the RPI.

Otto Hotte (Pskow, 1892–?), after having finished the *Realschule* (High School) in Dorpat in 1909, enrolled in RPI's Department of Civil Engineering. In 1910, he changed to mechanical engineering and graduated during the war in 1916. During the 1920s and 1930s, while teaching at a vocational school and giving driving lessons, Hotte wrote several books about automobiles. In 1936, he together with *Maksis Čūlītis* (1911–2009) published the book *Lidmašīnu uzbūve* (Airplane Construction) [53].

Karl Heintz (St. Petersburg, 1876–1955) graduated from the RPI with a Diploma in Mechanical Engineering in 1902. He continued as an assistant at the Institute of Applied Mechanics from 1903 to 1904. In 1906, Heintz was appointed Assistant Professor in Ventilation, Heating and Applied Mechanics. From 1918 to 1919, Heintz worked at the *Baltische Technische Hochschule, BTH* (Baltic Technical University), a German-run institute (German was the official language) which for a short time acted as RPI's successor. During World War I, Heintz was a general representative for the Red Cross at the Eastern Front. From 1920 to 1921, he was engaged as a consultant by the Latvian Ministry of Health. In 1935, he is known to have managed a firm specializing in ventilation, heating and heating technology. He died in Germany in 1955.

Arvid Heintz (Courland, 1878–195?), brother of Karl Heintz, graduated from the RPI with a Diploma in Chemistry in 1902. He moved to St. Petersburg in 1903 where he started to work for the rubber manufacturing firm *Треугольник* (Treugolnik), first as an engineer,

later – possibly until 1923 – as director. After his return to Riga in 1924/1925, he became one of the founders of the rubber factory *Kvadrāts* (Quadrangle). In addition to holding a seat on the Board of Directors Heintz was also Technical Director of *Kvadrāts*. In 1931, he became the part-owner of a small rubber factory in Riga. In 1939, like most other Baltic-Germans, he was forced to immigrate to Germany. Later he moved to Switzerland where he died in the 1950s.

Arnold Jensch (1866–1920) received a Diploma from the Institute of Civil Engineering in St. Petersburg. From 1905 to 1907, Jensch held the position of Assistant Professor in Civil Engineering (sewerage and water supply) at the RPI, from 1907 onwards the position of professor.

Theodor Kalep (1866–1913) graduated from the Riga Polytechnic in Mechanical Engineering in 1895; he continued at the institute as an assistant from 1895 to 1898. Kalep was the founder, co-owner, and later managing director of the machine-building company *Motor* in Riga. He was to play a decisive role in the development of early aviation in the governorate, purchasing the first airplane brought to Riga (*Wright* biplane), manufacturing airplanes at his factory and designing and manufacturing Russia's first aero-engines (see further).

Gustav Kirstein (Berlin, 1851–1915) graduated from the Riga Polytechnic in Civil Engineering in 1875. He held the position of adjunct professor at the institute between 1900 and 1905, lecturing in bridge-construction and civil engineering. In 1905, Kirstein was awarded the title of Professor Emeritus. Later he moved to Germany where he died during World War I.

Adam Milodrowski (Warsaw, 1872–1928) graduated from the RPI with a Diploma in Mechanical Engineering in 1904. He continued as an assistant at the institute from 1904 to 1906, from 1906 to 1918 being employed as Assistant Professor in Textile Technology. He died in Warsaw in 1928.

Edmund Pfuhl (1844–1919) served as Professor in Mechanical Technology at the Riga Polytechnic / RPI from 1879 to 1905. Unlike his colleagues, Pfuhl took an early interest in aeronautics and aviation, holding public lectures about balloons, airships and motorized airplanes, joining the group of founders of the *Luftschiffahrt Studiengesellschaft* (Society of Aeronautical Studies) in Riga in 1910 (see further).

Hermann Seuberlich (Riga, 1878–1938) graduated from the RPI with a Diploma in Architecture in 1903. He held the position of Assistant Professor in Architectural Drawing at his institute from 1910 to 1918. In 1938, Seuberlich went missing in the Soviet Union.

Nikolai Schiemann (Riga, 1865–1944) graduated from the Riga Polytechnic in Mechanical Engineering in 1893. In 1906, he was appointed extraordinary Professor in Machine Construction at his

institute; in 1919, he joined the faculty of the University of Latvia. Schiemann died in 1944 in Germany.

Ernst Snicker (*Ernests Sniķeris*) (1886–1944) graduated from the RPI with a Diploma in Mechanical Engineering in 1912. During 1935–1937, Snicker headed the flight school of Latvia's Aero-Club in *Liepāja* [54].

Wjatscheslaw Suschkow (1880–1951) graduated from the RPI with a Diploma in Mechanical Engineering in 1903. He continued as an assistant at RPI's Institute of Machine Elements from 1903 to 1907. In 1909, Suschkow joined the technical department of the *Русско-Балтийский вагонный завод, RBVZ* (Russia-Baltic Waggon Factory) as an engineer. From 1910–1912, he headed *RBVZ*'s automobile department. This happened at the same time the *RBVZ* started to manufacture airplanes based on a French license, an activity closely integrated with its automobile production (see further).

Gustav Taube (Riga, 1870–1965) graduated from the RPI with a Diploma in Mechanical Engineering in 1896. In 1905, he was appointed Assistant Professor in Mechanical-technical methods, Technical Drawing and Agricultural Machines at the RPI. He joined the faculty of the University of Latvia after the war in 1919. In 1939, Taube left Latvia and moved to Germany.

Artur Voegeding (Courland, 1878–Riga, 1936) graduated from the RPI with a Diploma in Mechanical Engineering in 1901; from 1899 to 1903, he was engaged as an assistant at RPI's Institute of Machine Elements. In 1903, Voegeding joined the *RBVZ* as an engineer, staying with the firm until 1917. After having left the *RBVZ*, Voegeding moved to Moscow where he became Technical Director of the rubber-manufacturing firm *Проводник* (Provodnik). He died in 1936 in Riga.

Herbert Westermann (Riga, 1886–1956) graduated from the RPI with a Diploma in Mechanical Engineering in 1906; he continued as an assistant at the institute from 1911 to 1912. In 1911, he joined Kalep's *Motor* factory as an engineer. He later moved to Germany where he held the position of *Ingenieur für Flugwesen* (Aeronautical Engineer) at the firm *Zermat* in Berlin [55]. Westermann was the son of the mathematician Hermann von Westermann (1842–1918), an RPI-graduate who had augmented his studies in Zürich, Stuttgart and Dorpat. From 1871 onwards, Westermann held the position of Assistant Professor in Mathematics and Descriptive Geometry.

One possible explanation for RPI's faculty members to stay away from aeronautics in general and early aviation in particular can indirectly be found by looking at the activities of the *Technischer Verein zu Riga* (Riga Technological Society) founded in 1858. This voluntary society, many of its members were connected with the Polytechnic / RPI, served over the years as an effective platform for scientific-technological discussion.

Included among its membership, in addition to faculty members and other staff from the institute, were industrialists, state functionaries, journalists and others deemed worthy to join this exclusive circle. After 1900, one third of around 200 members were mechanical engineers, another one third chemists, and the rest engaged in other professions. Many were RPI-graduates, the majority, judging by their surnames, of ethnic German descent. The editorial board of the *Rigasche Industrie-Zeitung*, the society's official organ since the 1870s, was traditionally recruited among RPI's staff. The paper regularly published the society's minutes of bi-monthly meetings, annual reports and other relevant information. During the years leading up to World War I, the editorial board consisted of Maximilian Glasenapp (Editor-in-Chief), Benedykt Wodzinski, Edmund Pfuhl and Nikolai Schiemann, all from the Riga Polytechnic / RPI, and the RPI-alumnus architect Boris von Bock.

Despite the rapid break-through of motorized airplanes during 1903–1910 and its impact on public and scientific debate, the *Rigasche Industrie-Zeitung* carried surprisingly few articles about the novel flying machines (often called *Drachenflieger*). In 1908, for example, aeronautics was mentioned in only three short articles, all dealing with dirigibles. During the following year, the number of relevant articles had increased to seven, only one mentioning airplanes (Farman, Wright). One of the articles this year talked about the establishment of an aviation department at the Polytechnic Institute in St. Petersburg, an event which passed without any public comment from the side of RPI's faculty [56].

Only in 1910, by that time three airplanes had arrived in Riga from abroad and two local firms (Kalep's *Motor* and *RBVZ*) had started to manufacture flight equipment, aviation started to receive some extra attention when Professor Emeritus Pfuhl advertised public lectures about aerostats and airplanes (see further). That year also the editors of the *Industrie-Zeitung* found it worthwhile to notice aeronautics on four occasions, publishing one article written by Pfuhl about airplanes and one by Glasenapp about a country-wide subscription launched for financing the Russian air fleet. In 1911, nothing much had changed: five short articles about aerostats and airplanes were submerged in a flood of contributions about steam engines, sewers, chemical compounds or peat. The only novel element that year was one longer article about German aviation. In 1913 and during the first half of 1914 (the *Rigasche Industrie-Zeitung* stopped publication in September 1914) only one aviation-related article appeared, one in 1913 and none in 1914.

The cause of this ambivalence can possibly be found in the opposite views of Glasenapp and Pfuhl, two of RPI's more prominent professors. Maximilian Glasenapp (1845–1923), Professor in Chemical Technology from 1878 and Editor-in-Chief of the *Rigasche Industrie-Zeitung* from

16 Zander wearing RPI's student uniform (1910s).

1882, was outright negative regarding the usefulness of flying machines both for civil and military purposes. In the beginning of 1910, Glasenapp expressed strong doubts regarding the subscription mentioned above concerning Russia's air fleet. According to Glasenapp, acquiring flying machines for private transportation purposes should not depend on collecting money from the public, while airships used for war were highly susceptible to counter-measures. Shouldn't Russia, a poor country, wait until the usefulness of this novel technology had been clearly demonstrated? [57].

In 1911, Glasenapp's attacks continued, the past 12 months having strengthened his belief in the futility of going along this road: in the meantime, no less than three Zeppelins had crashed, while the death of aviators flying airplanes appeared regularly in the columns of newspapers. Thus, Glasenapp wrote:

> «Under these circumstances, the importance of a collection of 'aircraft including all presently existing systems' does not go beyond the one of a museum for breakneck machines» [58].

According to Glasenapp, one should not have any illusions. Even if (and this was a big if) flight safety could be improved to the point where it no longer posed a constant lethal threat, using aircraft for transporting passengers and other goods could never pose any serious challenge to railroads or steamships «...because of the laws of mechanics, which need not be repeated here, and due to high transportation costs» [59]. Glasenapp did not care to mention what exact laws of mechanics

were barring further progress in air travel. Interesting is also his referral to steamships at a time when seagoing vessels powered by internal combustion engines were overtaking the shipping trade. In any case, that was not all. Glasenapp saw no real use of air cruisers (*Luftkreuzer*) for military purposes, or for any other of military airborne machines. Had work not already started to develop effective counter-measures, for example by *Krupp* and *Rheinische Metallwaren- und Maschinenfabrik* in Germany manufacturing special guns and ammunition to force the airships away from enemy lines? And only the future could tell how to deal with airplanes in wartime.

All in all, according to Glasenapp «one can hardly expect any cultural advancement from motorized aircraft in the near future». The way forward, avoiding additional military spending, was to simply ban the use of airships in war by convention, their further development for peaceful purposes having to rely on its own merits.

A position different from Glasenapp's was taken by Edmund Pfuhl (1844–1919), who from 1879 to 1905 held the position of Professor in Mechanical Technology at the Riga Polytechnic / RPI and who also belonged to the editorial board of the *Rigasche Industrie-Zeitung*. In August 1909, Pfuhl visited the *Internationale Luftfahrtausstellung, ILA* (International Aeronautical Exhibition) in Frankfurt am Main in Germany. In November 1909, apparently under the influence of this experience, Pfuhl organized a series of three lectures at the Riga Technological Society focusing on the history, technology and future prospects of aeronautics and aviation [60].

Pfuhl's first lecture concentrated on the history of flight lighter-than-air, going all the way back to 18th century France, to the Montgolfier brothers and Professor Jacques Charles. The second lecture, in turn, focused on motorized balloons, or different types of dirigibles (rigid, semi-rigid, soft). In his third lecture, concluding the series, Pfuhl talked about recent advances made in flight heavier-than-air and thereby mentioning Lilienthal, the Wright brothers, Santos-Dumont, Ellehammar, Blériot, Grade and others who by that time had succeeded to take to the air with gliders and motorized airplanes. On 29 November, Pfuhl gave a public lecture titled *Vortrag über die Eroberung der Luft* (Lecture about the Conquest of the Air) supplemented with visual material, an event that was received with great acclaim [61].

Pfuhl's lectures summarized what by that time had become common knowledge in many of the aviation-wise advanced countries of Western Europe. Interesting to notice thereby is his optimism, his strong belief in human ingenuity and the central role played by science and technology for furthering human progress, an outlook quite at odds with Glasenapp's skepticism:

«He expressed the hope that the invention of airships and airplanes will be successful, speeding up a lasting condition of lawful co-existence between cultures in order for them to be able to dedicate their efforts towards more peaceful tasks than now. Thereby, it is not really foreseeable what advances with regard to mastering the forces of nature, and their utilization for the well-being of the individual and society at large, will result from this development» [62].

The *Rigasche Industrie-Zeitung,* in its bi-monthly editions, regularly published a list of patent applications registered in Russia. Thus, during the pre-war period from 1908 to 1914, over 10 000 applications were listed together with their application numbers and names of inventors. However, the paper did not publish all applications, a pre-selection having been made by its Editor-in-Chief Glasenapp.[1] This in combination with Glasenapp's general approach to aeronautics and aviation has to be kept in mind when considering the following aeronautical/aviation-related patents shown in the table.

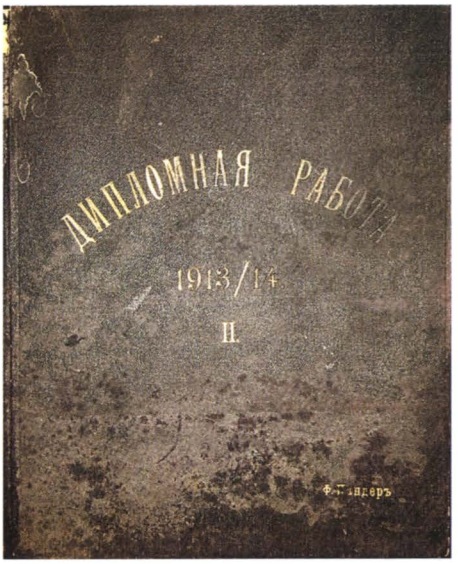
Number of patent applications in Russia in 1908–1914

1908	0
1909	5
1910	7
1911	4
1912	8
1913	6
1914	7

Among those patents, noteworthy from the perspective of Riga and the Baltics are the following:

- No. 46008/1911 A. Hackel (Gakkel), elektr. Ing., *Aeroplan des Seetyps* (Seaplane);
- No. 53265/1912 Th. Kalep, ing. Techn., *Zylinder und Auspuffventil für Verbrennungsmotoren mit radial um die Achse angeordneten rotierenden Zylindern* (Cylinder and exhaust-valve for combustion engines having around the axis radially organized cylinders);
- No. 54981/1913 Th. Kalep, ing. Tech., *Kolben f. Motoren innerer Verbrennung mit radial um die Achse angeordneten rotierenden Zylindern* (Piston for internal combustion engines with around the axis radially organized cylinders);
- No. 57244/1913 Fürst Kudashev, ing., *Rotations-Wärmemotor* (Radial-heating engine).

[1] This can be seen when looking at the patent numbers.



17 Front cover of Zander's diploma paper (Part 1), presented at the RPI in spring 1914. The handwritten original (in three parts) is found in the archive of the Friedrich Zander Museum of Space Exploration of the University of Latvia in Riga.

Gakkel and Kudashev were employed by the *RBVZ* at a time when the factory was manufacturing airplanes at its Riga plant. Kalep, in turn, was one of Russia's first constructors of aero-engines. The work of all three will be described in greater detail in the next chapters.

In late spring 1914, after studies which had lasted the best of nine years, Zander presented his diploma paper, a handwritten study in two main parts comprising 120 pages and with the following titles:

Part 1

Расчеты к дипломной работе 1913/14 год. (Calculations for the diploma work 1913/14)

I. Судно (Vessel)

II. Строительная часть (Construction)

Part 2

I. Расчеты к проекту турбинного грузового парахода (Calculations for the project of a turbine-powered freight vessel) *L=124 m; B=16 m; T=7 m; v=10 узл.* (knots)

II. Расчеты к проекту здания для дирижабля (Calculations for the project of a building for dirigibles).

As it appears, Zander's diploma work consisted of three different and unrelated sections, none directly dealing with aeronautics or space. Zander did not mention the diploma work in his short autobiography of 1927, neither has it been observed in standard reference texts about Zander [63].

Рижскій Политехническій Институтъ.

ДИПЛОМЪ.

Фридрихъ Артуровичъ Цандеръ,

инженеръ-технолога.

№ 2694

18 Zander received the Diploma of Engineer-Technologist (*инженер-технолог*) from the RPI in 1914.

2.3 Early Aeronautics and Aviation in Riga

2.3.1 Aerostats and Airplanes

In the early days of the 20th century, aeronautics could look back upon a development, which had started in 1783 in France. Since then, despite theoretical studies and practical experiments by men like Cayley, Stringfellow, Pénaud, Mozhaisky, Maxim, Ader, Lilienthal, Langley and others, the practical implementation of motorized flight heavier-than-air had to wait until 17 December 1903 when two Americans, Orville and Wilbur Wright, succeeded taking-off in their biplane at Kitty Hawk, having their longest flight that day (250 meters) last just 60 seconds. Shortly thereafter motorized flights happened also in Europe, including tsarist Russia. The first flight made on the continent, by the Brazilian Alberto Santos-Dumont in 1906 on his Canard 14-bis, was soon repeated by others flying on different types of machines. At *La Grande Semaine d'Aviation de la Champagne*, the first international air-show held in Europe organized in Rheims in 1909, an event duly noted in Russia, no less than 30 different airplanes from the workshops of Wright, Curtiss, Farman, Voisin, Blériot, Antoinette, Bréguet and others took part, Europe's aviator-elite and airplane firms competing for prize money and publicity. Hundreds of thousands of spectators were to follow this event, military officers among them [64].

After 1906, aviation workshops started to be set-up in many countries, like the *Societé Antoinette* in 1906 in Puteaux or Louis Blériot's shop in 1909 in Paris. Cross-country flights over ever longer distances, aerial demonstrations in front of large crowds, and military

competitions were organized all around the continent, the development in France acting as primus motor. In mid-1909, Louis Blériot crossed the English Channel in his *Blériot XI* monoplane, a breathtaking event. In late September that year, an air saloon opened at the *Grand Palais* in Paris, where besides balloons and airships numerous monoplanes, biplanes, multiplanes and even model helicopters were on display [65]. Some short time thereafter, in October, the *Internationale Luftschiffahrt Ausstellung* (*ILA*) in Frankfurt am Main displayed both aerostats and airplanes, including an American *Wright*. Like in Rheims, the event in Frankfurt was followed by flight competitions with aviators from France, Belgium and Germany competing for monetary prizes. In Russia, the first aeronautical exhibition and air-show was organized in spring 1910 by the Imperial All-Russian Aero-Club in St. Petersburg [66].

In Europe, first to replicate the *Wrights*, as told, was Santos-Dumont who in October 1906 succeeded to make some short jumps in the Bois de Boulogne in Paris. After that performance the ice was broken, motorized flights starting to spread to many countries in leaps and bounds. Only four years later, in 1910, the Frenchman Henri Farman would succeed to stay airborne for more than eight hours, Maurice Tabuteau cover a distance of 582 km, and Alfred LeBlanc reach a speed of 115 km/h [67]. Those records were soon broken again, some on a monthly, even daily basis. Longer-higher-faster became the underlying dynamic of flight, challenging constructors and aviators alike.

During the first decade of the twentieth century, airplanes moved into the spotlight of public attention also in Russia's Baltic provinces. In 1908, for example, the *Rigasche Rundschau* published no less than 145 flight-related articles of varying length, the majority (86) dealing with free balloons and dirigibles. However, already at that early stage motorized airplanes, in addition to a wide variety of aviation-related articles concerning air law, airports, aviation medicine, balloon-photography or aerial torpedoes, were duly noted in 28 articles. Center stage was still taken by the aerostats, though, Zeppelin's rigid dirigibles appearing in no less than 40 entries. In any case, airplanes had started to attract public attention, many starting to believe that both kinds of aircraft would develop in parallel, playing important roles especially in military aviation. In 1904–1905, the French military had started to establish a force of semi-rigid dirigibles, a development which other countries, foremost Germany, Austria-Hungary, Russia and Italy, had the ambition to match.

By 1914, Russia's military air fleet operated 13 dirigibles of various sizes, with 4 additional ships under construction. To compare, there were 12 ships in Germany (plus 7 under construction), 16 in France (8 under construction), 9 in Italy (2 under construction) and

19 Announcement regarding the first Aviation Week organized in Russia, St. Petersburg, 25 April – 2 May, 1910.

5 in Austria-Hungary [68]. Some observers, however, had started to challenge this development. In an article in the *Rigasche Zeitung* of May 1907, published hardly one year after Santos-Dumont's exploit, one could read the following: «... one can prognosticate that the future does not belong to the already well-developed gas-filled motorized balloons but the gas-independent dynamic craft, the airplane, flying along heavier-than-air» [69].

The year 1909 witnessed first flights with motorized airplanes in several European countries, the majority performed by French aviators on French machines. Among the countries involved was Russia, where the Dutchman Van den Schkrouff, invited by the Odessa Aero-Club, on 29 June (J. C.) carried out the first flight heavier-than-air in the country, piloting a *Voisin* biplane; a few months later, on 11 October (J. C.), the Frenchman Georges Legagneux would pilot a *Voisin* biplane overhead a military exercise ground at Gatchina outside St. Petersburg [70]. First flights in Russia, like in many other countries, were performed by foreign pilots on French airplanes. At that same time, Russian military officers and private enthusiasts were travelling to France and Germany to learn to fly.

Until the outbreak of World War I, airplanes flown in Russia were with some exceptions brought into the country from abroad, while aeronautical equipment manufactured in the country was often based on licensing agreements with foreign firms, alternatively were copies or derivatives of foreign models. Theoretical contributions to aeronautical engineering made by Russian scientists like Nikolai Zhukovsky did not alter this basic dependency. In pre-war Russia, the design and manufacturing of equipment, the organization of aero-clubs and air-shows, or the training of pilots were activities concentrated in cities such as St. Petersburg, Moscow, Kiev, Odessa or Riga, Russian aviation thereby following the development in Western Europe [71].

In April 1911, an aeronautical congress in St. Petersburg under the chairmanship of Nikolay Zhukovsky and organized by the Imperial

Russian Technological Society,[1] discussed the state of affairs of Russian aeronautics and aviation, attempting to formulate steps for advancing its development [72]. The complexity of technical, organizational and legal issues confronting the authorities and others involved in pre-war Russian aviation is well illustrated by the manifold issues under discussion.

1. Classification and registration of an aircraft.
2. Clarification of the relative advantages of different flight systems.
3. Questions concerning the construction and manufacturing of free and dirigible balloons as well as airplanes.
4. Materials used for manufacturing aircraft of any kind.
5. Propellers and other propellants for aeronautics and aviation. Theory and construction. Performance. Test methods.
6. Scientific questions concerning aeronautics and its implementation; methods for studies and tests; measuring instruments and other apparatus.
7. Studies of the law of air resistance. Studies of the effects of (flying) apparatuses and the law of stability.
8. Aerodynamic institutes, their equipment and the scientific modus operandi of experiments.
9. Modus operandi of education in sciences related to aeronautics at higher education institutions.
10. Qualifications of an aeronautical engineer.
11. Creation of a special institute for studies of issues concerning aeronautics.
12. Schools for pilots and technicians and their technical equipment.
13. Meteorology. Permanent and movable stations for meteorological observations and systematization of observations.
14. Types of current apparatus and instruments for meteorological observations; technical novelties in this field.
15. Application of meteorology in aeronautics, agriculture, communication, geography, astronomy, etc.
16. Current status of aeronautics in Russia and measures for its development.
17. Importance of aeronautics for the urban and industrial life in Russia and for military purposes.
18. Inventors in aeronautics, types of support rendered for the design and realization of their inventions.

[1] The congress took place on 12–19 April 1911. Vice Chairman of the congress and main organizer was Vasily Naidenov (1864–1925), military engineer and Chairman of the Aeronautical Section of Technical Society.

19. Governmental rewards and subsidies, means for the support and development of aeronautics in Russia.
20. Organization and development of contests and competition for flying apparatuses, distribution of prizes and rewards not only to aviators but also to constructors of apparatuses.
21. Organization and development of regular air traffic and calculations of profitability in this field.
22. Customs duties and formalities, and their effects on the success of aeronautics in Russia.
23. Administrative regulations and juridical questions related to the development of aeronautics.
24. Questions concerning air law and regulations for flying apparatuses and flight participants.
25. Signaling.
26. Accidents of aviators and third persons.
27. Accident statistics and follow-up.
28. Invalidity insurance of employees and their families in case of death of employees.
29. Expropriation of suitable terrains for the take-off of flying apparatus, accommodation of flying apparatus according to the rules of regional and city administrations.
30. Aerodromes and their equipment.
31. Distribution of knowledge about aeronautics among the population regarding assistance at landings and accidents of aerostats.
32. Use of aircraft for wireless telegraphy.
33. Mail pigeons and aeronautics.
34. Use of photography in aeronautics.
35. Production of geographical maps for aeronautics.
36. Technical and commercial organizations of aeronautical enterprises in Russia.
37. Factories and workshops for building flying apparatuses.
38. Permanent and movable gas generation stations needed in aeronautics.
39. Status of experts.
40. Engines for aeronautics.
41. Arrangement of cylinders in engines and scientific judgments about their most beneficial construction.
42. Hydroscopic effect in relation to the arrangement of cylinders.
43. The newest constructions of apparatuses and equipment for power transmission and steering in airplane and dirigible engines.
44. Turbines with internal combustion for aeronautics.
45. Economic performance of engines.

46. Amount of horsepower per engine presently believed to be acceptable, and maximum possibility for its achievement.
47. Comparable engine data under different and similar conditions.
48. Factories for the production of aero-engines and the necessity of raising this kind of mechanical production in Russia.
49. Engines currently demanded in aeronautics [73].

In addition to scientific and technical issues concerning aircraft, aero-engines and other flight equipment, explicitly included were both aerostats and airplanes, the program highlighted such central issues as governmental regulations for pilots and aircraft, insurance for aviators and third parties, meteorological issue, airports and the role of local governments, expropriation of terrain for airports, customs formalities and governmental support for inventors. Out of 49 issues put on the agenda more than 10 dealt with aero-engines, emphasizing the importance of this type of equipment.

The congress in St. Petersburg was the first of its kind in Russia. It attracted more than 400 delegates from 21 local and regional organizations, practically representing all aeronautical societies active in the country. However, plans to organize an All-Russia Aeronautical Union came to naught due to the unwillingness of the Imperial All-Russian Aero-Club to cede its position of quasi head-organization in Russia, and also the insistence of the provincial organizations on keeping their independence [74].

It can be mentioned that in 1912, Nikolay Zhukovsky, on the occasion of RPI's 50th anniversary, was awarded Honorary Membership. One amongst Zhukosky's many disciples was *Jānis Straubergs* (1886–1952) from Riga, who in 1908–1912 was enrolled in the Faculty of Physics and Mathematics of Moscow University. Specializing in aerodynamics, at that time a new academic subject, Straubergs had the opportunity to work in Zhukovsky's laboratory. Later, in 1926, *Straubergs* was invited to teach courses in hydro-mechanics and introductory aerodynamics at the Faculty of Mechanics of the University of Latvia, an invitation which he declined.

The state of air-mindedness, which had gotten hold of Europe's public after the turn of the century depended to no small extent on the daily press, aeronautics and its many exploits making ever-catching headline news. However, other publications prospered as well, including scientific books and aeronautical journals. This can be illustrated by the almost 400 scientific journals, which were kept by RPI's library which included: *Zeitschrift für Luftschiffahrt*, Berlin, 1883→; *Prometheus: Illustrierte Wochenschrift über die Fortschritte in Gewerbe, Industrie u. Wissenschaft*, Berlin, 1891→; *Meteorologische Zeitschrift*, Berlin, 1884–1891; and *Zeitschrift des Vereins deutscher Ingenieure*, Berlin,

РИЖСКІЙ ПОЛИТЕХНИЧЕСКІЙ ИНСТИТУТЪ.

Его Превосходительству, Заслуженному Профессору, Доктору прикладной математики, Действительному Статскому Совѣтнику

Николаю Егоровичу Жуковскому.

Рижскій Политехническій Институтъ, въ день празднованія пятидесятилѣтія своего существованія, свидѣтельствуетъ Вашему Высокопревосходительству, какъ надлежитъ дѣятелю на поприщѣ науки, свое глубокое почтеніе.

Приложивъ высокія Ваши заслуги въ теченіе сорокалѣтій, стать блестящей и обще-признанной академической и научной дѣятельности, Институтъ проситъ Васъ, глубокочтимый Николай Егоровичъ, принять званіе

ПОЧЕТНАГО ЧЛЕНА

Рижскаго Политехническаго Института.

Рига, октября 2 дня 1912 г.

№ V

20 Certificate of Honorary Membership of the Riga Polytechnic Institute, issued to Nikolay Zhukovsky in October 1912.

1861→. The collection did not include two at the time widely read French publications, i.e. *L'Aéronaute* (1863→) and *L'Aérophile* (1893→). The *Zeitschrift für Luftschiffahrt*, again, was Germany's oldest and most widely-read aeronautical publication, dealing with flight lighter-than-air and heavier-than-air.[1]

Besides the journals, included in RPI's collection were also aeronautically relevant monographs under sections such as *Astrophysik und Kosmogenie* (Astrophysics and Cosmogeny), *Hydro- and Aeromechanik incl. Flugtechnik* (Hydro- and Aeromechanics including Flight Technology), *Geophysik* (Geophysics), *Meteorologie* (Meteorology), *Klimatologie* (Climatology), *Witterungskunde* (Weather Phenomena), and *Astronomie und Geodaesie* (Astronomy and Geodesy). The following titles deserve to be mentioned:

- Lilienthal, O. *Der Vogelflug as Grundlage der Fliegkunst: Ein Beitrag der Systematik der Flugtechnik. Auf Grund zahlreicher Versuche bearbeitet*. Berlin, 1889;
- Parseval, August v. *Die Mechanik des Vogelfluges*. Wiesbaden, 1889;
- Popper, J. *Flugtechnik*. Berlin, 1889;
- Schlotter, H. *Ueber das mechanische Prinzip des Fluges u. dessen Anwendung auf die Luftschifffahrt*. Gera, 1874;

[1] During 1882–1888 published as *Zeitschrift des Deutschen Vereins zur Förderung der Luftschifffahrt*, from 1892 as *Zeitschrift für Luftschiffahrt und Physik der Atmosphäre*, from 1900 as *Illustrierte Aeronautische Mitteilungen: Deutsche Zeitschrift für Luftschifffahrt*.

- Strasser, H. *Ueber den Flug der Vögel, Ein Beitrag zur Erkenntnis der mechanischen u. biologischen Probleme der active Locomotion.* Jena, 1885;
- Koch, G. *Die Lösung des Flugproblems u. das Luftschiff der Zukunft.* München, 1893;
- Glaisher, J., Flammarion, C., Fonvielle, W. de & Tissandier, G. *Voyages aériens.* Paris, 1870 [75].

This list refers to the library's collection in 1895, when flight both in theory and practice was still very much an aerostatic phenomenon. At that time, different from the aeronautical main stream were the observations, theoretical efforts and practical flying attempts made by the German Otto Lilienthal (1848–1896). During 1891–1896, Lilienthal carried out more than 2 000 flights in and around Berlin, testing a dozen different fixed-wing gliders (mono-, bi-, and triplanes) and thereby reaching distances of up to 250 meters, attempts which gained him worldwide recognition. Amongst Lilienthal's many visitors was Professor Nikolay Zhukovsky, Russia's most prominent spokesman in the field of flight heavier-than-air. On his return home to Moscow Zhukovsky brought with him a Lilienthal's monoplane (standard) glider, an apparatus which still today is on display at the Zhukovsky Museum in Moscow. On 9 August 1896, Lilienthal crashed in the Rhinow Mountains outside Berlin, and succumbed to his injuries the following day.

In pre-war Riga, various voluntary associations were keeping libraries, which regarding scientific and other journals were fully comparable with RPI's library. The *Naturforscher-Verein*, for example, in addition to its extensive collection of books, regularly received hundreds of different periodicals from around the world. In its 1908-catalogue, books and journals specifically dealing with aeronautics and aviation, or space-related subjects, were sparsely repressented, though. Among its collection one finds the German journal *Prometheus* and L. Zehnder's monograph *Das Leben im Weltall* (Tübingen and Leipzig, 1904) [76]. The library of the *Gewerbeverein* (Trade Association) in turn was keeping various monographs on aviation and outer space including Heinrich Adam's *Flug: Unser Flieger von Wilbur und Orville Wright* (Flight: Our Aircraft from Wilbur and Orville Wright), published in Leipzig, and Ferdinand von Zeppelin's *Die Luftschiffahrt,* published in Stuttgart. In addition, the catalogue of 1914 listed A. Zart's *Die Bausteine des Weltalls* (The Elements of Space) and Joseph Phole's *Die Sternenwelten und ihre Bewohner* (The Worlds of Stars and their Inhabitants), Köln 1902 [77]. The third library for which a catalogue could be mustered was one kept by the *Fraternitas Baltica* (Baltic Association), a student association. Its catalogue of 1911 listed Camille Flammarion's *Die Mehrheit der bewohnten Welten* (The Majority of the Inhabited Worlds), Leipzig, 1865,

Im Saale der Börsen-Commerz-schule (Todleben-Boulevard, Ecke der Nikolai-straße) findet **Sonntag** den **16.** November, **5** Uhr Nachmittags, eine

öffentlicher Vortrag

(in russischer Sprache) des Ingenieuren **J. M. Herzfeld** über das Thema **„Fort-schritte der Luftschifffahrt"** (Eroberung der Luft) statt. Der Vortrag wird durch 80 Lichtbilder von Herrn **R. Jordan** illustriert.

Preise der Plätze: 1—5 Reihe **1** Rbl., 6—15 Reihe **75** Kop., alle übrigen **50** Kop., Schüler **35** Kop. Die Plätze sind nummeriert. **Billette** sind zu haben in den Buchhandlungen von **F. J. Treskina,** Thronfolger-Boulevard 25, **Gebr. Baschmakow,** gr. Sandstr. 12, und im Zeitungskiosk, Ecke Thronfolger- u. Alexander-Boulevard. (3584)

21 Announcement regarding J. M. Herzfeld's public lecture *Fortschritte der Luftschiffahrt* at the *Börsen-Commerzschule*, Riga, 16 November 1908. (The illustration shows a Lillienthal biplane glider).

and three works by M. W. Meyer, i.e. *Kosmische Weltansichten* (Cosmic Idologies), Berlin, 1866, *Welt der Planeten* (The World of Planets) and *Der Mond* (The Moon) [78].

Analyzing the literature that has been found in Riga, the authors discovered, that there are some books about astronomy translated into Latvian. Among them are book by German astronomer Max Wilhelm Meyer (1853–1910) and author Wilhelm Bölsche (1861–1939) about the stars (*Debess spīdekļu pasaulē*), printed and edited in Riga in 1910 [79]. Both authors were very popular in the 19th and 20th century in Germany [80].

In pre-war days, different from today with its over-reliance on the internet, a common way to publicly promote one's ideas was to organize meetings, lectures or exhibitions. The development of flight heavier-than-air in the early days of the 20th century was thereby accompanied by manifold promotional events and flight demonstrations, performances which from the very beginning attracted large crowds and the close attention of the press. Riga was not immune to this development. Thus, on 9 November 1908, at the *Börsen-Kommerzschule* (Commerce School of the Stock-Exchange), the book-seller Richard Jordan would hold one of the first public lectures on aeronautics in town, talking about Count Zeppelin and his forerunners in aerostatics, going back in time some 200 years. Jordan's presentation, supplemented by 60 photographs, attracted a large audience, the speaker receiving lively cheers in the end [81]. Given this response, Jordan repeated his lecture on 13 November, this time also talking about an eventual aerial landing site in Riga [82]. On 16 November 1908, the engineer J. M. Herzfeld used Jordan's photographic material for his own presentation held in Russian on the progress of aviation [83].

Jordan continued to talk about aeronautics and aviation also during coming years. On 15 November 1909, at the Riga City High School, the

theme of his presentation was the history of flying machines, Jordan reaching back in time some 400 years (!) while noticing the latest achievements concerning the *Motordrachenflieger* (motorized airplanes) from Blériot, Farman, Wright, Grade and others.[1] The presentation, supplemented by 70 photographs, attracted only a handful of listeners [84]. On 4 March 1910, Jordan once again talked about airplanes, thereby concentrating on the *Wright* biplane, one of the most well-known types at that time, paying special attention to the take-off on wheels and skids, on wing warping and on details of piloting. Again, Jordan used numerous photographs, more than 100, as illustrations [85]. The speaker, who one week earlier had given the same performance in *Libau* (presently *Liepāja*) in front of a sold-out theater, also mentioned the upcoming exhibition of a *Wright* airplane organized by some of RPI's students (see further). This time his presentation at the *Johannis-Gilde* (presently Small Guild) attracted a large audience, including Russian military officers [86].

In 1909, discussions about the progress of flying machines continued both in public and in Riga's voluntary societies. Specially mentioned can be a series of public lectures by Professor Emeritus Edmund Pfuhl held in November–December 1909 (see further). On 28 November 1909, to take the last example, Staff-Captain Schabsky, constructor of Russia's first military dirigible *Учебный* (Uchebny) launched in 1908, and later commander of the military dirigible *Лебедь* (Lebed), held a public lecture at the *Gewerbeverein* (Trade Association) about aeronautics and flying apparatus. One can assume that this event received a favorable public response as well [87].

2.3.2 Balloons and Dirigibles

The first flight lighter-than-air carried out in Riga dates back to 18 August 1804, when the Frenchman Étienne-Gaspard Robert (Robertson) took-off in his hydrogen balloon *Minerve* [88]. It was hardly one year later, on 20 June 1803, that the French aeronaut André-Jacques Garnerin and his wife ascended from St. Petersburg by gas balloon [89]. Throughout the 19th century, flights with free balloons, a sport for an exclusive circle of well-endowed enthusiasts and a means of income for professional showmen, attracted the attention of the general public. The Russian government's first official involvement with aerostation happened only in 1869 with the appointment of an aeronautical commission by the military's Main Engineering Directorate [90]. The real break-through, however, had to wait until 1885 when a military balloon detachment was formed at Volkovo Field outside St. Petersburg. Starting

[1] *Motordrachenflieger* [motorized drake] was a term commonly used in Germany during pre-war years to denote motorized airplanes.


Technischer Verein.
Dienstag, den 3. Novemb. 1909:
Sitzung.
Beginn 8 Uhr Abends im
Phys. Aud. des Laboratorium-Gebäudes, Puschkin-Boulevard.
Prof. em. E. Pfuhl. Erster Vortrag: „Die Entwickelung der Motorluftschiffahrt".
Protocollführer: Ing. P. Lieven.
Gäste von Mitgliedern eingeführt, haben zur Sitzung zutritt.

22 Announcement regarding Professor Emeritus E. Pfuhl's public lecture Entwicklung der Luftschiffahrt at the *Technischer Verein*, Riga, 3 November 1909.


Im Dubbelnschen Kurhause:
Sonntag, den 15. August 1910, um 6 Uhr abends:
Ballon-Aufstieg
des Aeronauten
J. Drewnitzki
und Sturz zur Erde
mit dem Fallschirm.
Vor und nach dem Aufstieg Musik.
Vorbereitung zum Aufstieg von 5 Uhr an, Aufstieg präcise 6 Uhr abends.
Garten-Entrée (incl. Wohlf.-Steuer): à 25 Kop. Abgetheilte Plätze auf dem Balkon à 1 Rbl. Stühle auf dem Seitelplatz à 75 Kop., auf den Terrassen der Veranda à 50 Kop.

23 Advertisement for a planned balloon ascent by J. Drevnitsky, Riga, 15 August 1910.

with two hydrogen balloons purchased in France, Russian military aeronautics continued to develop right up to the beginning of World War I. In 1908, there were several parks of free and tethered balloons stationed at Russian fortresses along its western borders; included in this arsenal was also Russia's first dirigible *Учебный* (Uchebny). In 1910, fixed-wing airplanes started to be added to this force [91].

From the 1880s onwards, in Russia like in Europe at large, aeronautics started to be dominated by military requirements, after 1908–1910 supplemented by requirements specific for airplanes. In Russia, as well as in Germany, France, Austria-Hungary, Great Britain or Italy, military aeronautics and aviation became an integral part of the pre-1914 armaments race.

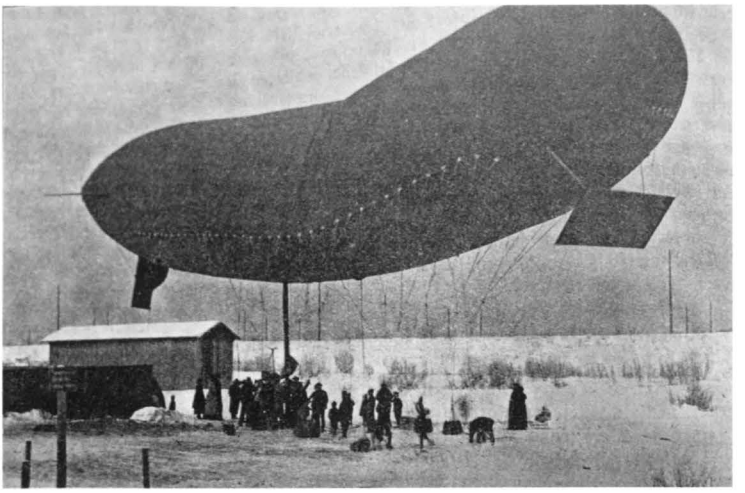
Despite the breakthrough of the airplane in 1906–1908, aerostats continued to attract public attention.[1] In summer 1910, for example, the Russian aeronaut Drevnitsky organized several public ascents in and around Riga with his hot-air balloon. During his second ascent, when

[1] The local press did not mention the temporary stationing of one of Russia's first military dirigibles, the *Krechet*, at the 9th Aeronautical Company in 1910 in Riga – see Дузь, П.Д. *История воздухоплавания и авиации в России: Период до 1914 г.* Москва, 1995, pp. 244–245.

the balloon drifted away from shore over the open waters of Riga Bay, Drevnitsky jumped from the balloon with his parachute and landed in waters near *Majorenhof* (presently *Majori*); the daring aeronaut, wearing a lifebelt made of cork, was soon picked up by local fishermen [92]. On another occasion, when parachuting from his balloon, Drevnitsky landed in the crown of a tree outside the *Montplaisir theatre* and had to be rescued by a cheering crowd [93]. In late 1910, when a film about the Swiss airship *Astra* (*Clément-Bayard* type) from Luzern was shown at the cinematographic theater *Orbis*, a local brewery felt compelled to advertise its product with the help of an airship illustration [94].

Two of Riga's aeronautical societies, which carried the term *Luftschiffahrt* (aeronautics) in their respective name, the *1. Rigaer studentischer Verein für Luftschiffahrt und Flugtechnik* (1st Riga Student Association for Aeronautics and Aviation Technology) and the *Luftschiffahrt Studiengesellschaft* (Society of Aeronautical Studies), demonstrated a limited interest in ballooning or airships. This is also valid for the *1. Baltischer Automobil- und Aero-Klub* (1st Baltic Automobile and Aero-Club) and the Riga-branch of the Imperial All-Russian Aero-Club: while the statutes of both organizations included the promotion of aerostation, few efforts were made for eventually purchasing a balloon or organizing balloon events. Free and motorized balloons, which between 1783 and 1903 were the only kind of aircraft able to lift-off the ground for any sustained period of time, started by 1910 to be overtaken by the airplane, at least among Riga's aeronautical circles where the conquest of the air belonged to the machines of Farman, Blériot or Voisin rather than the ones of Parseval, Julliot or Zeppelin.

In Riga, a notable exception to this trend was a soft-type dirigible designed by Villehad Forssman (1884–1944), an RPI-student who in 1905 had enrolled in the Department of Mechanical Engineering. In late 1905, due to the political situation, Forssman left Riga in order to continue his studies at the *Königlich-Technische Hochschule* in Danzig-Langfuhr. After his return in 1907, he started to design flying machines, from the beginning concentrating on aerostats. What had prompted Forssman's early interest in aeronautics and aviation, an interest that would dominate his life until the end of World War I, is difficult to establish. One possibility could be his contacts with Professor Johan Schuette at the institute in Danzig: in 1906–1907, when Forssman was enrolled at the institute, Schuette started to design large, rigid-type dirigibles made of wood, aircraft that were eventually ordered by the German military. In 1909, for unknown reasons, Forssman did not join the aeronautical circle at the RPI, starting to design an airship instead. According to one of the local newspapers, though, he had been one of the first in Riga who suggested building an airplane [95].



24 Forssman's soft-type dirigible, built by *Riedinger* in Augsburg, Gerstenhofen 1912.

Forssman's apparatus was from the start to be financed by some members of the 1st Baltic Automobile and Aero-Club [96]. As it turned out, though Forssman would offer his design to the Russian military.

Forssman's airship differed from Tsiolkovsky's metal aerostat, a design which became widely known at that time [97]. It did not display any radically new features despite it generally being called *the smallest dirigible in the world*. The aerostat was of the soft type, closely resembling the airship designs of the German engineer August von Parseval. It could carry two persons on flights lasting for 4 hours, an 18–22 hp engine coupled to one propeller allowing a speed of 40 km/h. Forssman believed that given this performance his craft was suitable for military reconnaissance missions. Forssman's advance to the military met a favorable response, the Main Engineering Directorate ordering one (possibly two) of his craft [98]. For the young constructor, who had not yet completed his studies, this meant a breakthrough. The dirigible, financed by the military and built by the well-known German firm *August Riedinger* in Augsburg, performed its maiden flight on 13 January 1911 at Gerstenhofen outside Augsburg; it was thereafter included in Russia's military air fleet [99].

Forssman never returned to Riga to complete his studies at the RPI, remaining for the rest of his life in Germany, at first settling down at the airfield in Berlin-Johannisthal, the cradle of German aviation. In 1913–1914, after having worked as a patent lawyer handling legal matters for airplane constructors including the later well-known Dutchman Anthony Fokker, Forssman designed and participated in the construction of a monoplane for Prince Sigismund of Prussia [100].

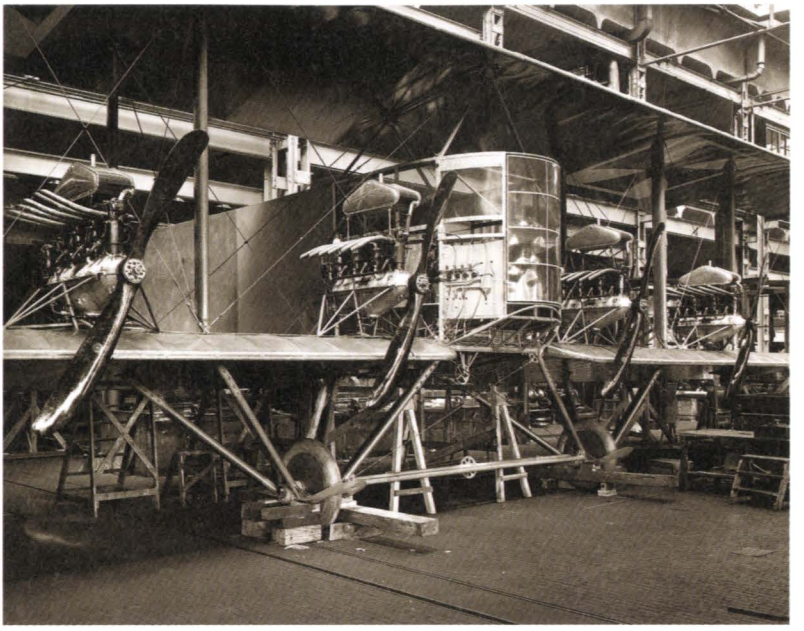
25 Forssman's *Bulldogge* monoplane, Berlin, 1914.

In late summer 1914, after war had broken out, Forssman was employed as an aircraft engineer at the *Siemens-Schuckert Werke (SSW)* in Berlin, Germany's at that time largest industrial conglomerate. There he became responsible for designing and supervising the construction of one of Germany's first so called *Riesenflugzeuge*, an airplane powered by four engines [101].

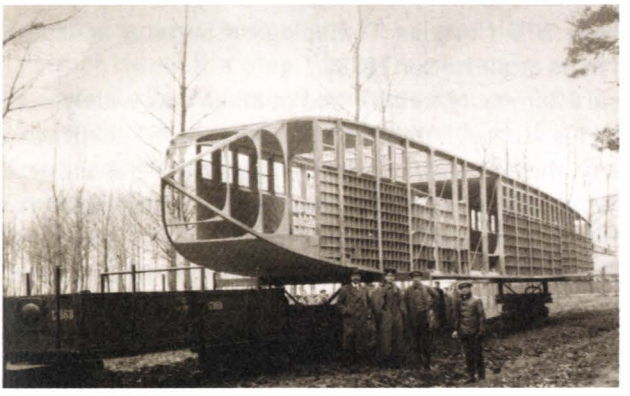
In 1916, Forssman was employed as chief aeronautical engineer by the plywood manufacturer *Brüning* in Kahl near Hanau. A special workshop was erected allowing the construction of the largest airplane ever designed up to that date, Forssman's 10-engine tri-plane bomber later called the *Poll Giant*. In 1917, the project was receiving the support of the German military, the bomber was moved from *Brüning* in Kahl to *Mannesmann* near Westhoven outside Cologne. Most likely Forssman's bomber was not completed before the war ended in late 1914. A series of photographs which show its transport from Kahl to Westhoven bear witness to the grandiose design of this extraordinary machine [102].

During Forssman's time in Cologne, *Mannesmann* together with the *SSW* and *Idflieg (Inspektion der Fliegertruppen*; English: Military Flight Inspectorate) started a new project, namely the design and construction of unmanned and remotely controlled aerial vehicles. In this quest, *Mannesmann* (Forssman) was responsible for designing the vehicle and *SSW* its guidance and flight control systems. It is still unclear if this for the time highly advanced technological project ever left the drawing board [103]. After the war, Forssman started a new career by opening a successful plywood business. In time he also registered a large number of patents, all unrelated to aeronautics [104].

Villehad Forssman, an RPI-student, despite his outstanding contributions made to early aeronautical engineering, never received any scientific or other credit for his work, neither in Russia, Germany, Sweden (he was a Swedish citizen) nor Latvia.



26 Forssman's 4-engine *Riesenflugzeug*, built by *SSW* in Berlin, 1914–1915.



27 Fuselage of Forssman's 10-engine triplane, Hanau, Germany, 1917. (Forssman second from right).

2.3.3 Aeronautical Societies in Riga

The launch of voluntary societies for promoting aeronautics and aviation in tsarist Russia started to gain momentum during 1908–1909. According to one observer, aero-clubs were popping up like «mushrooms after the rain». By spring 1910, besides the Императорский Всероссийский аэроклуб, *ИВАК* (Imperial All-Russian Aero-Club) founded in January 1908 in St. Petersburg with the aim to develop aeronautics «in all its forms and applications», aviation societies, clubs and circles took up activities in Odessa (March 1908), at the

Polytechnic Institute in St. Petersburg (March 1908), the St. Petersburg Institute of Railroad Engineers (April 1909), the Kiev Polytechnic Institute (July 1909), at Moscow's Technical University (September 1909), the Technological Institute in Kharkov (November 1909) as well as in Warsaw, Tbilisi, Rostov-on-Don, Tashkent, Novocherkassk and Elisavetgrad (Kirovograd) [105].

In Western Europe, aeronautical societies had first come forward in the mid-1860s: in 1863, the *Société de Navigation Aérienne* was founded in Paris, and in 1866 the *Aeronautical Society of Great Britain* in London. In October 1905, representatives from national aero-organizations in eight countries, Russia excluded, met in Paris to establish the *Fédération Aéronautique Internationale* (*FAI*) [1] in order to internationally co-ordinate the «art of flying» [106]. In 1909, the Russian journal *Воздухоплаватель* (Aeronaut) could report about the activities of 25 different aero-organizations in Germany alone with together more than 10 000 members, the oldest one dating back to 1882 [107]. In Russia, by comparison, the first aeronautical association, the *Петербургское общество воздухоплавания* (St. Petersburg Aeronautical Society), was instituted in the tsarist capital in 1870; it discontinued all activities already 10 years later in 1880. That same year, the *Русское техническое общество, РТО* (Russian Technological Society) added an aeronautical section to its organization [108].

The French journal *L'Aéronaute*, established in 1863, was widely read not only in France but also throughout Europe and continued publication until 1910. In Germany, the *Zeitschrift für Luftschiffahrt*, official organ of the *Verein zur Förderung der Luftschiffahrt* (Society for the Promotion of Aeronautics) in Berlin, was founded in 1883 and continued (with name changes) publication until well after 1900. In Russia, the first attempt to publish an aeronautical journal was made during 1880–1883 in St. Petersburg, when Colonel P. A. Klinder published *Воздухоплаватель* (Aeronautics) [109]. After this short-lived trial, the publication of the next journal had to wait until 1903 when Nikolai Stechkin founded one under the same name – the new *Воздухоплаватель* was published until 1916. In early 1909, a journal focusing on mechanical issues, the *Аэро и автомобильная жизнь* (Aero and Automobile World) started to be published, later that year followed by *Библиотека воздухоплавания* (Library of Aeronautics); publication of the *Библиотека* lasted until late 1913.[2]

During the pre-war period 1909–1914, five aeronautical societies were established in Riga, all with the aim to involve both members

[1] It is not clear if and when tsarist Russia joined the *FAI*; the Soviet Union joined in 1935.

[2] From No 10, 1910, the *Библиотека воздухоплавания* was called *Вестник воздухоплавания/ Библиотека воздухоплавания*.

and the wider public in aviation-related issues. All five except one, as shown further, had weak finances from the start and turned out to be short-lived. While some of the societies constructed home-made gliders, none was willing or able to acquire or operate a motorized airplane. In general, in addition to discussions and lectures organized both internally and in public, the societies' main involvement in aeronautics and aviation consisted in organizing public flight demonstrations or assisting in their execution. On one occasion, in 1911, an aeronautical exhibition was organized. Three of the organizations had close personal ties with the RPI, something that should not surprise given the technical-mechanical base of flight.

***1. Rigaer studentischer Verein für Luftschiffahrt und Flugtechnik am Polytechnikum* (1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute).** In late January 1909, the *Mitausche Landsmannschaft* (Corporation for RPI-students from Courland) called a meeting at its quarters at *Pauluccistrasse 6* (presently *Merķeļa iela 6*) to discuss aeronautics. In addition, there was another association at the institute which had informally gathered already during autumn 1908, and which was said to be building a glider, an apparatus expected to be ready by late spring 1909 [110]. While the Courland group confined itself to organizing public discussions, this latter circle took a step further by formally organizing one of tsarist Russia's first aeronautical student societies – the *1. Rigaer studentischer Verein für Luftschiffahrt und Flugtechnik am Polytechnikum / I Рижское Студенческое Общество Воздухоплавания и Техники Полета при Рижском Политехническом Институте* (1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute), founded on 8th April 1909. In a letter to RPI's Directorate dated 7 March 1909, Gumal Knopp and Friedrich Zander, both enrolled in RPI's Department of Mechanical Engineering, respectfully asked permission for starting this new venture, the establishment of voluntary organizations at that time requiring authorization from the authorities. The Directorate eventually gave its go-ahead, and also approved the statutes.

The aim of the students was basically twofold: 1) to become directly acquainted with aeronautical theory and practice by studying relevant literature, organizing scientific lectures and debates and developing future projects; 2) to construct flying machines, carry out aeronautical experiments and promote aviation among the wider public [111].

Gumal Knopp (1887–?) had graduated from the *Alexander Gymnasium* in Riga, and enrolled at the RPI in 1905 (No. 7721). Later that year, because of the political turmoil at the institute, Knopp like other students went abroad to study at the *Königlich Technische Hochschule* in Danzig-Langfuhr. In 1907, he returned to Riga while apparently

Vereinsnachrichten.

Ein akademiſcher Luftſchifferkreis hatte ſich, wie die „Riſhſk. Now." mitteilen, bereits am Anfang dieſes Jahres unter den Polytechnikern gebildet. Die Mitglieder dieſes Kreiſes haben es ſich zur Aufgabe geſtellt, die Luftſchiffahrten nicht nur theoretiſch, in Form von Referaten und Vorträgen, zu betreiben, ſondern auch praktiſch, und zwar arbeiten ſie in einer privaten Werkſtatt in Saſſenhof. Hier wird ausſchließlich von Gliedern des Kreiſes das Geſtell eines Fliegers gearbeitet, zu dem der Stoff (Flugflächen) bei der Firma „Prowodnik" beſtellt iſt. In nächſter Zeit ſoll bereits mit Probefliegen begonnen werden. Es handelt ſich in dieſem Falle um einen Gleitflieger (ohne Motor) zwecks Uebung in der Flugpraxis und Erprobung gewiſſer Ideen.

28 Short notice in the Riga press about «Knopp & Zander's» aviation association, Riga, 1909.

Утвержденъ Учебнымъ Комитетомъ
20 апрѣля 1911 года измѣненъ устава отъ
8 апрѣля 1909 г.
Директоръ: проф. Д-ръ В. ф. Книрим̀ъ.
Секретарь Уч. Ком.: проф. Б. Водзинскій.

Уставъ

I-го Рижскаго Студенческаго Общества Воздухоплаванія и Техники Полета

при Рижскомъ Политехническомъ Институтѣ.

I. Цѣль и задача общества.

§ 1. Цѣль общества состоитъ въ развитіи знаній въ области теоріи и практики аэронавтики.

§ 2. Общество — чисто студенческое и никакими политическими цѣлями не занимается.

II. Дѣятельность общества.

§ 3. Дѣятельность общества состоитъ изъ:

а) теоретической части, какъ-то: чтеніе рефератовъ, научныя пренія и предварительныя работы для построекъ;

б) изъ практической части, какъ-то: постройка аэропланов̀ъ, летательныхъ снарядовъ, другихъ относящихся къ этой области аппаратовъ и предварительныя испытанія.

Дѣятельность общества подчиняется всѣмъ изданнымъ и могущимъ быть изданными правиламъ и распоряженіямъ правительства о воздухоплаваніи.

III. Члены общества.

§ 4. Членомъ общества можетъ состоять всякій студентъ Рижскаго Политехническаго Института, имѣющій легитимаціонную карточку на текущее полугодіе.

29 Statutes of the 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute, 8 April 1909 (first page).

30 Gumal Knopp, one of the founders and President of the 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute.

staying enrolled at Danzig until 1909; if and to what extent he pursued parallel studies is not known [112]. During those years, Knopp also completed an internship at the *Kolomnaer Maschinenfabrik* (Machine Factory) near Moscow. In 1911, he started as an assistant with his department at the RPI, concurrently being a free-lance journalist for the *Rigasche Zeitung*. Knopp graduated from the RPI in 1915 with a Diploma of Engineer-Technologist. With this diverse background it hardly surprises that in spring 1909 Knopp, together with Zander, founded an aviation association. Despite Knopp having been one of Zander's closest

associates during his time at the RPI, studies about Zander have so far kept silent about Knopp.

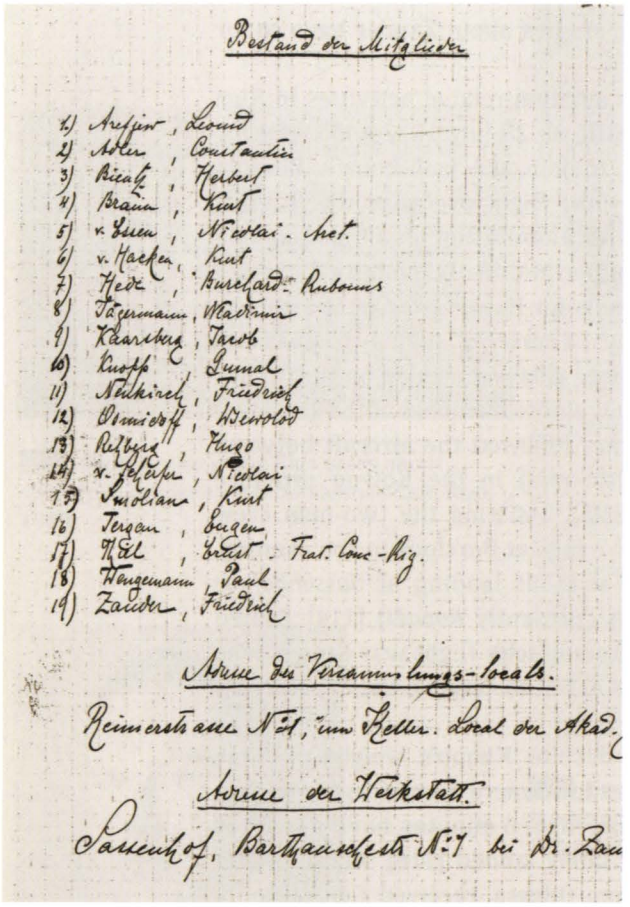
Not much is known about Knopp's aviation-related activities in Riga before, during or after World War I. Still, on 28 July 1912 while visiting St. Petersburg, Knopp was allowed to join the well-known Russian aviator Vsevolod Abramovitch on a short flight overhead the Russian capital. A few days before, on 25 July, Abramovitch in his *Wright* biplane had completed an overland flight from Berlin to St. Petersburg. Covering this distance, Abramovitch and his navigator Hackstätter were airborne for 17 hours over the course of 23 days, a series of engine troubles and other technical mishaps causing repeated delays. Included on the flight's itinerary were Russia's Baltic provinces, where members of the 1st Baltic Automobile and Aero-Club in their cars followed the aircraft between *Tauroggen* (presently Taurage in Lithuania) in the Kowno province and *Pleskau* (presently Pskov in Russia), assisting the two-man crew on their frequent landings [113]. On 12 July, at 8 o'clock in the evening, Abramovitch passed overhead Riga without landing at *Sassenhof* as planned, landing instead at *Rodenpois* (presently *Ropaži*) [114]. Seated in one of the cars, which followed Abramovitch's flight was Knopp, who on his return from St. Petersburg was asked to compile the expedition's official protocol [115].

In St. Petersburg, Abramovitch, despite Knopp's weight of some 270 pounds and also strong winds, needed a mere 33 meters for taking-off the airfield of the Russian Aero-Club. After 6 minutes, having reached an altitude of 150–200 meters, they safely landed [116]. Abramovitch, a 21-year old engineering student from Odessa, received German pilot license No. 122 on 9 October 1911 from the *Deutsche Luftfahrerverband* (Association of German Aviators). In April 1913, he fatally crashed at the Johannisthal airfield near Berlin in his *Wright* [117].

Another overland flight which involved Riga during that period was made in July–August 1913 by the Frenchman Louis Janoir on his route Paris-St. Petersburg-Paris. The aviator, who piloted a *Deperdussin* monoplane, landed at Kalep's airfield in Sassenhof on 28 July where he stayed overnight. After minor repairs, Janoir continued his journey on 31 July, accompanied some short distance by the local Russian aviator Slyussarenko on a *Farman* biplane [118].

After World War I, Knopp became a co-owner of a paper mill in Riga. In the late 1920s, beginning of the 1930s, he moved to Berlin-Wilmersdorf where he at first worked as an engineer. During the 1920s, he applied for and was granted a number of patents both in Germany and in the United States, none related to aeronautics and aviation [119]

The activities of the student association, during its short life-span, largely followed what was stated in its statutes, generally promoting



Bestand der Mitglieder

1) Arefjew, Leonid
2) Adler, Constantin
3) Bicalz, Herbert
4) Braun, Kurt
5) v. Essen, Nicolai - Arch.
6) v. Haefen, Kurt
7) Heide, Burchard - Rubbenas
8) Jägermann, Waldemar
9) Kaarsberg, Jacob
10) Knopp, Gunnar
11) Neukirch, Friedrich
12) Ossmisoff, Wsewolod
13) Rehberg, Hugo
14) v. Tiesenhausen, Nicolai
15) Smoliano, Kurt
16) Tergan, Eugen
17) Will, Ernst - Frat. Cons.-Rig.
18) Wangemann, Paul
19) Zander, Friedrich

Adresse des Versammlungs-locals.

Reimerstrasse N:1, im Keller. Local der Akad.

Adresse der Werkstatt.

Sassenhof, Bartholomäistr. N:7 bei Dr. Zan

31 List of members who joined the 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institutein 1909, handwritten by the association's secretary Friedrich Zander.

aviation among the general public, organizing lectures and debates, paying visits to airplane factories, and assisting in public flight demonstrations. From the very start the association had joined the Imperial All-Russian Aero-Club, from mid-1912 officially acting on its behalf in local air-shows by measuring airborne times, airspeeds and altitudes of participating airplanes; to that end chronometers and anemometers were said to have been purchased [120]. During 1909–1910, the association also organized bi-monthly reading sessions based on the latest available aeronautical literature.

In 1913, Vladimir Korjakov (1884–?), a member of the association from the start, gave a lecture at the RPI about «the construction and details of airplanes», later repeating his presentation in a popularized form at Riga's *Alexander Gymnasium* [121]. Korjakov had graduated from the *Kronstadt Gymnasium* before enrolling in RPI's Department

32 *Mārtiņš Dzērve*, member of the 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute.

33 Announcement of the exhibition of Arntzen & Kalep's *Wright* biplane at the *Kasino Theatre* in Riga, spring 1910, organized by the 1st Riga Student Association for Aeronautics and Aviation Technology.

of Mechanical Engineering in 1908 [122]. Another public lecture which involved one of the association's members was organized in 1912 at a congress of the *Naturforscher Verein* (Society for Researchers in the Natural Sciences) held at RPI's newly opened main building at *Elisabethstrasse* (presently *Elizabetes iela*), Gumal Knopp speaking about the theoretical foundations of flight. In the press, Knopp's presentation elicited the comment that «... except some members of the Riga Student Association for Aeronautics and Aviation Technology almost nobody else is familiar with this theory» [123].

The most widely publicized event organized by the students took place already in spring 1910 when an aeronautical exhibition opened its doors to the public on 7 March that year. In tsarist Russia, this was one of the first events of that kind ever organized, even predating the first flight made by a Russian in Russia (Efimov, 8 March 1910 in Odessa). Put on display at the *Kasino Theater* in Riga were two wooden gliders (one constructed by Bertels, the other by the student association), small-scale airplane models, and a *Wright* biplane – the star of the show. This apparatus, lyrically acclaimed by the local press as «... dieses graziöse, zierliche und empfindliche Ding, stolz, vornehm» (this gracious, delicate and vulnerable object, proud, distinguished), had arrived in Riga just eight days prior to the opening of the exhibition and belonged to Theodor Kalep and the

Danish aviator Orla Arntzen. Arntzen, as it soon turned out, would carry out the first motorized heavier-than-air flight in Riga (see further) [124]. The exhibition attracted large crowds, including the Governor of the Livonia province who officially opened the event, the province's Vice-Governor, the Chief of the Riga Police, RPI's Rector and other notables [125].

The students' ambitions regarding the design and construction of airplanes, or of other more practically oriented activities, did not turn out as expected. A biplane glider built during 1909 and displayed at the exhibition in 1910, along with practical flying attempts made by some members during autumn 1909, were the only efforts made in this direction. Limited financial resources and with time also a rapidly fading interest among the members aborted any further attempts to either build or acquire a lighter-than-air or heavier-than-air flying apparatus. An exception in this regard was the engagement of some members (names unknown) in the rebuilding of one of Slyussarenko's *Farman* biplanes after it had crashed in 1912 [126].

In the beginning of 1909, 19 students joined the association, all with two exceptions having been enrolled in RPI's engineering departments. Gumal Knopp was elected Chairman of the association, with Friedrich Zander acting as secretary. Both Knopp and Zander, as told, had left Riga in 1905 for continuing their studies in Danzig-Langfuhr. One must assume that their acquaintance dated back to that interlude, a relationship which continued after their return to Riga in 1907. Most of the association's other members had enrolled at the RPI in 1906 or thereafter, the majority coming from Riga or one of the Baltic provinces. It is noteworthy that among the first group who had joined the association two students came from inner Russia and one from Denmark. Five members also belonged to other associations in Riga: Knopp, for example, was a member of the *Fraternitas Baltica*, the oldest student corporation in town dating back to 1865.

Biographic data about members of the association is hard to come by and in some cases altogether missing. Konstantin Adler (1885–1938), for example, moved after graduation to Russia where he worked in a mechanical factory in Leningrad. In 1938, during Stalin's purges, he was arrested and eventually shot. Nikolai von Essen (1887–1919) was killed in 1919 during the struggle for Latvian independence. Boris Shemtschushin (1889–?) graduated from the RPI with a Diploma of Engineer-Technologist; many years later, in 1937, he is known to have worked as an engineer at a British-owned electricity plant in Shanghai.

Vsevolod von Ozmidoff (Riga, 1881–?), the son of Professor Nikolai von Ozmidoff, studied at RPI's Department of Civil Engineering. On 30 August 1914, during the first month of the war, he was taken prisoner by German forces and remained in captivity until November 1918. From late 1918

until 1923 he worked as a geometry teacher while completing his studies at the Polytechnic Institute in Ivanovo-Vosnesensk (presently Ivanovo) in Russia, graduating in 1922 [127]. In 1937, Ozmidoff was arrested during the ongoing purges, and in 1938 (some sources state 1941) executed. During the war, Ozmidoff's father Nikolai had remained in Ivanovo-Vosnesensk where he worked at the institute. When Vsevolod tried to stay in touch with his Latvian relatives and also sister who lived abroad he was considered an enemy of the people, which in the end led to his arrest. In 1990, Vsevolods's son Rostislav (1928–1998), an oceanologist specializing in the turbulence and motion of oceanic masses, received a professorship at the Russian Academy of Sciences [128].

Ernst Thiel (1886–?) graduated from the RPI on 28 May 1914 (on the same day as Friedrich Zander) with a Diploma in Mechanical Engineering [129]. From 1912 to 1914 he headed the *Hartgummiabteilung* (Hard Rubber Department) at the *Provodnik* rubber factory in Riga, at that time Russia's largest company of that kind. After the war, Thiel joined Kablitz's *Wärmetechnisches Büro* (Heating Technology Bureau) in Riga as an engineer. Between 1927 and 1939, before being forced to leave Latvia and move to Helmstedt in Germany, Thiel was Deputy Director at the *Kränholmer Baumwollmanufactur* (Cotton Manufacturing Plant).

Boris Taranda (1890–?) was an RPI-student who closely followed the aviation-related activities of pre-war Riga. Taranda took numerous photographs of early flights which became widely published by local journals and magazines including the *Illustrierte Beilage der Rigaschen Rundschau.* Between 1909 and 1913, before moving to RPI's Department of Economics, Taranda had studied mechanical engineering (No. 8850). In 1917, he graduated from the RPI with a Diploma of Certified Economist (*Diplomierter Kaufmann*) [130]. Taranda, it appears, never joined the 1st Riga Student Association for Aeronautics and Aviation Technology.

From the beginning, the student association attracted attention not only among the wider public, primarily by its organization of the aeronautical exhibition, but also the interest of fellow students. Membership rapidly increased to over 200. Soon, however, this early enthusiasm ceased. In March 1910, at the time of the exhibition, only 30 members were said to be still active, in late 1913 a mere 12 members remained. Among this motley group of staunch supporters only five, including Knopp and Zander, had been active from the start. As a consequence, at a general meeting held on 23 May 1913, the unanimous decision was taken to discontinue all further activities «due to a lack of interest among the younger generation of the academic youth» [131]. On 2 October 1913, in a letter to RPI's Directorate, Knopp and Zander asked to delete the association from the active list.

The 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute

(1. Rigaer studentischer Verein für Luftschiffahrt und Flugtechnik am Polytechnikum).

Membership from April 1909 – 4 February 1913 [132].

	Member-ship in 1909	Member-ship as of 4 Feb 1913	No. in RPI Student register	Place, time and field of studies [133]. Degree acquired	Born	Membership in other associations
Gumal Knopp [134]	Chair	Chair	7721	Danzig 1906–1909; Riga M 1905; 1907–1915; D*	Riga, 1887	Fraternitas Baltica**
Friedrich Zander	Secretary	Secretary	7808	Danzig 1905–1906; Riga M 1905–1906; 1907–14; D	Riga, 1887	
Leonid Arefjew	member	member	8248	Riga A1907; Ch1908–1910; L 1910–1916; D	Twer, 1885	
Konstantin Adler	member		7953	Riga M 1906–1915; D	Riga, 1887	
Herbert Bientz	member		8062	Riga M 1906–1911; 1912	Riga, 1885	
Kurt Braun	member		7844	Riga I 1905–1906; 1907–1915; D	Reval, 1886	
Nikolai von Essen	member		8000	Riga M 1906–1914; 1914–1918	Estonia, 1887	Fraternitas Arctica
Kurt von Haken	member		7907	Riga Ch 1906–1912; D	Livonian governorate, 1885	
Burchard Heede	member		7905	Riga M 1906–1912; D	Riga, 1886	Rubonia
Vladimir/ Woldemar Jägermann	member		8129	Riga M 1906–1916	Riga, 1888	
Jakob Kaarsberg	member		8079	Riga M 1906–1914	Denmark, 1885	
Friedrich Neukirch	member		7118	Riga I 1903–1910; D	Riga, 1884	
Wsewolod von Ozmidoff	member		6925	Riga I 1902–1914	Riga, 1881	

Hugo Rehberg	member	Cashier	8433	Riga M 1907–1913; D	Riga	
Nikolai von Scherffer	member		8142	Riga I 1906–1915	Voronezh, 1885	
Kurt Smolian	member		7783	Riga M 1905–1909	Riga, 1884,	Fraternitas Baltica
Eugen Tergan	member		8857	Riga M 1908–1912	1890, Dorpat	
Ernst Thiel	member		8103	Riga I 1906–1907; M 1907–1914	Fellin, Livonian governorate, 1886	Concordia Rigensis
Paul Wengemann	member	member	7971	Riga M 1906–1911	1886, Riga	
Nikolai von Wrede		member	8558	Riga M 1907–1913; D	Reval, 1889	
Martin Dsehrwe***		member	9682	Riga M 1911-1915	Courland, 1892	
Herbert Birseneek		member	8066	Riga M 1906–1911	Schlock, Livonian governorate, 1885	
Boris Shemtschushin		member	9035	Riga M 1909–1916; D	Estonia, 1889	
Sergei Shemtschushin		member	7975	Riga I 1906–1915	Reval, 1887	
Johann Ronnimois		member	8441	Riga M 1907–1914; D	Livonian governorate, 1889	
Sergei Trofimov		member	8862	Riga M 1908–1913; D	Riga, 1888	
Total number of members	19	12				

* Abbreviations used in the table: D = Diplom; CH = chemistry; M = mechnial engineering; I = civil engineering; L = agriculture.

** Knopp is not listed in the fraternity's register for this period.

*** Martin Dsehrwe/ Mārtiņš Dzērve studied at RPI (mechanical engineering) from 1911 to 1914, he continued his studies in mechanics from 1922 to 1924 at the University of Latvia, but he never graduated.

Bertels' Aeronautical Association. In March 1909, a notice appeared in the Riga press about an aeronautical association, which supposedly was active at the RPI, an organization open only to Russian and Jewish students; this association has not been noticed in historical accounts before [135]. One of the initiators was said to be an engineering student who in the local press was shortly called B. During spring and summer 1909, student B. built several gliders made of «cheap materials» which supposedly cost their constructor less than RR 30. Despite the sturdy and heavy construction of these apparatuses, B., according to press accounts, had successfully tested them at Riga beach [136].

Trying to secure finances for aeronautical experiments, including the eventual construction of a motorized airplane, interested parties in Riga were encouraged to join a public subscription, to this end contacting General Oskar von Bertels. Hence, student B. was identified as Alexander Bertels, the general's son. Born in 1886, Alexander had graduated from the *Орловская гимназия* (Orel High School). Before enrolling in RPI's Department of Civil Engineering in 1907 Alexander had lived in St. Petersburg. In 1909, he switched from civil to mechanical engineering [137]. Like with Knopp and Zander's association, not much is known about Bertels and his group, except for some brief notices in the press about his flights in 1909. It appears that the association was not accredited with RPI's Directorate. Bertels' plan to build a motorized airplane did not materialize.

During pre-war times, restricting membership in voluntary societies on ethnic grounds was common practice. In 1908, there were 38 voluntary associations accredited with the RPI pursuing a wide variety of different purposes including the study of scientific subjects, music, sports, gymnastics, literature or mutual assistance. Besides, there were social clubs exclusively open for Germans, Latvians and Jews, as well as for students coming from different Russian regions such as Courland [138].

Students who joined Knopp & Zander's or Bertels' group were not the only ones taking a closer interest in aeronautics and aviation. In late 1909, for example, a newly founded *Technischer Zirkel* (Technological Circle) called a meeting at the *Mirage* theatre in order to discuss aeronautics, at the same time demonstrating different types of dirigibles. In November 1909, this circle was known to have over 200 members. A visit by members of the circle to the Riga Steelworks headed by Professor Denffer from the RPI indicates, however, that aeronautics constituted but one element in the circle's technological interest [139].

Riga Aero-Club. In early February 1910, a short notice in one of the local newspapers informed about a meeting to be held at the *Gizycki Halle* at *Sand Strasse* (presently *Smilšu iela*) in Riga, the aim being to prepare

the foundation of an aero-club. The meeting was said to be organized by I. A. Inosemzev. Ten days later, another meeting apparently adopted the club's statutes. A commission for presenting these statutes to the authorities was elected and included I. A. Inosemzev, A. N. Jablonev, the President of the Russian Educational Society Nikolaev [140], as well as Theodor Kalep, the Director of the *Motor* factory [141].

On 14 April 1910, the Governor's office in Riga examined the statutes of various newly founded societies including those of *Riga Aero-Club* (possibly the organization formed by Inosemzev, Kalep and others) [142]. Not much is known about the club's further activities. In any case, it was not identical with the Riga-branch of the Imperial All-Russian Aero-Club that started its activities in March 1910 [143].

Riga-branch of the Imperial All-Russian Aero-Club. On 7 March 1910, on the day of the opening of the aeronautical exhibition organized by the students, the authorities granted permission to open a Riga-branch of the Imperial All-Russian Aero-Club (founded in January 1908, St. Petersburg). A first meeting was held on 12 March in the local garrison with more than 80 persons attending. Membership, according to the statutes, was restricted to Russians, the first board of directors consisting of the General of Infantry Oscar von Bertels, the club's President, a lieutenant-general and a lieutenant-colonel, with a sub-lieutenant acting as secretary. The aim of the club, besides promoting aviation among the wider public, was to acquire a motorized airplane, two gliders and a balloon [144]. Already the previous year, in April 1909, Bertels had publicly supported the idea of establishing a branch in Riga for the purpose of supporting the build-up of a Russian air fleet [145]

In April 1910, the Riga-branch formed two commissions, one for scientific and technical questions, and a sports commission tasked to organize flight competitions, exhibitions, air races, theoretical and practical experiments, consultancy services and aviation awards. Members of these two commissions, both chaired by von Bertels, were military officers with the exception of von Bertels' son Alexander. That year a decision was taken to build a glider for flying exercises, and to contact the authorities in St. Petersburg asking for two more flying apparatuses intended for officers at military encampments in Riga [146]. By September 1910, ambitions running high, officers from the Peter Military Camp were said to have built a glider baptized *Riga*; the apparatus was successfully tested by officers at an airfield specially prepared along *Kalnezeemschen Strasse* (presently *Kalnciema iela*) in Riga [147].

In October, it was decided to prepare a proper airfield located at a military exercise ground located along the Petersburg Chaussee, and to purchase a motorized airplane. For this purpose, a subscription among

the members was planned to raise RR 25 000, a sum made up of personal loans which in time were to be redeemed, possibly with interest, from the revenue generated by organizing public flight demonstrations. Until the end of 1910, membership increased to 104. At that time the club's library kept some 50 volumes [148].

Acquisition of a motorized airplane, or an aerostat, appears to have remained on the club's wish list. In early spring 1912, local newspapers reported that the Riga-branch had ceased to exist, that it had «wilted away» [149].

1. Baltischer Automobil und Aero-Klub **(1st Baltic Automobile and Aero-Club).** In summer 1910, a fourth aero-organization was founded in Riga, the 1st Baltic Automobile and Aero Club, a private organization which among its planned activities included both automobiles and aviation. A constituent meeting was held on 7 July 1910, the governor having sanctioned the statutes already beforehand on 29 May [150]. The establishment of this organization signaled that aviation had made its entrance into the highest circles of the province. In spring 1913, Count N. D. Kropotkin was elected as the club's president, while six out of nine directors had been recruited from among the Baltic nobility; the only exceptions thereby were Eugen Feitelberg, the owner of a car dealership and garage, A. Frey and W. K. Bronovsky. Added to this illustrious circle that year were Her Imperial Highness Grand-Duchess Viktoria Feodorovna as Honorable Member, and His Imperial Highness Grand-Duke Kyrill Vladimirovitch as Honorary President. A year later, the list of honorary members was extended to include King Gustav III of Sweden and other Swedish royals [151]. In August 1913, the directorate proudly announced that by permission of the highest authority the club had the right to call itself the *Kaiserlicher Baltischer Automobil- und Aero-Klub* (Imperial Baltic Automobile and Aero-Club) [152].

The *Baltische Sport-Zeitung*, first published in May 1913, became the club's official organ. That same month, the club purchased a house at *Schulenstrasse 3a* (presently *Skolas iela 3a*) in central Riga for RR 80 000, furnishing it according to proper standards. In early 1913, members of the club, 118 in total, together owned 92 automobiles. One year later, membership had increased to 170 including 10 honorary members. Only 35 members lived in Riga, 103 coming from other Baltic provinces, 13 from St. Petersburg, 14 from Russia's North-Western provinces and five from abroad. The number of cars owned by members by now had increased to 130 [153]. At that time, it can be recounted, the total number of registered automobiles in Riga was 300, compared to 2 654 in St. Petersburg and 1 608 in Moscow [154].

Automobile-related activities such as car races and overland tours dominated the club's activities, with aeronautics and aviation relegated


I. JAHRGANG. HEFT 12.

BALTISCHE

30 K.

SPORT-ZEITUNG

INHALT: Neun Jahre Herrenfahrer in Russland — Werstreunen bei Moskau. — Pariser Automobil-Salon 1913. — Vom Automobilkongress in Paris. — In welchen Fällen wird das Platzen der Vorderreifen gefährlich? — Zur grossen schwedischen Automobilwinterfahrt. — Aus Industrie und Technik. — Die Riesenflugmaschine von Sikorsky. — Zentrierung von Flugzeugen. — Auf dem »Seebären« nach Finnland — Pferdezucht und Gestütswesen. — Verschiedene Sportnachrichten.

34 *Baltische Sport-Zeitung* (No. 1, 1913), official organ of the 1st Baltic Automobile and Aero Club.

at the sidelines. Early attempts to financially support the construction of an airship, the above mentioned Forssman-project, came to naught when the constructor instead of the club turned to the military. The club never engaged in any public or other discussions about flight, or carry out any practical experiments with flying apparatus; however, it avidly supported the organization of public air shows and other promotional activities.

In May 1912, the club launched three aviation trophies in order to stimulate the art of flying in the Baltics. Thereby, certain flight records had to be broken for receiving a trophy and the attached financial reward: 1) airborne time: longer than 33 minutes; 2) altitude: higher than 500 meters; and 3) female aviators: airborne longer than 2 minutes [155]. At that same time, also the 1st Riga Student Association instituted a trophy, to be awarded to aviators able to stay airborne longer than 60 minutes. As suggested by those criteria, expectations in Riga compared to records set on the continent (since 1905 certified and registered by the *FAI* in Paris) were rather modest.

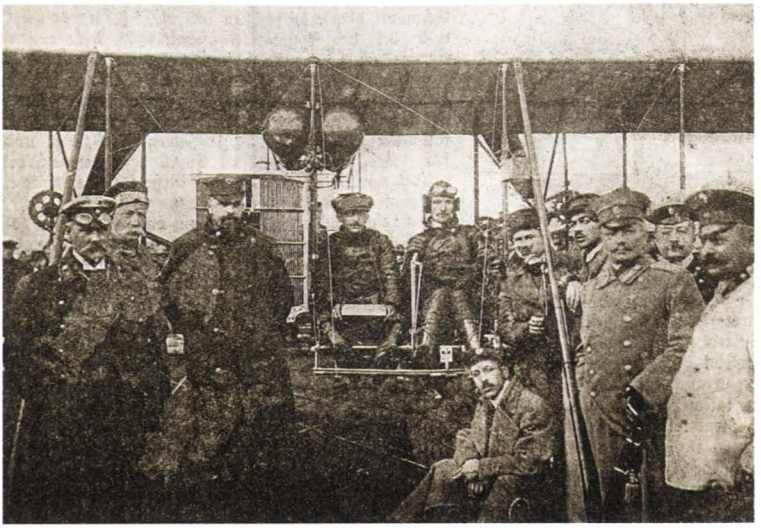
In summer 1913, the club participated in the opening of Slyussarenko's flight school in Riga, details of its financial engagement in this venture remaining unknown [156]. The following year, in 1914, the manifold activities of the club appear to have necessitated a re-organization. The directorate remained unchanged while a number of new sections and commissions were instituted for handling different activities: Section 1 (Tourism); Section 2 (Club inventory); Section 3 (Publishing); Section 4 (Club tours, excursions and exhibitions); Technical Commission; Commission for the examination of pilots

35 Conference room of the 1st Baltic Automobile and Aero Club, Riga, 1913.

and airplanes; and Auditors [157]. Of special interest thereby is the Aeronautical Commission headed by Count Kropotkin together with Vice President A. von Transehe and Eugen Feitelberg. On its institution, the club officially took over responsibilities previously held by the Riga-branch of the Imperial All Russian Aero-Club.

Considering the price-tags for airplanes in pre-war Europe (8 000–12 000 Reichsmark for a 50-hp aero-engine, or an airplane without engine; RM 8 000 for one of the cheaper airplanes (25-hp engine); RM 36 000 for a more powerful 100-hp aero-engine; RM 16 000 to RM 24 000 for a monoplane equipped with engine, the final price depending on the type of engine and other equipment), the only voluntary aero-organization in Riga able to raise this amount of money would have been the 1st Baltic Automobile and Aero-Club [158]. However, as told, this never happened, aviation being watched from the grandstand rather than actively practiced in cockpits.

Luftschiffahrt Studiengesellschaft **(Society for Aeronautical Studies)**. The Riga-press briefly mentioned one more aero-organization, the Society for Aeronautical Studies founded in early 1910. According to some journalists, «this can be noted with satisfaction, as no more lively activity in this timely issue has been noted» [159]. The list of the society's members included in addition to two professors from the RPI, namely Edmund Pfuhl and Charles Clark, also Baron von Maydell, R. Freysinger, A. Leutner and Th. Kalep. The professed aim of this circle was to support studies relevant for the further development of aeronautics and aviation, to acquire an airplane and to organize



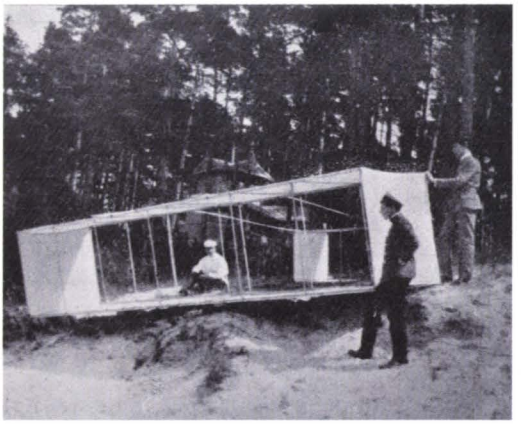
36 Russian aviator Abramovitch on his *Wright* biplane (sitting in the pilot seat to the right, with goggles) and representatives from the 1st Baltic Automobile and Aero-Club, Riga, July 1912.

flight demonstrations. It was also planned to join the Imperial All-Russian Aero-Club at a later stage [160]. Further information about this organization is still missing.

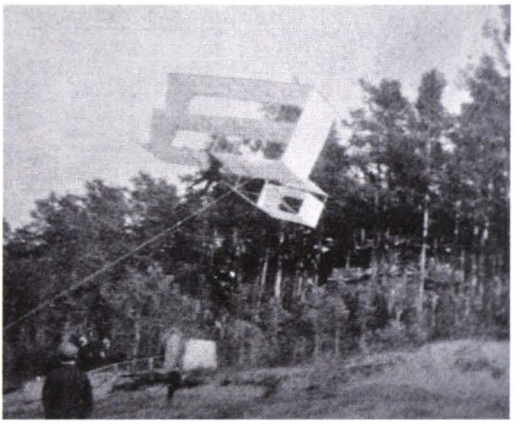
2.3.4 Flights with Gliders and Airplanes

In pre-war Riga, like in other parts of tsarist Russia, first attempts to take to the air with fixed-wing aircraft involved gliders. In Riga, the first one to try his luck appears to have been Alexander von Bertels, an engineering student. In mid-1908, according to press reports, he successfully carried out a number of short aerial jumps in the sandy dunes of Riga beach with two of his home-built gliders. Bertels used a box-kite design to construct his bi- and triplanes, the fabric-covered wings having flat and not curved surfaces generally used to generate lift. Bertels' flights, whereby the aviator was pulled up into the air against the wind by ropes hanging down between the wings, reached heights of up to 10 meters over distances of 20–35 meters [161]. In spring 1909, as told, Bertels organized an aeronautical society among RPI-students. In 1910, he joined the Riga-branch of the Imperial All-Russian Aero-Club where his father was President.

In March 1909, news leaked out that an aero-organization active at the RPI was in the process of completing the construction of a flying apparatus, the first and as it turned out only practical project carried out by members of the 1st Riga Student Association for Aeronautics and Aviation Technology at the RPI [162]. In early October, the wooden glider was said to be still under construction in Riga Sassenhof, at the private



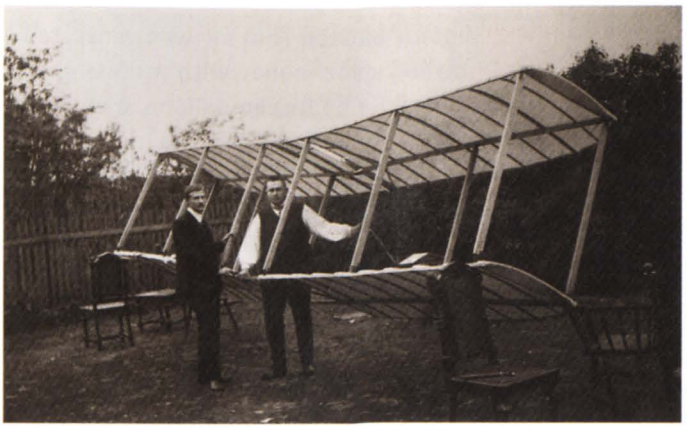
37 Alexander von Bertels' biplane glider, *Jūrmala* beach outside Riga, summer 1909.



38 Alexander von Bertels' triplane glider, *Jūrmala* beach outside Riga, summer 1909.

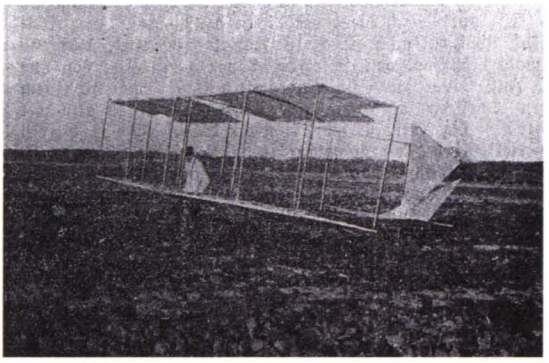
home of the association's secretary Friedrich Zander. Flight trials were expected to take place in the near future [163]. Different from Bertels', the glider built by the students was based on a biplane design originally drafted by Professor B. N. Delaune from the Kiev Polytechnic Institute. Its wings were covered with special fabric from the *Provodnik* rubber factory in Riga and had curved surfaces for achieving lift [164]. Later that year, construction having been completed, more than 200 flying attempts were said to have taken place by members of the association, the daring aviators taking to the air at Riga beach using some sort of a wooden platform for the start [165]. In March 1910, the glider was put on display side by side with Bertels' and Kalep's *Wright* biplane at an aeronautical exhibition organized by the students [166]. After that event, further interest in the apparatus, in another flying machine, or in flying experiments appears to have faded, no more attempts being mentioned in the press [167].

In November 1910, the *Rigasche Zeitung* reported about a biplane glider constructed by V. M. together with the Engineer H. S., both members of the *Kaiserwald Sport Klub*; the apparatus was said to have been built on the premises of the club's yacht section. For the construction of the fuselage spruce was used, while the surfaces of the wings (arched 1/18 in width) were covered with nettle fabric. Structural strength of the wing-frame was achieved by installing six vertical ribs (which were said to be easily changeable) tightened by 1.5 mm steel-wire. At the tail section a vertical rudder was installed. Lateral control was achieved by the installation of ailerons instead of relying on the



39 Zander (left) and Gumal Knopp, Chairman and Secretary of the 1st Riga Student Association for Aeronautics and Aviation Technology of the Riga Polytechnic Institute, holding the wing-pair of a glider built by members of the association, Riga-Sassenhof, Zander residence, 1909.

40 Wing-pair for a glider built at the Zander residence at *Bartschenstrasse 1* (presently *Bārtas iela 1*), autumn 1909.



41 Biplane glider built by V. M. and Ing. H. S. from the *Kaiserwald Sport Klub*, Riga, 1910.

usually employed method of wing-warping (patented by the Wright brothers) [168].

In September 1910, the local press reported that members of the Riga-branch of the Imperial All-Russian Aero-Club had completed the construction of a glider (baptized *Riga*), an apparatus (design unknown) built at the Peter Military Camp. Flying attempts took place at Kalep's airfield in Sassenhof and the *Kurtenhof* military installation [169].

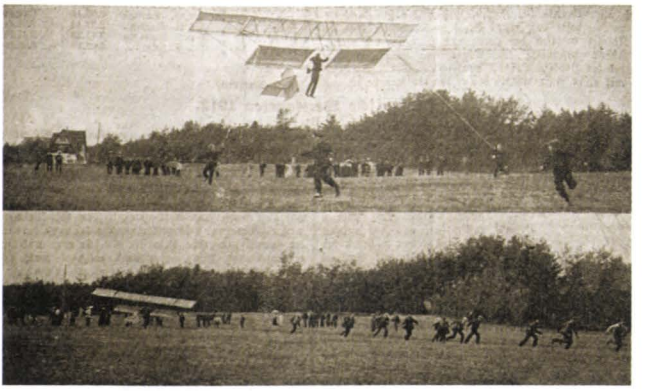
Kārlis Skaubītis (1889–1929) from Krustpils, an aviation enthusiast of the early days, is said to have built a quadruple-type glider as well as a

hot-air balloon (hot air was generated by the burning of straw). Having earned some money with professional wrestling, *Skaubītis* was also able to build a hydrogen balloon, a craft, which he supposedly used in 1912 on a tour through Russia performing balloon ascents and parachute jumps. At the beginning of the war, *Skaubītis* joined the Russian Flying Corps [170]. Some authors have also mentioned that Skaubītis built a biplane [171]. However, the local press never took any notice of *Skaubītis'* quadruple glider, hot-air balloon, hydrogen balloon or biplane; there also was no mention of his balloon ascents or parachute jumps.

In 1911–1914, *Pēteris Ābrams* (1890–1924), *Kārlis Vīzinš* and *Treibergs,* young students from Riga, built a biplane glider said to have been successfully tested outside Riga, efforts which went unnoticed by the local press. Attempts to obtain an aero-engine for building a motorized craft were cut short by the outbreak of war, when both *Ābrams* and *Vīzinš* joined the Russian Flying Corps [172]. During that same period, also *Jānis Šūmanis* from Riga is said to have built a glider. Starting in 1910, *Šūmanis* supposedly demonstrated his apparatus on many occasions in public, events, which passed wholly unnoticed by the local press. When war broke out, also *Šūmanis* joined the Russian Flying Corps [173]. Less successful than *Šūmanis'* are said to have been the attempts of *Vilis Balcers* and *Rūdolfs Celms* (1894–1984) in trying to construct a biplane glider, an attempt which went unnoticed. During World War I, *Celms* served in the Russian Flying Corps. After the war, he at first signed up with the Latvian Air Force, later joining Latvia's first commercial airline, the *Latvijas Gaisa Satiksme* (Latvia Air Transport) established in Riga by the German firm *Junkers* [174].

Oļģerts Teteris (Riga, 1890–1917) enrolled in RPI's Chemistry Department (Reg. No. 9497) in 1910. Like other students at the institute, he took an early interest in aviation, supposedly having built his own glider and testing this apparatus on hillsides outside Riga. Again, nothing about these attempts ever reached the local press. When war started, Teteris joined the Russian Flying Corps and was in time highly decorated for bravery; he was killed in battle in 1917 [175].

In summer 1912, a glider built by the high-school student A. Rosenthal took to the air at the *Kaiserwald* outside Riga. Thereby, eight men, four on each side, pulled the apparatus upwards against the wind with the help of 16 meters-long ropes. Rosenthal's wooden construction, the wing surfaces (24 m^2) were covered with canvas, was able to carry a load of 320 kg. On one of his attempts the young aviator even took along a passenger. His longest flight lasted for 3 minutes 15 seconds [176]. In 1913, Rosenthal successfully carried out flights with his own motorized airplane (see further) [177].



42 Rosenthal's biplane glider, 1912.

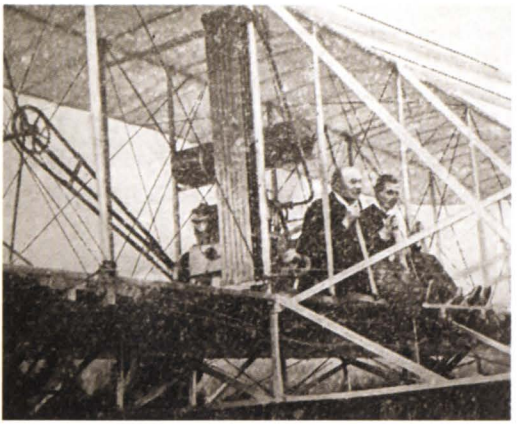
2.3.5 Flights with Motorized Airplanes

In Riga, flights with fixed-wing motorized aircraft, events, which became increasingly common in Western Europe after Santos-Dumont's first jumps in 1906, had to wait until spring 1910. A planned demonstration flight by the Frenchman Albert Guyot (on a *Blériot XI*) on 8 November 1909 in Riga, advertised in the local press, never materialized: Guyot's apparatus had gotten damaged in an aerial demonstration in St. Petersburg some days earlier [178].

In tsarist Russia, like other European countries, first flights with motorized airplanes involved foreign pilots on French or German machines. In Riga, this trend was partly broken – the first (unofficial) flight on 14 May 1910, involved not a Frenchman but the Danish aviator Orla Arntzen, a 28-year old lawyer piloting a *Wright* biplane built in Germany and purchased in early 1910 by Kalep and Arntzen. After displaying the *Wright* in public at the aeronautical exhibition in Riga mentioned earlier, Arntzen's first public flights followed on 30 May 1910 [179]. This event broke the ice also in Riga, flights in public soon turning into spectacles, which attracted large crowds, with foremost Russian aviators performing ever more advanced aerial stunts.

In 1910, altogether 13 flights were carried out in public, most at the *Solitude* racetrack outside Riga. During June–July that year, in addition to four attempts by Arntzen on his *Wright* there were nine flights by Meybaum on a *Grade* monoplane, an airplane owned by Leutner. Thus, Meybaum has been credited for having been the first local aviator piloting a motorized airplane in Riga.

Flights performed in Riga during 1911–1914, in addition to the ones with Kalep & Arntzen's *Wright*, a monoplane built by Kalep, Leutner's



43 Theodor Kalep (left in the pilot-seat) and the Danish aviator Orla Arntzen in their *Wright* biplane, Riga, June 1910.

Erster Schauflug
in Riga.

Aufstieg des Wright-Fliegers Dr. Orla Arntzen
Sonntag, den **30. Mai** a. c.
zwischen **6—7** Uhr abends
auf der **Traberbahn** an der verlängerten Antonienstrasse,
Ecke der Ritterstrasse.

Preise der Billette:

Ganze Logenplätze à 6 Person	Rbl. 15.—
„ „ à 4 „	„ 10.—
einzelne Logenplätze	„ 3.—
Tribünenplatz	„ 2.—
Sattelplatz	„ 1.—

Die Inhaber von Logen- und Tribünenplätzen haben das Recht zum Startplatz zu gehen.
Vorverkauf der Billette in der Konditorei **A. Kreepsch,** im grossen und kleinen Wöhrmannschen Park.
Sollte wegen schlechten Wetters oder Motordefekts ein Flug nicht stattfinden können, so behalten die Billette ihre Gültigkeit für den nächsten Schauflug.
Die Kasse wird um 4 Uhr geöffnet.

44 Announcement for the first public flight demonstration in Riga, performed by the Danish aviator Orla Arntzen on a *Wright* biplane, Riga, 26 May 1910.

Sonnabend, den **26.** und **Sonntag,** den **27. Februar,** um **5** Uhr nachmittags **Aeroplanaufstieg**
des Blériot-Piloten

A. Kusminski.

Der Billettverkauf findet im Hôtel „Imperial" v. 10—8 U. statt. Die für den 23. Februar gelösten Billette haben für **Sonnabend** Giltigkeit.

45 Announcement for the Russian aviator A. Kuzminki's public flight demonstration, Riga, 26–27 February 1911.

Grade, Feitelberg's *Blériot*, *Sommer* biplanes built by the *RBVZ* and Slyussarenko's *Farmans*, are described further in this section.

Starting in 1911, in addition to flights on the airplanes of local owners, or ones built in Riga, an increasing number of air-shows in and around town were organized by aviators from outside town. An apparent inactivity of local pilots in combination with an apprehension shown by local aircraft owners, all said to be afraid of accidents, soon came under public criticism. Therefore, in early February 1911, the local press warmly welcomed an announcement by the Russian aviator Alexander Kuzminski[1] to organize an air-show with his *Blériot* [180]. Alas, high expectations among the public were soon shattered when Kuzminski either failed to take-off or had to cancel one show after another because of technical problems, unsuitable weather or difficult conditions on the ground. Many felt that a more stringent organization

[1] Kuzminski (born 1881, Kharkov) received Russian pilot license No. 18 (*FAI* license No. 227) on 19 November 1910.

was required surrounding these events, local aero-organizations being called upon to take greater responsibility [181].

By mid-March 1911, after a number of mostly failed attempts by Kuzminski, the following public performances were recorded:

1) Meybaum, *Grade*, 7 July 1910, duration 0:56 min, altitude 8 m;
2) Kuzminski, *Blériot XI*, 5 March 1911,1:50 min, 25 m;
3) Smit, *Sommer*, 6 March 1911, 3:44 min, 80 m;
4) Smit, *Sommer*, 10 March 1911, 9:37 min, 170 m [182].

For whatever reason, Arntzen's attempts from April-May 1910 had been excluded from this list.

Kuzminski's failures soon ran into heavy criticism [183]. With shows cancelled one after another – was he possibly trying to fool the (paying) public? On 21 March 1911, a journalist who had followed the Russian's exploits at close quarters had enough, bursting out: «It is an unprecedented thoughtlessness to bother the audience with such amateurish attempts as practiced by this gentleman» [184]. In mid-April, when Kuzminski moved from Riga to Libau, no one was sorry to see him leave. There, on Courland's west coast, his showmanship appears to have continued unabated, the daring aviator, on his second attempt – on his first he had reached an altitude of some 10 meters – steering his *Blériot* into the waters of the Baltic Sea, all further attempts having to be cancelled. Different from Riga, though, this episode entailed legal repercussions, the organizers claiming RR 3 000 in damages [185]. During autumn that year, Kuzminski, after performances in Tula and Kaluga, planned to return to Riga. This time around his machine was to be a *Blériot XI*, an airplane part-owned by Alexander Grahe who had studied engineering at the RPI (1897–1905) and who was a member of the 1st Baltic Automobile and Aero-Club [186]. As it turned out, though, Kuzminski never returned to Riga.

More successful than Kuzminski was his countryman Sergey Utochkin (1876–1916),[1] who in June 1911 arrived in Riga [187]. Seemingly effortlessly, Utochkin took his *Farman* biplane into the air already on his first public appearance, circling high above the many-headed crowd. After this first flight the aviator, wearing a tuxedo and polished boots while smoking a cigar, took-off three more times together with passengers, endearing him to the spectators and assuring his reputation as a serious sportsman [188]. Utochkin, who after Riga had planned to move on to Odessa, was convinced by the officials of the 1st Baltic Automobile and Aero-Club to prolong his stay in town, an initiative warmly applauded in the press «... because no aviator

[1] Utochkin received Russian pilot license No. 34 on 1 January 1911; see *Вестникъ воздухоплавания*, 1911, No. 5, p. 35.

Schauflüge

veranstaltet vom Baltischen Automobil- und Aero-Klub.

Schauflüge Utotschkins

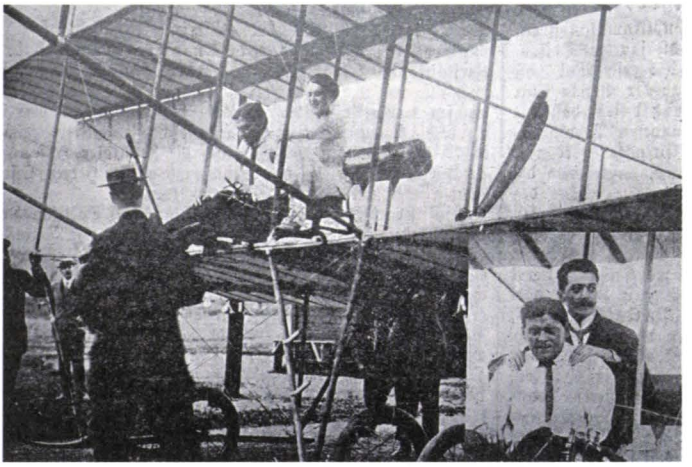
auf Farman- und Blériot-Apparaten

Sonnabend, den **18.** und **Sonntag,** den **19.** Juni, 8 Uhr abends, am **Strande** beim **Edinburger Kurhaus.** Die Kassen an der Grenzstrasse und am Strande sind von 5 Uhr nachm. geöffnet. Billettpreise: 2 Rbl., 1 Rbl. und 50 Kop. Die Schauflüge finden unabhängig vom Wetter statt.

Voranzeige: Dienstag, den 21. Juni, findet um 8 Uhr abends **ein Schauflug in Riga** auf der Traberbahn statt und **Mittwoch,** den 22. Juni, bei günstigem Wetter ein **Ueberlandflug von Riga nach Mitau** und Schauflüge in Mitau auf der Biemannschen Wiese.

Der Ueberlandflug wird von Automobilen des Klubs begleitet werden. — Passagierflüge finden nur bei einer Windstärke statt, die 6 Sekundenmeter nicht übersteigt. — Für einen Passagierflug sind 100 Rbl. zu zahlen.

46 Announcement for the Russian aviator Utochkin's flight demonstrations on *Farman* and *Blériot* airplanes, Riga, 18–19 June 1911.



47 Utochkin on his *Farman* together with Baroness Marcella Leitner, Riga, 12 June 1911. (Leitner was the first woman to fly in Riga; the smaller picture shows Utochkin and his passenger W. Kauffmann).

appears to be more qualified to attract new friends for aviation than the splendid Russian pilot Utochkin» [189]. Profits generated by organizing Utochkin's shows, the charge for following along as passenger on a flight was RR 100, the club planned to invest in an aircraft, a plan which in the end did not materialize. Further flights along Riga beach and at Solitude went well, Utochkin, in addition to performing aerial stunts, carrying numerous locals as passengers, among them Baroness Marcella Leitner and Mrs. Engelmann. An overland flight from Mitau to Riga, however, had to be discontinued – having been forced to make an intermediate landing because his hands started to freeze, the landing gear of the *Farman* was broken at take-off caused by obstacles on ground.

Utochkin's airborne time on his solo-flights in Riga that summer summed up to 58 minutes 11 seconds, on his flights with passengers to 28 minutes 26 seconds [190]. In 1909, Utochkin, originally a bicycle racer and balloonist, built a *Blériot XI* type monoplane equipped with a 35-hp Anzani engine; parts of this engine Utochkin had received from Louis Blériot when visiting France. After having made some few flights the

48 Baroness Leitner crashed when piloting a biplane of the *Luft-Verkehrsgesellschaft*, 22 February 1912, Berlin-Johannisthal.

49 Gordian Hösli in the cockpit of an *Etrich-Rumpler Taube*, 1912. Hösli fatally crashed on 18 April 1912 at Berlin-Johannisthal.

50 Local Riga-pilots Martoglio (*Blériot*), Th. Flégier (*Sommer*) and M. Trautmann (*Wright*), Riga 1911.

machine was apparently stored in a warehouse. In this connection it was noticed in the Riga press that Utochkin had built this machine together with an aviator from Riga, unfortunately without mentioning any name [191].

Plans by the aviator Gordian Hazly (also *Hösli*) to visit Riga during summer 1911 for demonstrating his *Etrich-Rumpler Taube*, one of the most advanced monoplanes at that time, came to naught. On 4 September 1911, Hazly received German pilot license No. 104, flying on an *Etrich-Rumpler Taube* at Bork in der Mark [192].

In 1911, Utochkin took a clear lead among the group of 9 aviators who that year had performed public flights in Riga, in addition to Utochkin also Smit, Flégier and Kudashev from the *RBVZ*, Schuchhalter from *Motor*,

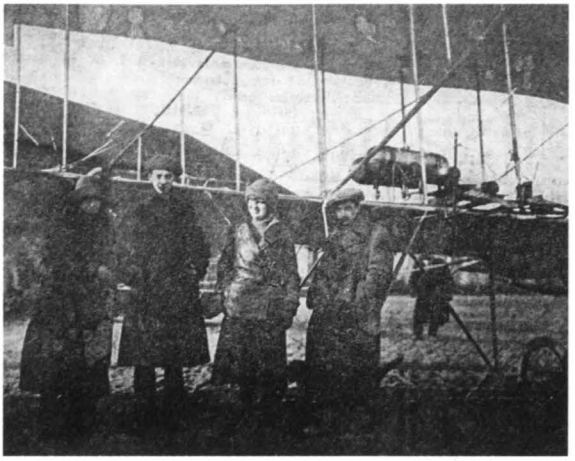
as well as Trautmann, Meybaum, Porokhovshchikov and Kuzminski. Out of 60 flights that year noted by the press, Utochkin had performed 29, or almost half. It needs to be mentioned that 60 reported flights represent a bare minimum, many test-flights having been neither noticed in public nor recorded by the press.

In an international context, flight activities in Riga that year as compared to similar events in Europe show that Riga had some way to go before catching up. While Utochkin on his Mitau-Riga attempt had flown a distance of 15 km, at that time the longest flight ever made in the province, the Frenchman Fourny on his *Maurice-Farman* had covered a distance of 720 km, staying airborne for 14 hours. While Smit and other local aviators had climbed to altitudes of some 100 meters, the Frenchman Roland Garros flying a *Blériot* had reached 3 910 meters [193].

Among the 592 pilots who until spring 1911 had received a pilot license according to regulations stipulated by the *Fédération Aéronautique Internationale* (governmental regulations were still missing) 35 came from Russia. With regard to aerostats (balloons and airships), 5 licenses out of 1 150 issued in total were held by Russians [194].

In 1912, the number of demonstration and other flights carried out in Riga increased to around 80, the exact number being unknown due to many trial- or test-flights not having been recorded. However, it seems clear that the two front-runners that year with regard to take-offs were the Russian F. Koltchin on his *Farman* with 44 flights followed by the Russian V. Slyussarenko (1888–1969) on a *Farman* with 18 flights. Neither the *RBVZ*, which in late 1911 had relocated its aviation branch to St. Petersburg, nor *Motor*, which had started to concentrate on aero-engines, were any longer participating in public air-shows. Also, the two airplanes owned by Leutner (*Grade*) and Feitelberg (*Blériot*) had somehow gone missing. Most public flights that year still took-off from the racetrack at Solitude, with Riga beach becoming increasingly popular for organizing public events. Some aviators also started to use an open field at Spilve, a terrain, which during World War I was turned into the governorate's first official airfield [195].

In 1912, the airspace overhead Riga, like in the year before, largely belonged to outsiders, or foremost Russian showmen trying to make a living by performing in front of increasingly sophisticated and demanding crowds. Among the aviators that year, besides Koltchin and Slyussarenko, were Mikhail Grigorashvili (1888–1953), a student and pilot-instructor from the Imperial All-Russian Aero-Club with 9 flights on a *Blériot*, Naval-Lieutenant Viktor Dybovsky (1884–1955) with 2 flights on a *Nieuport*, an unnamed naval officer with 2 flights, Ljubov Galantchikova (1889–1961) with 1 flight on a *Farman*, Lidiya Zvereva-Slyussarenko (1890–1916)



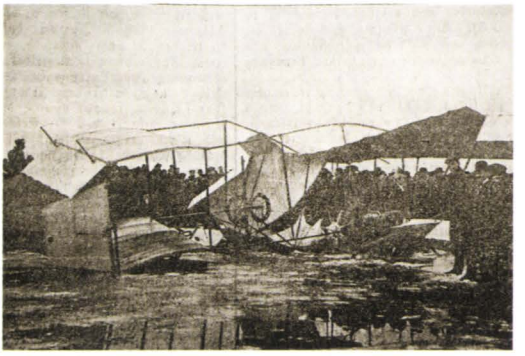
51 Russian aviators in Riga: from left Koltchin (2nd), Galantchikova (3rd), Slyussarenko (4th), April 1912.

with 1 flight on a *Farman*, and Vsevolod Abramovitch (1890–1913) on his overland flight Berlin-St. Petersburg via Riga [196].

On 5 July 1912, Grigorashvili broke both the altitude and endurance record for the Baltic provinces, climbing to 1000 meters and staying airborne for 36 minutes 26 seconds; the flight took place at Edinburgh along Riga beach [197]. During that year, some of the public performances went exceedingly well, aviators being cheered by crowds and at times carried on the shoulders of enthusiastic spectators. On other occasions, however, shows had again to be cancelled, one of the reasons being a lack of paying onlookers. One flight hour with a *Farman* biplane powered by a *Gnôme*-engine[1] cost around RR 30, forcing organizers and aviators to closely monitor the number of tickets sold before opening a show [198].

Also crashes occurred that year, none causing any serious injuries. On 1 April, for example, Zvereva-Slyusarenko and her husband took-off on a *Farman* at Solitude in front of a large crowd, with Zvereva at the controls. Trying to make a turn in windy conditions the apparatus crashed from a height of 20 meters. While both aviators were able to walk away unharmed, the *Farman* was damaged [199]. On 19 April, a spectator threw a stick at Galantchikova's low-flying *Farman* causing the aviator to crash into a nearby fence. Galantchikova, who for a short while lost consciousness, was luckily enough only lightly injured, while her apparatus was severely damaged [200]. On 6 May, Galantchikova, having

[1] A *Gnôme* engine for RR 3,000 was expected to last 150 flight hours, or RR 20/hour; adding fuel and oil one hour was estimated to cost RR 30.



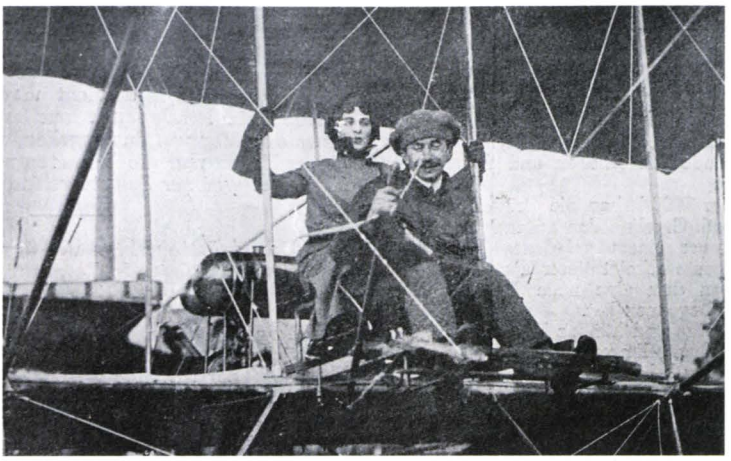
52 Zvereva-Slyussarenko and her husband crashed with their *Farman*, both aviators remaining unharmed, Riga, 1 April 1912.

53 The second flight of Voldemar Smit on a *Sommer* biplane built by the *RBVZ*, Riga, 6 March 1911.

been airborne for 21 minutes overhead Riga, after having landed was carried in a chair in front of a tribune full of cheering spectators [201].

That year, one of the spectators trying to get a closer look of the aviators and their thrilling machines was *Gustavs Vanags* (1891–1965), between 1910 and 1918 a chemistry-student at the RPI who in the 1920s joined the faculty of the University of Latvia. On 12 March 1912, according to his diary, he visited the Riga hippodrome in order to watch an air-show advertised by *RBVZ's* pilot Voldemar Smit. Smit, according to Vanags, kept the crowd waiting for some time before he suddenly jumped into the cockpit of his biplane and started the engine. With a roar the plane started to roll. Immediately after having lifted-off the ground the apparatus fell back again and landed behind the fence that enclosed the racetrack. Another attempt to take-off failed as before, this time damaging the machine. A third attempt that day, after quick repairs had readied the machine, failed altogether. Trying to pacify the spectators the organizers decided to let everyone, even those without tickets, look at the airplane at close range while ticket-holders were invited to Smit's next demonstration. Vanags took this whole episode without any misgivings – «As it is, I have seen what an airplane looks like and how it is operated» [202].

In 1913, the flight scene in Riga was dominated by Slyussarenko on his *Farman* – of 50 public flights in total that year Slyussarenko performed 44. Other recorded flights involved Slyussarenko's pupil, a local gentleman named Moll (1 flight, *Farman*), Zihrul/*Cīrulis* (1 flight on a biplane), and the Frenchman Janoir (2 flights, *Deperdussin*). One of the reasons for this decrease in flights was the absence of both the *RBVZ* and *Motor*. In addition, there appears to have been a marked decline also in

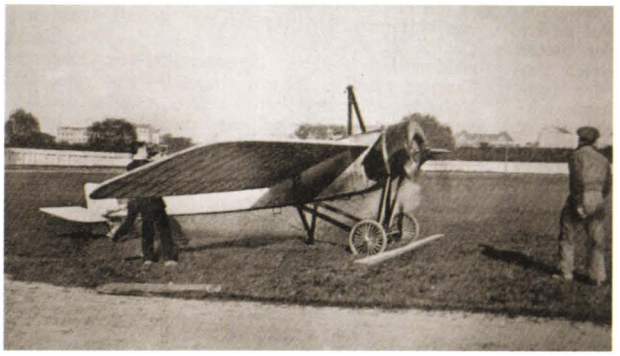


54 Slyussarenko and his wife on a *Farman* biplane, Riga, 10 June 1913.

public interest – demonstrations by different pilots on different aircrafts often entailed similar and with time unspectacular programs. Accidents occurred again like the previous years. On 28 April, for example, strong winds pushed *Cīrulis* on his biplane into telephone wires at Spilve, an incident which left the aviator unharmed and damaged the airplane [203]. On 16 June, Slyussarenko, after a number of successful flights at Edinburgh, collided with a beach chair when a boy ran into the landing zone, an incident, which frightened two women occupying the chair and lightly damaged the *Farman* [204].

One of the highlights that year was an intermediate stop in Riga made by the French aviator Louis Janoir (1885–1968) on his overland flight Paris-Berlin-St. Petersburg. Flying on a *Deperdussin*, Janoir announced his arrival in town when passing the Russian border at Tauroggen; some time later members of the 1st Baltic Automobile and Aero-Club met the aviator in Mitau with their cars. In Riga, having landed on 29 July in the morning at Kalep's airfield in Sassenhof, Janoir was taken to the clubhouse in central Riga for refreshing and a hearty breakfast. Trying to continue his flight in the afternoon, Janoir crashed during take-off into the fence surrounding the airfield. After repairs, he finally left Riga on 31 July [205].

During the first half of 1914, the number of public flights in Riga had come down to a total of 20, 16 of which carried out by military pilots. The remaining flights made during those pre-war months involved the Frenchmen Poirée and von Spitzberg. However, like during previous years, numerous flights, for example made by pilots and trainees at Slyussarenko's flight school, went unnoticed by the press, leaving the total number of take-offs unclear.



55 Slyussarenko, Zvereva-Slyussarenko and the Russian aviator von Spitzberg, Riga, May 1914.

The 23-year old Russian E. R. von Spitzberg had undergone flight training at Morane's flight school in Paris. Inspired by the Frenchman Pégoud, he soon started to perform advanced aerial maneuvers on his own, including the Death-Roll. In Riga, Zvereva-Slyussarenko became the third Russian woman to be taken along on one of von Spitzberg's flights, a breathtaking exercise 300 meters up in the air. One notices that more than 50 ladies from town were said to have waited in line for being taken along on a flight with the dashing Frenchman. In Riga, on 4 May and 6 May, von Spitzberg – on a *Morane-Saulnier* monoplane powered by an 80-hp *Rhône* engine – performed in front of an enthusiastic crowd, letting his machine sharply slip sideways or even fly upside down, making nosedives and tight loops, and as told performing the Death-Roll (inside loop) [206]. This was very different from the days of Utochkin or Grigorashvili, Riga experiencing extreme pilotage at last.

Like von Spitzberg, also the 29-year old Frenchman Poirée, who had been invited to Riga by the 1st Baltic Automobile and Aero-Club, succeeded to mesmerize the public. The aviator, on a *Farman XX* powered by an 80-hp *Gnôme* engine, performed as daring aerobatic maneuvers as his countryman, flying the Death-Roll, putting the aircraft on its back and even carrying out the «Falling Leaf» by switching off the engine in flight and letting the aircraft tumble towards the ground. This time an adventurous local lady, Mrs. Mehnert, was allowed to follow the aviator on one of his flights [207]. Since the days of Arntzen, aviation in the Baltics had visibly moved forward, new technology incorporated in stable aircraft hulls and powerful aero-engines together with experienced pilots allowing maneuvers no one could have foreseen a mere 2–3 years ago.

On 25 June 1914, military aviators from Russia's 18th and 19th Corps arrived in Riga from St. Petersburg on their biplanes, two aircrafts having been forced to land en-route due to technical problems [208].

War was at close quarters now – on 28 June, the Austrian Archduke Franz Ferdinand would be shot in Sarajevo, an event, which set Europe, including the Baltics, ablaze.

Summarizing public flight activities in Riga during 1910–1914, from Arntzen's first attempts in March 1910 to Poiree's flights in May 1914, one can list a total of 210 flights, recorded by the local press. The majority, an estimated 150, were carried out for commercial reasons, showmen-aviators trying to attract crowds of paying spectators. The rest of the flights were made for other purposes, like for testing new equipment or training pilots.[1] Those 200 odd flights made in Riga over a period of 4 years can be set in relation to the more than 2 200 flights performed by members of the Aero-Club in St. Petersburg in 1913 [209]. In this perspective, Riga was not among the main centers of Russia's pre-war aviation.

2.3.6 Airplanes and Manufacturers

In Riga, like in other Russian cities, first flights heavier-than-air involved foreign-made equipment. Thereby, in spring 1910, three machines were brought to Riga from abroad:

- a *Wright* biplane, purchased in Germany by Theodor Kalep and the Danish aviator Orla Arntzen, arrived in early March 1910 [210];
- a *Grade* monoplane, purchased in Germany by Alexander Leutner, arrived in mid-May 1910 [211];
- a *Blériot-XI* monoplane (*Humber-Blériot Eindecker*, Channel type), purchased in France by Eugen Feitelberg (the machine was said to be owned by E. Feitelberg, G. Schauber and one Martoglio, a car technician) arrived on 16 June 1910 [212].

In addition to these three machines, four more airplanes made their appearance in Riga that year, i.e. two monoplanes designed by Kalep and built by the *Motor* factory, and two *Sommer* biplanes built by the *Russisch-Baltische Waggonfabrik (RBVZ)*. During the following three and a half years, or until the outbreak of World War I, three local firms engaged commercially in the building of airplanes and aero-engines, all on a limited scale and mostly for the Russian military – *Motor, RBVZ* and *Helios*.

Kalep & Arntzen's *Wright*. Theodor Kalep (1866–1913) came to Riga from Reval where he had graduated from the *Realschule* (High School). He enrolled at the Riga Polytechnic in 1886 and graduated six years later with a Diploma in Mechanical Engineering. After graduation, from 1893 to 1895, Kalep was active at his alma mater

[1] This number, as told, is too low as many trial and other flights were not publicly recorded.

as an assistant while at the same time working at the local shipyard of *Lange & Sohn*. In 1898, he became one of the founders of the *I. Rigaer Transmissionsbauanstalt, Maschinenfabrik u. Eissengiesserei Motor* (1st Riga Transmission & Machine Factory and Iron Foundry Motor [213]) located at *Champêtrestrasse 2* in Riga Sassenhof. Since 1902, Kalep was both a co-owner and the factory's managing director [214].

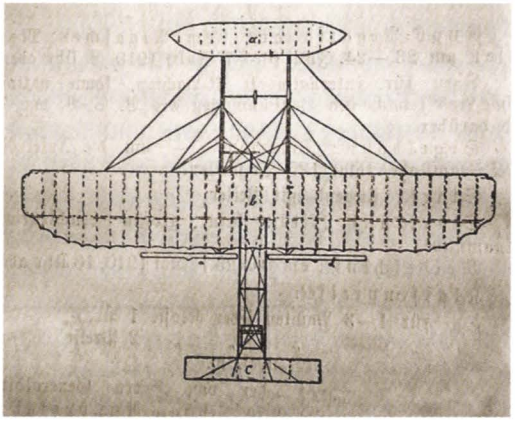
After graduation, Kalep continued to stay in close contact with his institute, holding lectures, accepting students for internships at *Motor* and employing some of them after their graduation. When French and German aviators started to build motorized airplanes following Santos-Dumont's first jumps in 1906, Kalep took an immediate interest. In spring 1909, he became an ardent supporter when some RPI-students formed an aeronautical association. In August that year, he mingled among the many-headed crowds that had gathered at the first international air-show, *La Grande Semaine d'Aviation* in Rheims. During early November, when the Frenchman Albert Guyot visited St. Petersburg with his *Blériot XI*, Kalep was again among the spectators, watching the Frenchman's performance [215]. On that occasion, he also met with members of the Imperial All-Russian Aero-Club, an organization instituted the previous year. Already by that time the air was filled with rumors about the serial production of Russian-made aircraft, with factories said to be established in St. Petersburg and Moscow.

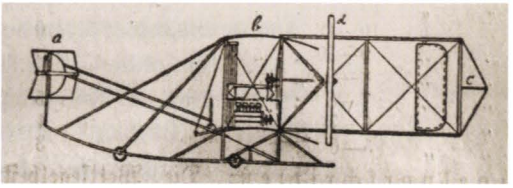
On his return to Riga, Kalep did not let go of his newly awakened interest. In early 1910, he travelled abroad to obtain an aircraft, a move which resulted in the purchase of a *Wright* biplane from the *Flugmaschine Wright-Gesellschaft m.b.H.* (Wright Airplane Limited Liability Company) in Berlin for RM 22 000.[1] The co-owner of the apparatus, according to the local press, was the 28-year old Danish aviator Dr. jur. Orla Arntzen from Copenhagen. Arntzen, who had undergone basic flight training in Berlin-Johannisthal at the school of the renowned aviator Paul Engelhard (German license No. 3), would soon become the first aviator to carry out motorized flights in the Baltics [216].

In May 1910, Kalep had completed the construction of a hangar, a round, wooden structure of his own design located close to the factory for the *Wright* and other airplanes planned to be built by *Motor*. In addition, he had prepared a rudimentary airfield. It was therefore no accident that first flights in Riga with the *Wright* took place at Sassenhof. In addition to airplanes built by *Motor*, which were believed to be

[1] The aircraft was said to have demanded a price of RR 10,000, RR 2,500 for the engine and RR 100 for each propeller. *Rigasche Neueste Nachrichten*, 22 February 1910, 22 March 1910.

56 Theodor Kalep (left) and the Danish aviator Orla Arntzen on their *Wright* biplane, Riga, June 1910.





57 Technical drawing for a *Wright* biplane purchased by Arntzen & Kalep in Germany in 1910.

cheaper than imported models, Arntzen planned to establish a flight school, the first in Riga [217].

First flights with Kalep & Arntzen's *Wright* took place from late April to early May 1910, local newspapers noticing 10 successful test-flights at Kalep's airfield. Thereby, Arntzen took the aircraft (placed on skids, not wheels) to the air with the help of a wooden slide-rail, using the same take-off method as the Wright brothers in 1903 on their first attempts. A local worker passing by the *Motor* factory at 4 o'clock one morning, watching Arntzen on his machine, could not refrain from applauding the daring aviator [218].

Arntzen's first public performance happened on 30 May 1910 at the hippodrome in Solitude. The event had been advertised and attracted more than 1 000 paying spectators together with large crowds of non-paying onlookers. Because of unsuitable ground conditions and also

unfavorable winds, Arntzen – on one attempt out of four – succeeded to lift the *Wright* off the ground and reach a height of 6 meters before a strong gust pushed him down again [219]. A few days later, on 4 July, Arntzen again tried his luck, taking off and reaching a height of 40 meters. On landing, some of the wing struts broke and injured Arntzen's face, leaving the airplane slightly damaged [220]. After that mishap, a planned demonstration in *Libau* (presently *Liepāja*) was cancelled; shortly thereafter Arntzen left Riga. On 21 September 1910, having completed the required tests on a *Wright* at the Berlin-Johannisthal airfield, Arntzen received German pilot license No. 27 issued by the *Deutscher Luftfahrer-Verband* (German Pilot Association) [221]. On 15 February 1911, when international regulations for the licensing of private pilots came into force based on rules adopted by the 6th Conference of the *Fédération Aéronautique Internationale*, Arntzen was among the select few who had already qualified [222].

In September 1910, hangar-space at *Motor* had in the meantime been enlarged, four airplanes stood parked at the facility: Kalep & Arntzen's *Wright*; Leutner's *Grade*; Feitelberg's *Blériot*; and a monoplane resembling a *Grade/Blériot* monoplane designed by Kalep and built by *Motor* [223]. By that time, both the *Wright* and *Grade* had been tested in flight (by Arntzen and Meybaum), while the two *Blériots* had so far remained grounded. Thus, by late 1910, the *Wright* had been flown twice in public at the racetrack (30 May, 4 July) in front of expectant and in the end disappointed crowds. Out of public view, though, the *Wright* had several times been flown at Sassenhof, meaning that Arntzen on his *Wright* was the first aviator to pilot a motorized aircraft in the Baltics, the exact dates of these (unofficial) flights being unknown.

Leutner's *Grade*. The *Grade* monoplane, purchased by Alexander Leutner (1864–1923)[1] from Hans Grade's factory in Bork in der Mark for RR 6 000, appears to have been flown in public for the first time on 6 July 1910 with Theodor Meybaum at the controls [224]. Before that date, during June, Meybaum had already carried out a number of trial-flights at Solitude, reaching heights of 5–10 meters and flying over distances of 50–100 meters [225]. His public performance on 6 July at Solitude showed similar results, Meybaum making some jumps of 5–10 meters above ground over distances of up to 200 meters. On trying to repeat his performance some days later on 11 July Meybaum crashed after a flight

[1] The «*Russia*» *Fahrradwerke und Automobilfabrik A. Leutner & Co* (*Велосипедная фабрика «Россия» Александра Лейтнера и Ко*) was established in 1886, manufacturing bicycles. Later, for a short while, Leutner also produced automobiles and firearms. After the revolution 1905–1906, Leutner prospered, keeping subsidiaries in both Warsaw and Moscow. Leutner also operated a car dealership (*Humber*, others), a city-garage and an automobile repair shop. In 1911 turnover had reached over RR 1 million.

lasting 33 seconds, the incident causing serious injuries to the pilot and damaging the airplane [226]. The local press, however, fully exonerated the brave aviator: a glaring lack of proper start and landing facilities in and around Riga were said to seriously restrict flight practices. After that performance, which had been watched by an expectant crowd, extra trains had been organized to get the spectators from town to Solitude, public air-shows appear to have come to a halt that year, no more flights being mentioned by the press.

On 17 February 1911, after his public flights in Riga which led to his unofficial nomination as first «official» aviator of Russia's Baltic provinces, Meybaum (Pernau, 1864–Germany, 1946), having completed the required flight tests at Grade's school, received German pilot license No. 60 [227].

In 1910, most flights on motorized airplanes had been marred by mishaps mainly caused by a combination of inexperienced pilots, unreliable aero-engines and unsuitable landing grounds. Nevertheless, no deaths had to be recorded, aviators in the worst of cases having walked away from their damaged machines with minor injuries. Accidents statistics for flights in Western Europe showed a different picture: since 1908, 234 accidents had resulted in 18 deaths, 15 serious and 46 lighter injuries; 85 aircrafts involved in those incidents had been totally destroyed. At the start of 1910, only 16 pilots in Europe held official pilot licenses, a number, which by end of the year had increased to 250 [228].

In February 1911, local newspapers concluded that local flights so far had been marked by misfortune: Arntzen on his *Wright* was found to have by and large failed; Meybaum on the *Grade* had performed some short jumps; and the *Blériot* (Feitelberg's machine) had not flown at all [229]. One reason underlying this situation, criticized all along, was a lack of proper facilities on ground which forced the aviators to use the racetrack or make do with Kalep's rudimentary field at Sassenhof. Both alternatives, with regard to space and surrounding obstacles, were largely unsuitable for aviators trying to take off and land with their under-powered machines [230].

The only successful public performance that far had been a flight on 11 January 1911 by Max Trautmann on Kalep's *Wright*. Trautmann took-off at Sassenhof, flying overhead the *Motor* factory with Kalep watching from below, turning into the direction of Solitude where he landed after 4 minutes. Flying at an altitude of 40 meters and performing several turns in the air, Trautmann covered a distance of 5 km. On landing, the aviator was forced to make a sudden maneuver in trying to avoid a woman loitering on the racetrack; making a hard landing, several wooden struts got broken. Trautmann had undergone flight training on a *Wright* at Theodor Schauenburg's school in Berlin-Teltow, where he

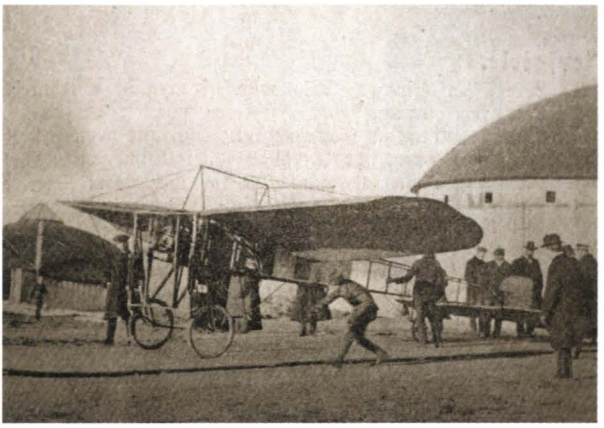
performed 35 long-distance flights. Despite that training, Trautmann does not appear to have received a German or other license [231]. After his exploit on 11 January, Trautmann instantly reached local fame, the press lauding his flights as «... the first really remarkable aeronautical event which had taken place in the Baltic provinces» [232]. However, Trautmann, like other pilots that time, was somehow haunted. At a public demonstration on 5 March 1911 at Solitude, after two cancelled performances caused by bad weather, and despite using a wooden slide-rail for take-off, Trautmann failed to get the machine off the ground on four attempts, lifting twice and immediately falling back again. The demonstration was cut short when the *Wright* was damaged on the fourth attempt, with disappointed, maybe also disillusioned, spectators having to make their way back home [233].

After a long winter, Meybaum took the *Grade* out from the hangar at Sassenhof for flight testing. Again, disaster was not long in waiting. On 13 March, at the Sassenhof airfield, hard winds pushed the apparatus down to ground from a height of 30 meters, machine and pilot crashing into a fence surrounding the airfield. The incident caused substantial damages to the aircraft's propeller, left wing and tail section while Meybaum this time, luckily enough, escaped without serious injuries [234].

The first public flight that according to the local press had finally resulted in what could be called the «conquest of the sky overhead Riga» took place on 6 March 1911 at Solitude when V. Smit, a pilot employed by the *RBVZ*, made two successful flights on a *Sommer* biplane, both lasting over 6 minutes and proceeding at altitudes of 50–80 meters (see further) [235].

Feitelberg's *Blériot.* In mid-March 1911, a first mention was made in the press of Eugen Feitelberg's *Blériot*, a machine purchased the previous year that since that time appears to have been parked in Kalep's hangar. The car mechanic Martoglio, waiting for favorable winds, was said to prepare himself for his first take-off [236]. However, like in 1910, not much happened that year. In April 1912, it was announced that Martoglio's *Blériot*, powered by a 36-hp *Anzani* engine, which since 1910 had been standing in Director Kalep's hangar, was prepared for an upcoming demonstration at Solitude – again, no flights followed [237]. After that announcement, the *Blériot* disappeared from public view.

The *Automobilhaus Eugen Feitelberg*, which acted as general agent for a number of foreign car manufacturers (*Humber, Benz, Gaggenau, Pipe*) also sold aeronautical equipment. In March 1910, first ads in local newspapers told about Feitelberg selling not only automobiles and motorboats but also airplanes, i.e. *Humber-Blériot* monoplanes. One of these monoplanes was said to carry a price tag of RR 4 500–7 800, a biplane of RR 11 000 [238]. If at all and how many airplanes Feitelberg



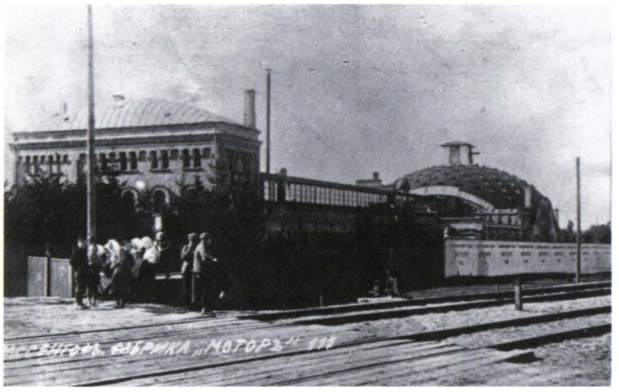
58 Feitelberg's *Blériot* standing outside Kalep's hangar by the *Motor* factory in Riga-Sassenhof, October 1911.

59 Eugen Feitelberg.

60 Advertisement of the *Automobilhaus Eugen Feitelberg*, which sold automobiles, motorboats and airplanes, Riga, 1910.

eventually sold before the war is unknown. In any case, none of these aircrafts were ever flown in Riga [239]. When A. von Kuhlberg overtook Feitelberg's agency in January 1911, the aircraft dealership remained part of the business [240]. In 1913, Feitelberg joined the 1st Baltic Automobile and Aero-Club, in 1914 being elected as a member of the club's Technical Committee.

Kalep's *Motor* factory. In spring 1910, after the exhibition organized by the RPI-students had closed its doors, it became known that the *Motor* factory had received an order for building several airplanes. In autumn that year, a journalist from one of Russia's aeronautical journals reported about airplane production at the factory, machines that design-wise resembled *Wright & Farman* biplanes (2 seats, 2 pusher propellers) [241]. During 1910–1911, according to Shavrov, *Motor* built a total of 10 airplanes, 4 in 1910 followed by 6 in 1911 [242]. Given that one of



61 *I. Rigaer Transmissionsbauanstalt, Maschinenfabrik u. Eissengiesserei* (1st Riga Transmission & Machine Factory and Iron Foundry), Riga-Sassenhof, early 1900s.

these aircrafts was a monoplane designed by Kalep (see further), *Motor* must have built 9 *Wright & Farmans*, all most likely powered by engines designed by Kalep. According to Shavrov, however, these airplanes were never completed [243]. Regarding the biplanes this assertion could be correct, the local press keeping silent in this respect. Concerning Kalep's monoplane, on the other hand, some few flights did actually take place.

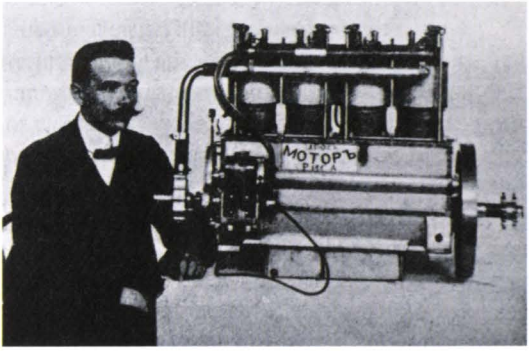
The monoplane designed by Kalep was said to resemble a combination of a German *Grade* and French *Antoinette/Demoiselle*. Its wings (area 39 m^2) were covered with loose fabric, which tightened only after the aircraft started to move against the wind. The plane was powered by a 22 hp engine [244]. First flights on this aircraft, built by *Motor*, took place on 25–26 March 1911 at Sassenhof with Max Schuchhalter, an engineer employed by *Motor*, at the controls. Schuchhalter carried out two successful trial-flights over short distances of 50–150 meters and at low altitude (3–15 meters). Some days later, on his third attempt, he crashed when trying to make a turn, damaging the aircraft chassis and right wing. Despite this mishap, however, the local press was full of praise – «These flights are even more remarkable, because the whole apparatus has been built based on the design of Director Kalep, who used only local materials for its construction» [245]. During spring 1911, also Trautmann, in addition to piloting Arntzen & Kalep's *Wright*, flew with the monoplane.

On 1 April 1911, on a flight from Sassenhof to Solitude on the *Wright* Trautmann took along a passenger, a first in Riga: the flight lasted 1.5 minutes, proceeded at an altitude of 40 meters and reached an average speed of 75 km/h. The passenger, said to be a former seaman aspiring to become an aviator, weighed about 5½ Pud (90 kg) [246]. On 6 April 1911, Trautmann made his first flight on Kalep's monoplane, again at Sassenhof. However, a broken wire connecting the flight

62 *Motor's* airplane hangar with Arntzen & Kalep's *Wright* biplane and an unfinished wing-pair, Riga-Sassenhof 1910.

controls to the rudder made this a short experience. On a subsequent flight that evening, using the *Wright*, Trautmann together with the seaman Sussenko crashed from an altitude of 25 meters, an incident which caused severe damages to the machine but left both pilot and passenger unharmed [247]. After that event in early April, silence descended on Kalep's planes, both the *Wright* and his monoplane. What happened with the aircraft is unknown: were they sold, parked inside a hangar, or parts used for building other machines? Kalep, who never piloted an aircraft himself, had by now started to turn his attention away from airplane hulls, devoting his energy to the design and eventual production of aero-engines.

The engine installed on Kalep's monoplane had been either taken-off the *Wright* purchased in Germany or designed by Kalep and built by *Motor* during 1910–1911. In case the latter holds true, this would have been the first indigenous aero-engine ever built in Russia, never mind that its design to an unspecified extent was based on a foreign model.



63 Kalep's first aero-engine, manufactured by *Motor* in Riga 1910.

When a journalist from an aeronautical journal visited *Motor* in late autumn 1910, Kalep proudly presented his engine: a 4-cylinder internal combustion engine weighing 90 kg and generating 1 500 rpm [248].

In tsarist Russia, aero-engines started to draw the attention of both scientists and industrialists from an early date. Already in 1909, the journal *Воздухоплаватель* (Aeronautics) published a lengthy article about foreign engines written by S. Baldin, including technical drawings, photographs and specifications of their main characteristics [249]. Among 15 engines listed in the article five had been designed for installation on dirigibles (*Bayard-Clément, Panhard & Levassor, Daimler, N.A.G.* and *Gebrüder Körting*), the remaining 10 for powering fixed-winged airplanes (*Wright/Barriquand & Marre, Antoinette, Pipe, Renault, Esnault-Pelterie, Anzani, Farcot, Dutheil et Chalmers, Gobron-Brillie* and *Gnôme*). While three of the five airship engines came from Germany, most airplane engines were French. That far only one manufacturer had succeeded to design and produce a usable rotary engine, i.e. the French firm *Gnôme* with its 30/50/100 hp engines, a type, which soon attracted the attention of Russia's military authorities; [1] all other engines used standing layouts [250].

With the *Wright* biplane and its *N.A.G.* engine serving as blueprints, in addition to Leutner's *Grade* and Feitelberg's *Blériot* (both aircrafts were parked at Sassenhof), Kalep started to work on his own designs, at first focusing on both airframes and aero-engines, in time concentrating on engines. His first steps in aeronautical engineering, naturally, focused on examining foreign equipment, at that time a common practice, that was widely employed by engineers in Russia and abroad. However, Kalep's studies of foreign models, different from many other constructor, soon resulted in the design and production of partly patented *Kalep*-engines.

Of certain interest thereby is the engine installed on Kalep & Arntzen's *Wright*, a 32-hp, 4-cylinder (placed in a row), water-cooled, internal combustion engine manufactured by the German company *N.A.G.* (*Neue Automobil-Gesellschaft*) in Berlin: it weighed 91.3 kg, generated 1200 rpm and consumed 290–300 g of petrol per flight minute. For cooling the engine, 27 liters of water running in a pipe system were used. Capacity of the petrol tank was 47 liters, an amount that lasted for more than 4 flight-hours [251]. After successful attempts to replicate the *N.A.G.*, with its standing layout, Kalep[2] moved to rotary engines [252].

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[1] In 1909, *Gnôme's* rotary was patented also in Russia: No 39439, Motor mit radialen, um eine unbewegliche Achse rotierenden Zylindern.

[2] In 1912–13, Kalep received (at least) two Russian patents for parts of a rotary engine: 1) No 53265, Zylinder mit Auspuffventil für Verbrennungsmotoren mit radial um die Achse angeordneten rotierenden Zylindern; see Rigasche Industrie-Zeitung, 1912, No 22, 350; 2) 54981, Kolben für Motoren innerer Verbrennung mit radial um die Achse angeordneten rotierenden Zylindern.

The dynamic underlying Kalep's exploratory activities was of course the prospect of lucrative military orders. In Russia, like in other countries at that time, the only viable customer for flight equipment was the military, the circle of potential private customers being restricted to a minute group of aviation enthusiasts from the upper echelons in society. Starting in the 1880s, military establishments in countries such as Germany, France, Austria-Hungary, Great Britain and Russia had started to pay increasingly close attention to the usability of aircraft in war. At first, tethered balloons were used as platforms for frontline observation and artillery spotting, latter supplemented by dirigibles believed to be useful for long-range reconnaissance and aerial bombing. In rapid succession, military aeronautical units were instituted in military forces across Europe, at first based on aerostats and airships. By 1908–1910, this development had arrived at a crossroads, the rapid technological advance of airplanes starting to overtake the aerostats. Tapping into this newly awakened military interest, of course, also motivated Kalep.

In 1911, the Russian military decided on the following performance criteria for airplanes: 1) capacity: two-seats; 2) distance: 180 km without intermediate stops; 3) endurance: fuel, oil and water for 3-hour flight carried on board the aircraft; 4) speed: 70 km/h for biplanes, 75 km/h for monoplanes; and 5) successfully passing required flight testing [253]. At a military competition organized during September 1911 in St. Petersburg, substantial monetary prizes awaited the winners: RR 15 000 for the first prize, and RR 13 000 for the second. Winning airplanes were to be taken over by the military for possible serial production [254]. Similar competitions were organized also during the coming years.

In early 1911, the journal *Воздухоплаватель* (Aeronautics) reported about the progress made by *Motor* in building aero-engines of the *Gnôme* type, believed to be the first such attempt ever made in Russia. The journal wrote: «If the experiment succeeds, we will be completely independent from foreigners in aeronautics, because we are able to design and build all other parts of flying apparatus, the only delay being the engines» [255]. However, this for Kalep encouraging message was premature. Already a few months later the same journal published a long article, supplemented with numerous photographs and drawings by Professor Rynin from St. Petersburg about the French *Gnôme* rotary – this engine, as it turned out, became the front-runner in powering Russia's military airplanes [256].

In June 1911, Kalep sent one of his newly designed rotaries built by *Motor* to the military station in Gatchina for practical tests, without receiving any noticeable response. In February 1912, Kalep, having

continued to study foreign models and improve his design, stepped forward with a new engine, which most likely was again partly based on the *Gnôme*. When Kalep applied for a patent regarding his engine he restricted the application to certain engine-parts (see above). In mid-April 1912, Kalep presented this engine to a military commission in Sassenhof, stating that 5–7 engines[1] of this new type were ready for immediate shipment [257]. Installing Kalep's engine (in the press called *Gnôme* engine) on a *Nieuport* biplane allowed demonstrating its performance before the commission in flight, the aircraft being piloted by Lieutenant Dybovsky from the Navy Flight School in Sevastopol. Flight-testing went well and resulted in strengthening the commission's resolve to order *Nieuports* (until 1920, more than 1 000 *Nieuports* were built in Russia) instead of *Blériots* or *Farmans*, the *Nieuport* ranking first due to its uncomplicated construction, stability in flight and transportability (assembly lasted 20 minutes) [258]. Nothing much was decided regarding Kalep's engine, though. On 18 April 1912, Kalep informed the War Ministry that *Motor* was ready to manufacture six *Nieuports* within two and a half months, promising to deliver 300 machines of this type equipped with engines within one year [259]. Kalep's proposal, however, fell on deaf ears: no military orders were forthcoming during the rest of 1912. That year, Russia's dependence on foreign engine manufacturers continued unbroken. Kalep putting his latest rotary on public display at the 2nd International Aeronautical Exhibition in Moscow (25 March–8 April) did not make any great difference [260].

Other efforts by Kalep to promote his engine followed: installing the engine on airplanes flown by well-known Russian aviators (e.g. Koltchin's *Farman*, Riga, 27 May 1912 [261]); attempting to engage influential members of the Imperial All-Russian Aero-Club; having the military at Gatchina and in Sevastopol once again carry out practical flight tests; letting specialists from the Polytechnic Institute in St. Petersburg test the engine. All these efforts, apparently, were to no greater avail. Despite the comparatively good performance of the *Kalep*-rotary and its relatively lower cost, the military authorities – for whatever reason – showed no greater interest in Riga-built engines. Instead, the French firm *Gnôme* was given the go-ahead to start assembling its engines in Moscow based on ready-made parts imported from France. The first of these *Moscow-Gnômes*[2] left the factory in August 1913 [262].

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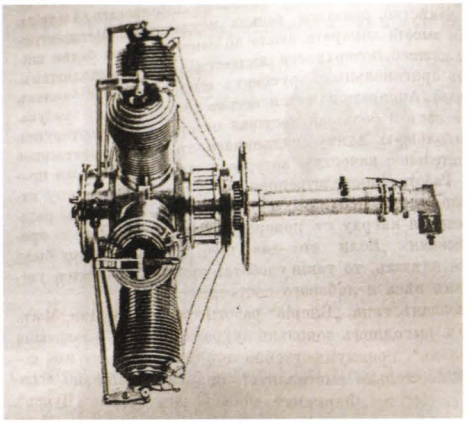
[1] The engine had the following characteristics: rotary design, 60-hp, 1,200 rpm, weight 68 kg, length 1,000 mm, diameter 835 mm, diameter cylinder 110 mm, fuel consumption 0.315 kg/hp, oil consumption 0.1 kg/hp, guaranteed run without stops 10 hrs, 50 hrs to overhaul.

[2] In March 1912, Gnôme took Kalep to court, claiming that his engine was a copy of their design.



64 Rotary engine, designed by Kalep and built by *Motor* in Riga, displayed at an aeronautical exhibition in Moscow in 1912.

RÉPUBLIQUE FRANÇAISE.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

BREVET D'INVENTION.

V. — Machines.
8. — Moteurs divers.

N° 448.389

Perfectionnements aux moteurs à combustion interne à cylindres tournants.

M. Théodor KALEP résidant en France (Seine).

Demandé le 17 septembre 1912.
Délivré le 25 novembre 1912. — Publié le 29 janvier 1913.

Les moteurs à combustion interne à cylindres tournants construits jusqu'à ce jour présentent l'inconvénient de ne pas permettre de faire varier la grandeur ou volume de la chambre de compression dans les cylindres, ce qui est cependant nécessaire si l'on désire obtenir un fonctionnement régulier et rationnel du moteur à des températures et pressions atmosphériques différentes, comme par exemple en été et en hiver.

La présente invention a donc pour objet de remédier à cet inconvénient grâce à un agencement des cylindres permettant de faire varier à volonté le volume de la chambre de compression.

En outre l'invention porte également sur un perfectionnement dans les moyens élastiques maintenant les soupapes d'échappement sur leur siège et permettant d'employer de très courtes tiges de soupape.

La figure unique du dessin annexé représente à titre d'exemple une vue en élévation partie en coupe d'un cylindre de moteur rotatif à combustion interne muni des présents perfectionnements.

Conformément à cette invention, chacun des cylindres *a* est fileté extérieurement en *b* près de sa base, et les filets *b* se vissent dans un filetage correspondant pratiqué dans le carter en deux pièces *c* et *d*; il en résulte qu'en vissant ou en dévissant les cylindres dans le carter on diminue ou on augmente le volume de la chambre de compression ce qui a pour effet d'augmenter ou de diminuer respectivement la pression du mélange explosif. Les cylindres sont maintenus en position par le serrage énergique des deux parties du carter au moyen de boulons *e*.

Le dispositif qui vient d'être décrit présente en outre l'avantage de permettre de démonter les cylindres du carter isolément, ce qui simplifie de beaucoup le montage du moteur.

Dans ces moteurs la tige des soupapes d'échappement *f* est généralement construite aussi courte que possible et le cône de la soupape est sollicité contre son siège *g* au moyen de ressorts plats; ou bien on emploie une tige longue et un ressort à boudin cylindrique ce qui augmente le poids et la résistance à l'air du moteur. Conformément à cette invention, on obvie à cet inconvénient en employant pour maintenir la soupape *f* sur son siège *g* un ressort à boudin conique *h* entourant la tige *f* et dont les spires vont en augmentant de diamètre, de telle sorte qu'à la compression de ce ressort *h*, ses spires peuvent rentrer l'une dans l'autre, ce qui permet ainsi d'employer une soupape à très courte tige.

RÉSUMÉ.

Cette invention a trait à des perfectionne-

Prix du fascicule : 1 franc.

65 French patent No. 448.389 assigned to Kalep for improvements made on a rotary engine. Paris, September 1912.

Kalep died on 26 April 1913 in Riga, not having succeeded to convince Russia's military to order serially produced *Kalep*-engines.

In October 1913, another military commission arrived at Sassenhof for testing the *Kalep* in parallel with the French *Gnôme*, using one of Slyussarenko's *Farmans* as flying test-bed. After the tests, which also involved bench-testing, had been completed the commission concluded that the performance of the *Kalep*-rotary was on the same level as the *Gnôme*, while being considerably cheaper. As a result, in November 1913, the government placed an order for twenty 80-hp *Kalep*-engines with *Motor*, which was the firm's first large order [263]. In spring 1914, somewhat belatedly perhaps, a letter arrived at *Motor* from Russia's Finance Minister Timashev congratulating the factory for its successful provision of aero-engines to the military [264]. In 1915, ordered by the authorities, the *Motor* factory was relocated to Moscow where engine manufacturing continued.[1]

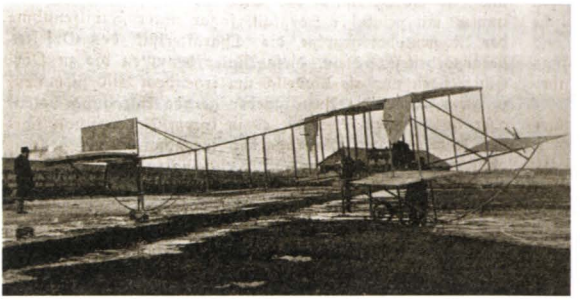
[1] In February 1919, Zander started to work at Aviation Factory No. 4 *Motor* in Moscow.

During 1911–1913, *Motor* also built a monoplane, which had been designed by the Dybovsky brothers, an aircraft eventually powered by an 80-hp *Kalep*-engine [265]. The machine, called *Dolphin*, had an advanced aero-dynamic design, which included a wholly enclosed engine. At military trials in September 1913 in St. Petersburg, Dybovsky with his *Dolphin* was among the contenders. Due to engine problems Dybovsky crashed from low altitude and got injured [266]. More successful was the installation of a *Kalep K-80* engine on a *Sikorsky C-10*: the airplane won the first prize in a military competition in 1914 [267].

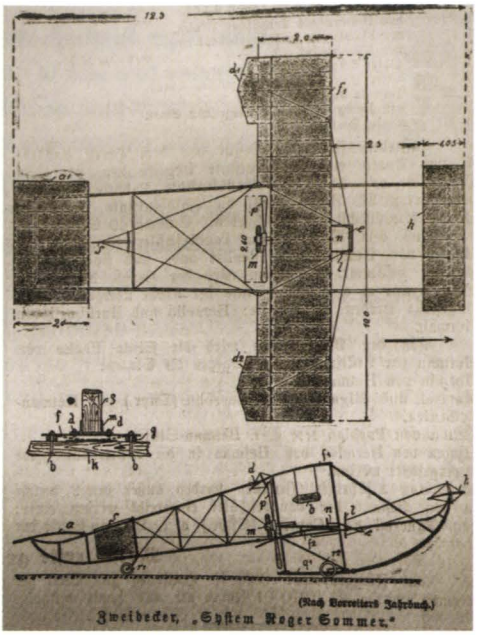
***Акционерное общество Русско-Балтийский вагонный завод, РБВЗ* (Russia-Baltic Waggon Factory, RBVZ).**[1] In 1909, Russia's largest factory for manufacturing railroad carriages, agricultural equipment and other machinery, experiencing a downturn in orders from state and private railroad operators, turned to find other outlets for its production by setting up an automobile department [268]. To this end, the firm brought foreign specialists to Riga together with a foreign license [269]. One potential customer for this new venture, according to the press, was the Japanese government. Already in August that year, the factory participated with its own automobile in a speed race in Riga, as well as in an overland competition between St. Petersburg and Riga, the first such event in Russia [270]. In early 1912, a car from the *RBVZ* won an international long-distance race from St. Petersburg to Monaco [271]. In time, the *RBVZ* manufactured both passenger vehicles and trucks, the largest customer being the Russian military.

In June 1910, the local press shortly noticed that the *RBVZ* had started building *Sommer* airplanes under the direction of its French constructor Roger Sommer (1877–1965) and with the assistance of French mechanics, one customer being the Russian military [272]. In July, more information was forthcoming about these endeavors: the planes' fuselages were said to be made of local materials, the aero-engines (*Gnôme*-rotaries) had been imported from France, and the propellers were delivered from a factory in St. Petersburg. One of the *Sommers* under construction had been ordered by the National Committee for the Creation of a Russian Air Fleet, others by aviation enthusiast (*Liebhaber*). Until early 1911, the factory completed five airplanes: 1 equipped with a 50-hp *Gnôme*-rotary (ordered by the National Committee); 2 with 50-hp, 7-cylinder *Gnômes*; 1 with a 35-hp *Aster*; and 1 with a 60-hp engine from

[1] The *RBVZ* was established in 1869 by the German *Waggonfabrik van der Zypen & Charlier*, Köln & Deutz. In addition to customers in Russia the firm also exported its products abroad (in 1908, for example, 360 wagons were ordered by the Italian State Railroads). After 1905–1906, the factory in Riga employed between 2,500–4,000 workers depending on orders.



66 French-designed Sommer biplane manufactured by the *RBVZ* in Riga 1911.



67 Technical drawing of a *Sommer* biplane manufactured by the *RBVZ* in Riga during 1910–1911.

E.n.V. Until January 1911, the person heading *RBVZ's* aviation branch was the engineer L. Vischnevski, who in early 1911 was joined by three more engineers, i.e. M. Keller, S. Volovski and Count Kudashev [273].

The *RBVZ*, unlike Kalep's factory *Motor*, was a large industrial enterprise with several thousand workers on its payroll. In 1909, the factory's turnover exceeded RR 6.2 million, resulting in a net profit of RR 480 thousand [274]. After a less successful year 1910, showing a net result of minus RR 375 thousand, the economic situation changed again in 1911, being positive with RR 20 thousand. Orders for tramway carriages, agricultural machines and automobiles had started to balance diminishing orders from the railroad sector, all new branches having positively contributed to the overall result [275].

In addition to the production of *Sommer* biplanes, the *RBVZ* planned to build two *Parseval*-type semi-rigid dirigibles (2000 m^3), one powered by one propeller and the other by two; water-cooled engines (80 hp & 60 hp) installed on the two craft were to come from *RBVZ's* own design bureau and workshop [276]. While *RBVZ's* dirigibles appear to have remained on paper, the first two *Sommers* (*Gnôme* 50-hp) were completed by early November 1910 and shipped to customers in St. Petersburg, one having been ordered by the military and the other by the well-known aviator Lebedev [277]. In the local press, no flight-trials involving those two aircrafts were mentioned before their shipment

from Riga. Instead, the test-flights took probably place at Gatchina, possibly due to a lack of qualified pilots in Riga at that time [278].

In early spring 1911, reports started to appear in the press about test- and demonstration flights carried out by pilots [1]employed at the *RBVZ*, flying on *Sommers* and other types [279]. Different from most other flights performed in Riga at that time, for example by the Russian Kusminski, *RBVZ's* pilots were often successful, which can be illustrated by a report from 7 March 1911:

> «The demonstration was well organized ... The weather was excellent ... An orchestra played ... After a short test of the *Gnôme*-engine, and an examination of the flight controls the pilot, dressed in a brownish leather overall, at 4:55 signaled to start. The propeller began to rattle, the support staff stepped aside and the biplane rolled away on its high chassis. Having rolled some 50 meters on ground the pilot pulled the elevator and, like a seagull, the airplane took to the air. Cheers of hurrah and applause followed the aviator, who took in the direction towards the Wagner Gardens, the airplane soon reaching some 80–100 meters without shaking and then making a wide turn over the city meadows and the central train station. On his return, he passed the grandstand and the jubilant public ... The landing was carried out with the highest possible margin of safety: Mr. Smit carefully put down the airplane on ground, like setting a glass of water on a table. Whoever was on the landing site rushed to the airplane to congratulate the pilot, who had flown for 3 minutes 45 seconds. The orchestra intoned a fanfare – there was happiness all around» [280].

After having completed another short flight that evening, which lasted for 2 minutes, Smit was carried on the shoulders of his support team passed a cheering crowd. Following many failed attempts by other aviators, Riga «... finally got to see a flying man» [281]. On 8 March 1911, Smit completed two more flights: the first one lasted for 4 minutes and progressed at an altitude of 50 meters; on the second one Smit took along a passenger. That same day, Thomas Flégier, another *RBVZ*-pilot, took-off on one of the *Sommers*, staying airborne for 3 minutes [282]. On 10 March, Smit, taking off from Solitude, soon reached an altitude of 300 meters, a local record, staying airborne for close to 10 minutes [283]. During the rest of March and part of April 1911, the *RBVZ* continued to organize flight demonstrations at Solitude, some successful, others caused by bad weather conditions, engine problems or conditions on

[1] Smit's first public flight appears to have taken place on 6 March 1911; however, he had carried out a number of trials before that date.

ground less so – all flights were performed on *Sommer* biplanes, mostly by Smit.

Testing *RBVZ's* aircraft (except the first two machines) before their delivery to customers was done by trained pilots employed by the factory: besides Voldemar Smit[1] there were Thomas Flégier and Count Kudashev. During 1910–1911, Smit had undergone basic flight training at Sommer's flight school at Mourmelon in France, in the end receiving a French pilot license [284]. Flégier (b. Warsaw, 1887), in turn, had obtained German license No. 59 on 17 February 1911, having trained on an *Aviatik* biplane at a flight school in Habsheim bei Mühlhausen [285]. Kudashev, the odd man out, never obtained any license, being self-taught in handling airplanes in flight [286].

In February 1911, Count Alexander Kudashev (1872–1917) was invited to join *RBVZ's* aviation branch in Riga where his latest design, the *Kudashev-4* (*Blériot*-type monoplane), was said to be under construction [287]. Kudashev, who upheld an extra-ordinary professorship at the Kiev Polytechnic Institute, is sometimes credited with having been the first Russian to fly in Russia on a Russian-designed airplane (*Kudashev-1*, 23 May 1910, Kiev). The first flight in Russia carried out by a Russian, as told, was M. N. Efimov (21 March 1910) flying on a French-built *Farman-4* [288]. Kudashev, who in May 1911 crashed with his Riga-built apparatus at an air show in St. Petersburg (see further), stayed with the *RBVZ* also after the factory in early 1912 relocated its aviation branch from Riga to St. Petersburg [289].

A third type of aircraft built by *RBVZ's* Riga branch in 1910–1911 was Russia's first amphibian airplane *Gakkel-V*, a 2-seat aircraft powered by a 50-hp *Örlikon*-engine [290]. Although the machine, as it turned out, never took-off, its constructor received a silver medal from the Russian Technological Society. In late 1911, Gakkel applied for this design to be patented in Russia [291]. Jakov Modestovich Gakkel (1874–1945), an electrical-engineer by profession, was one of the founders of Russia's first aeronautical firm, the *Первое российское товарищество воздухоплавания* (First Russian Aeronautical Association) in St. Petersburg. On 24 May 1910, one day after Kudashev's above mentioned (unofficial) flight in Kiev, the Russian Bulgakov took-off from an airfield in St. Petersburg on a *Gakkel-III* and was thereby officially credited for having performed the first flight on a Russian-designed aircraft. What Gakkel's and also Kudashev's involvement in Riga bears witness to was *RBVZ's* solid reputation in mechanical engineering as well as its early move into airplane production.

[1] Smit, an Englishman born in St. Petersburg, before becoming a pilot was a chauffeur employed by the *RBVZ*.

In April 1911, at Russia's first International Aeronautical Exhibition organized at the Michailovsky Arena in St. Petersburg (10–27 April), the *RBVZ* participated with all three aircraft types built in Riga – *Sommer* biplane, *Kudashev-4* and *Gakkel-5* [292]. Thanks to good craftsmanship, *RBVZ's* machines not only left a good impression among numerous foreign models (*Blériot, Harlan, Bristol,* and others) on display, the firm also received a gold medal «for impeccable construction of different types of airplanes». In addition, both Kudashev and Gakkel were honored with a silver medal, Kudashev for his biplane and Gakkel for his amphibian [293]. At the exhibition, the Russian-American rubber company *Treugolnik*, which had a subsidiary in Riga, was awarded a silver medal for its airplane fabric (used by *RBVZ*) and tires [294].

In mid-May 1911, the *RBVZ* and its pilots participated with two *Sommers* and the *Kudashev-4* (flown by Smit, Flégier and Kudashev) in the Second International Air Show (Aviation Week) organized in St. Petersburg, as it turned out a fateful event both for the *RBVZ* and its pilots. In addition to several foreign aviators and airplanes, most Russian pilots active at that time participated in the event attracted by monetary prizes and publicity. Already on 10 May, before the competition had started, Flégier collided with a signal pylon at the airfield, getting injured and smashing up the airplane. On 14 May, the first day of the trials, Smit crashed with his *Sommer* from an altitude of 40 meters and was crushed to death by the engine on impacting the ground – he died on

68 The wreck of Smit's *Sommer* biplane after his crash at the air show in St. Petersburg, 11 May 1911.

69 Voldemar Smit, employed by the *RBVZ* in Riga, fatally crashed on 14 May 1911 at an air show in St. Petersburg.

the way to the hospital. And finally, on 19 May, Kudashev crashed with his *Kudashev-4* from a height of 5 meters, getting injured and damaging the machine [295].

The aviators from Riga were not the only ones involved in accidents at the competition, e.g. Campo-Scipio crashed with his *Morane* and was injured while Lebedev on a *Farman* was pushed against a fence by strong winds. Three crashes involving one and the same manufacturer was hard to accept, though. Thus, in late May, the *RBVZ* announced that it would discontinue all further participation in public demonstrations, instead concentrating on manufacturing airplanes based on firm orders [296]. In addition, the firm changed its statutes, which allowed moving its main administration and other sections from Riga to St. Petersburg [297].

The only other aviator connected with Riga who before World War I died in an aircraft accident was Gordian Hösli (b. Riga, 21 August 1891). On 2 May 1912, Hösli, employed by the *Dixi-Motorenwerke* in Germany, fatally crashed at Berlin-Johannisthal flying a *Gödecker* (*Sturmvogel*) monoplane. The cause of this accident was never fully established, some believing that he had slipped off a faultily installed pilot seat, thus forcefully activating the flight controls and thereby putting the aircraft in an uncontrollable downward spin. In September 1911, Hösli had received German license No. 104, flying on an *Etrich-Rumpler Taube* (Hösli was part-owner of the machine) at Bork in der Mark [298].

According to statistics generated by French Colonel Bouttieux in 1911, 46 aviators had lost their lives in 1909, and 98 in 1910; the number of aircraft in service during that period had increased more than fivefold from 200 to 1 300. In 1910, the most common cause underlying those deadly accidents was pilot error (46) followed by faulty constructions (27) and weather conditions (25) [299].

By the end of 1911, the *RBVZ* had relocated both its head-office and aviation department, the latter to a newly opened factory at Novaya Derevnya in St. Petersburg. In September 1912, Igor Sikorsky from Kiev was engaged as managing director [300]. It was there and not in Riga that the *RBVZ* started building Sikorsky's well-known 4-engine biplanes, a type which revolutionized airplane design [301]. According to some authors, *RBVZ's* production of aero-engines was kept in Riga [302]. In December 1912, the firm's automobile department received a governmental order for 100 trucks and other vehicles, necessitating the introduction of night-shifts at its Riga-plant [303].

On 21 August 1911, a *Sommer* biplane, possibly the last airplane serially produced in Riga, was delivered to a military detachment at Gatchina, its final destination being the Russian Navy's Flight School in Sevastopol on the Crimea [304]. In sum, from 1910 and until autumn 1911, according to Shavrov and information in the local press, *RBVZ's*

aviation branch in Riga had built a total of 10 airplanes: one *Gakkel-V* hydroplane; one *Kudashev-4* monoplane; and (most likely) eight *Sommer* biplanes [305].

Today, practically no documentary evidence about *RBVZ's* aviation-related activities in Riga can be found in the National Archives of Latvia, documentary material having possibly been moved to St. Petersburg in 1912, alternatively having been destroyed or simply mislaid. The only document (!) left is Order No. 5420 for ten 150-hp aero-engines, issued on 20 October 1914 (*Заказь No 5420 на 10 машинь: Спецификация No_ 150 HP авиационный моторь. Выдана 1914 г. октябрь месяца 20 дня.*). This document, apparently, was connected with the production of 10 *Sikorsky S-22* aircraft. However, there is no evidence that the engines for those planes had been produced in Riga [306]. In addition, there are some orders placed by the firm with local booksellers, for example for the French journal *La France Automobile at Aérienne*, Hörnes' *Buch des Fluges*, Hansen's *Rotations-Flugmotoren* and Lippmann's *Einführung in die Aeronautik*. As the titles suggest, except possibly Hansen's book, neither the journal nor the monographs could have been of any great use in airplane production. Instead, the *RBVZ* employed specialists from France together with the two Russians Gakkel and Kudashev, from 1912 also Sikorsky, to build its machines.

Slyussarenko's *Helios* workshop. In summer 1912, the press reported about plans by the two Russians Slyussarenko and Koltchin to open a flight school in Riga; both were well known locally by having participated in numerous flight demonstrations in and around town. The new enterprise, said to have caught the interest of 20 prospective students, was to receive financial support from one of Riga's aeronautical societies. Slyussarenko, in addition, was planning to construct a hydro-plane [307]. However, Koltchin that summer left Riga to participate as an aviator on the side of the Bulgarians in the first Balkan war [308].

On 10 September 1912, the local press reported about test-flights at Sassenhof carried out by Slyussarenko on a *Farman* biplane powered by a 50-hp *Kalep*-engine; the airplane was said to have been built by Slyussarenko with the help of local craftsmen. On that occasion, Slyussarenko also mentioned that he intended to take-up airplane production in Riga and to open a flight school [309]. What workshop in town had manufactured and assembled the *Farman* is unclear– it appears plausible to assume, though, that it had been the *Motor* factory. Using the Sassenhof airfield as his base, Slyussarenko soon started to introduce students to the art of flying. A number of his successful overland flights, some of which lasted up to 20 minutes, were duly noted in the press. In late September – early October 1912, Slyussarenko took the *Farman* to St. Petersburg where he participated in military

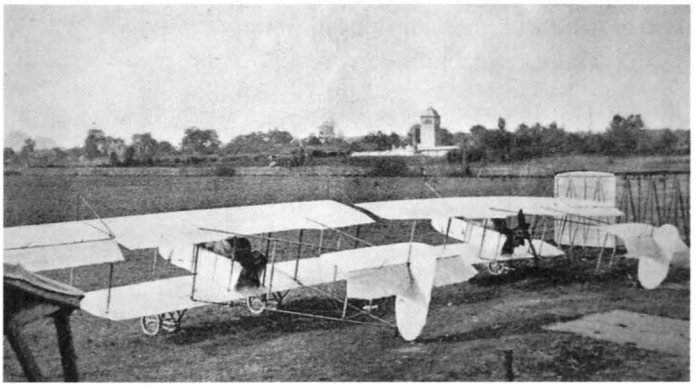
70 *Farman XVI* biplane built by the *Helios* workshop in Riga, 1913.

competitions. During the event, which demanded a minimum airborne time of 1.5 hour, he almost succeeded, being forced to land after 1 hour 28 minutes caused by a frozen carburetor [310]. In any case, on his return to Riga he carried in his pocket a military order for two airplanes. Porokhovshchikov, at the same time, had received a military order for five aircraft [311]. Both aviators planned to set up their workshops in Riga.

By mid-1913, Slyussarenko's workshop *Helios* at *Romanov Strasse 76* (presently *Lāčplēša iela 76*) had completed the assembly of several *Farman* biplanes, all equipped with 50-hp *Kalep*-engines; three of these machines were in turn delivered to the military in St. Petersburg. Larger sections of the *Farmans*, including the wings, hulls and propellers were said to have been built by *Motor*, smaller parts by *Helios* [312]. Calling the machines *Farmans* indicates that production was based on a licensing or other contract with the French firm. It is unclear who in Russia was the license holder, the military, *Helios* or *Motor*.

In October 1913, four officers commanded by Colonel Prutschenko visited *Helios* for acceptance tests. Despite strong winds, test-flights with Slyussarenko at the controls turned out well [313]. On 11 October and again on 13 October, the commission, having again tested the *Kalep*-engine, concluded that its performance was comparable to the French *Gnôme*. After the test-flights were completed, the commission at first accepted two machines, and a few days later a third one [314]. On 21 November 1913, as told, it was announced that *Motor* had received a military order for 20 80-hp *Kalep*-engines [315].

In November 1913, the *Baltische Sport-Zeitung* reported that since the beginning of 1913, *Helios* had produced a total of 13 airplanes including



71 *Farman-XXI* biplanes built by the *Helios* workshop in Riga-Sassenhof 1913.

3 *Farman XVI* airplanes,[1] 1 *Farman XXI*, 6 *Farman V* airplanes, 2 *Farman VII* airplanes and 1 *Farman* trainer. Rotary engines from *Gnôme* were used for powering 2 of these aircraft, the rest having *Kalep*-rotaries manufactured in Riga [316]. All aircraft had a two-seat layout, were able to carry fuel for 8-hour operations and were equipped with a map-reading device, an altitude meter and a device measuring propeller-rotations. The two *Farman VII* airplanes had been built for private customers, and the trainer for Slyussarenko's flight school in Riga; during summer 1913, four students practiced on this airplane.

In later research, different statistics turn up regarding the types and number of *Farmans* produced by *Helios* before the war, Shavrov talking about 14 (all in 1914), Sobolev about 32 (1 in 1913; 31 in 1914) [317]. This is of minor concern, though, considering the number of *Farmans* produced by *Helios* compared to the more than 1 500 *Farmans* (different models) built in Russia until 1917. After the outbreak of the war, *Helios* – like *Motor* – was relocated, in this case to St. Petersburg where until 1917 it produced 138 airplanes of different types [318].

In 1913, Slyussarenko continued his flight school operations, the financial involvement of the 1st Baltic Automobile and Aero Club, a well-endowed organization, providing a stable platform [319]. Slyussarenko's wife L. Zvereva-Slyussarenko, Russia's first female aviator, was also involved in flight training. Interestingly enough, the school was open also for women. Information about the number of students enrolled, or their names, is still missing.

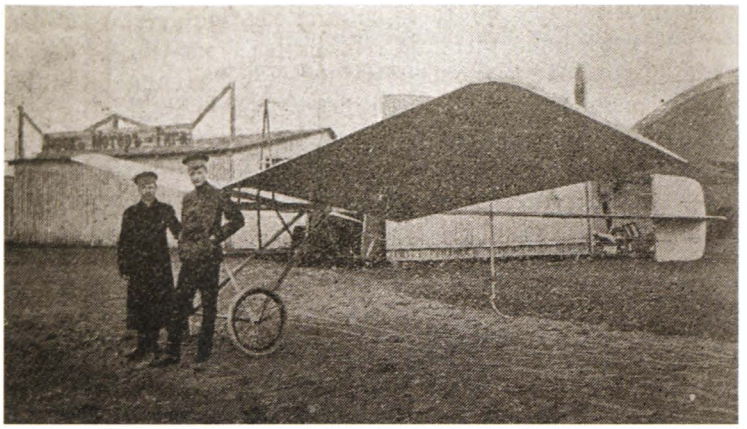
[1] The *Farman XVIs* had double controls. The engines, two *Gnômes* and one *Kalep*, were said to allow a speed of close to 100 km/h. One characteristic for this type was that it could be disassembled and stowed on a railroad car in 45 minutes.

In 1913, flight activities started in May that year, Slyussarenko's training-, test- and demonstration flights on his *Farmans* became a common sight in town. A new element that year was his carrying a considerable number of paying passengers, a thrill taken advantage of by many adventurous men and women. Another new venture in promoting his commercial interests was Slyussarenko's involvement with the local military. On 10 June 1913, for example, he took along on one of his flights an officer from the Topographical Corps, a Captain Romanowsky, the officer taking aerial photographs from an altitude of 120 meters [320]. On 17 July, Slyussarenko performed in front of soldiers at the military exercise field in *Kurtenhof* (*Kurtu muiža*) near Salaspils. On 19 July, on a flight 300 meters overhead *Kurtenhof* soldiers on ground fired with blank cartridges at the aircraft [321]. The next day, flying after dark, the daring aviator ignited fireworks from his aircraft, a risky stunt given the airplane's wooden construction. These kinds of events continued, allowing Russian officers to get to know the airplane.

Some of Slyussarenko's flights, not unexpectedly, ended in crashes, incidents which at times were caused by enthusiastic spectators on ground rather than by technical faults or weather phenomena. It is not known exactly how many flights Slyussarenko carried out during 1913 and the first half of 1914, many test-flights not having been recorded. In any case, he was the most visible aviator in Riga during those years.

Other constructors. In addition to the constructors and manufacturers just mentioned, there were several other individuals and firms connected with Riga who engaged in building aircraft and aeronautical equipment. Thereby, first to be noticed despite his not being mentioned in standard texts of early Russian aviation is Villehad Forssman, a Swede who in 1905 had enrolled in RPI's Department of Mechanical Engineering. In 1910–1911, Forssman, as told, designed an airship for the Russian military, in 1913–1914 a monoplane for the Prince Sigismund of Prussia, in 1914–1915 one of Germany's first 4-engine *Riesenflugzeuge*, in 1915–1918 a 10-engine triplane, and in 1918 one of the world's first remotely controlled unmanned aircraft.

In April 1911, Alexander Porokhovshchikov, a 19-year old student from St. Petersburg, presented his monoplane said to have been built in his apartment. The apparatus, made of birch/pine and strengthened by steel tubing in the wing sections, was powered by a 4-cylinder 20/24-hp *Volt* engine which allowed 1 300 rpm. Horizontal maneuvering of the machine was achieved by wing warping (by moving around and thereby changing the backside of his seat the pilot could control the outer sections of the wing), going up/down and sideways by a rudder and elevator in the tail section. Before coming to Riga, the young constructor was said to have built a biplane in Moscow, a project he was forced to



72 Porokhovshchikov (right) and his monoplane at *Motor's* airfield in Riga-Sassenhof, Riga, April 1911.

abandon due to lack of funds [322]. In mid-June 1911, Porokhovshchikov tested his apparatus at the hippodrome in Riga, making two more or less successful flights at heights of around 5 meters [323].

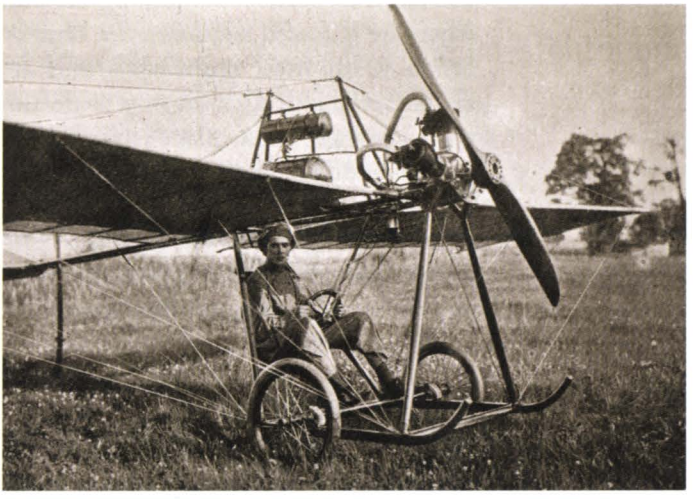
Following his first trial, Porokhovshchikov designed a new apparatus, which was to be automatically stable in flight, and also a model helicopter: blueprints for both machines were said to have been presented to the Technical Committee of Russia's Ministry of Finance [324]. In November 1912, the Riga-papers reported that Porokhovshchikov had received a military order for building five airplanes, the constructor planning to set up a new workshop in Riga [325]. After these news, though, nothing much happened. Instead, in 1914, Porokhovshchikov built an airplane called *Би-Кок* (Bi-Kok) in his apartment in St. Petersburg, a machine tested by the Russian Grigorashvili in August that year [326].

In August 1911, Robert Rosenfeld, a local electrician, was said to have invented a device installed onboard airplanes, that in case of engine problems was to safely land the craft. One can assume that this system was based on some sort of parachute ejected from the aircraft in case of technical mishaps, an idea propagated also by inventors abroad [327].

In 1913, Alfred Rosenthal, a local constructor, carried out some flights with his own fixed-wing aircraft. Rosenthal was a high-school student who in 1911 had built his own glider (see above). Not much is known about the aviator or his machine other than the fact that the apparatus resembled a *Grade* monoplane and was powered by a 2-cylinder 25-hp rotary *Anzani* engine [328]. According to Irbītis, Rosenthal had taken a loan to finance the engine. Due to his inability to pay back the principle or interest, the bank repossessed the aircraft. In 1914, Rosenthal joined Russia's Flying Corps; in 1915, he was killed in action [329].

Andrei Langer (b. 1876) graduated from the RPI with a Diploma in Architecture in 1904. Soon thereafter he moved to Tomsk in Siberia where he became widely known not only as an architect but also as an engineer. In 1910, he was the first to build an airplane in town, a bi-plane which he successfully tested on 12 September 1912 [330]. Langer also acquired a French *Bleriot XI-bis*, using it for demonstration flights at the local hippodrome. Langer is said to have been living for some time also in St. Petersburg where be attended courses in aeronautical engineering [331].

An RPI-student who became well-known internationally for his aeronautical endeavors was *Jānis Akermanis* (1897–1972). During 1915–1916, or at the time of RPI's relocation to Russia, *Akermanis* (John D. Akerman) studied at the Department of Mechanical Engineering. In 1916, before joining the Russian Flying Corps, he enrolled at the Imperial Technical Institute in Moscow headed by Zhukovsky. After the war, Akerman immigrated to the United States. In 1929, having graduated from the University of Michigan, he became Chief-Engineer at the *Hamilton Metal Plane Company*, continuing in a similar position the following year at the *Mohawk Aircraft Company*. Between 1931 and 1959, Akerman served as Dean at the Faculty for Aeronautical Engineering of the University of Minnesota, turning down job offers from the University of Latvia in the late 1920s, and from the Russian government in 1935. During the mid-1930s, Akerman visited Latvia where he discussed aeronautical projects with the Latvian constructor *Kārlis Irbītis*, Akerman handing over aircraft drawings and a wind tunnel design. In the United States, Akerman in addition to his academic position and work in his own laboratory at the *Strato Equipment Company*, served in



73 Rosenthal on his monoplane, Riga 1913.

various official positions, amongst others as an advisor on the National Defense Research Council. He died in Minneapolis, Minnesota [332].

Maximilian Wegner (1884–1962) graduated from the RPI in 1907 with a Diploma in Civil Engineering, specializing in hydro-technology. During World War I, he was responsible for the construction of Spilve airport outside Riga. He died in Berlin [333].

Mstislav Keldisch (1911–1978), a well-kown pioneer of Soviet rocketry and spaceflight, was born in Riga where his father Vsevolod had graduated from the RPI in 1901 with a Diploma in Civil Engineering. After graduation, Vsevolod, specialising in ferro-concrete structures and railroad construction, continued teaching at the institute until 1918, and was an Assistant Professor from 1911 [334].

Arnold von Hertwig (1859–1928) graduated from the Riga Polytechnic in 1887 with a Diploma in Mechanical Engineering. In 1894, after traveling around Europe, he joined the *Provodnik* rubber manufacturing company in Riga, from 1907 serving as Director at first in Riga and later in Moscow; in 1919, he returned to Riga. Around the year 1923, von Hertwig was invited to Leningrad to help modernize the former rubber company *Treugolnik*. He stayed in the Soviet Union until his death in 1928, and was later buried in Riga [335].

Rūdolfs Zārdiņš (1887–1957), having graduated from Riga's *Nikolai Gymnasium* with a silver medal, enrolled at RPI's Faculty of CivilEngineering in 1907 (No. 8324); he left the institute in 1915 without having obtained a diploma [336]. In 1911, Zārdiņš supposedly designed a new type of aircraft which he was going to patent and later try to sell, plans which never materialized. Zārdiņš, despite his interest in aeronautics, did not join Knopp & Zander's association at the RPI [337].

From 1915 to 1918, *Zārdiņš* was employed by the *Riga-Orla Railroad Company*, in parallel continuing his studies part-time in St. Petersburg where he followed lectures by N. Zhukovsky at the Military Aeronautical School [338]. After the war, Zārdiņš at first moved to Germany, where at the aeronautical laboratory of Göttingen University he experimented with a new type of airplane wing. In Zārdiņš' novel design slots placed on the underside of the trailing edge of the wing were to neutralize whirls created at certain angles of attack of the wing from reaching its upper surface. In 1924, Zārdiņš' *Flugzeugtragflügel* (airplane wing) was credited with a German patent [339]. He returned to Riga in the mid-1920s, joining as chief engineer the Aviation Department of the *A.S. Christine Backmans Company*, a firm founded in the early 1920s by Christine Backman, the second wife of Latvia's Minister of External Affairs *Zigfrīds Meierovics* [340]. The firm, before its liquidation in 1930, built a number of airplanes including some types based on foreign licenses and others designed by the company's leading engineers Zārdiņš and Irbītis [341].

Kristaps Henrijs Cīrulis, according to *Irbītis*, was a constructor who built his own airplane at a farm in Kurzeme. After many attempts he supposedly succeeded in his quest, taking his machine on a demonstration tour to central Russia before war broke out when *Cīrulis* joined the Russian Flying Corps. After the war, he left for the United States. Neither *Cīrulis'* airplane (from where did he get the engine?) nor his public flight demonstrations were noted by the local press [342].

Despite his not being directly connected with Riga, another constructor who deserves mentioning is *Jānis Steglavs* from *Mitau* (presently *Jelgava*), a city which before the war was the administrative center of the Courland province. In 1911, *Steglavs*, a coppersmith by trade who later owned a sewerage company in St. Petersburg, learning about a competition for military airplanes organized by the War Ministry, set about to construct his own machine. The outcome of this endeavor was not one but three biplanes. The first craft, the *Steglau-1*, was powered by a 50-hp *Vial*-engine, which *Steglavs* – who never received any flight training – piloted himself. After technical mishaps and crashes he designed a second model, the *Steglau-2* powered by a 100-hp *Argus*-engine. In a military competition organized in 1912, the *Steglau-2* turned out to be the fastest plane, reaching a speed of 130 km/h. Test-flights with his third design supposedly took place in 1914. By that time, however, *Steglavs'* finances were running short, with banks refusing further credits. During the 1917 Revolution, Steglavs was arrested but succeeded to escape, eventually returning to Latvia. In 1924, he left for the United States [343].

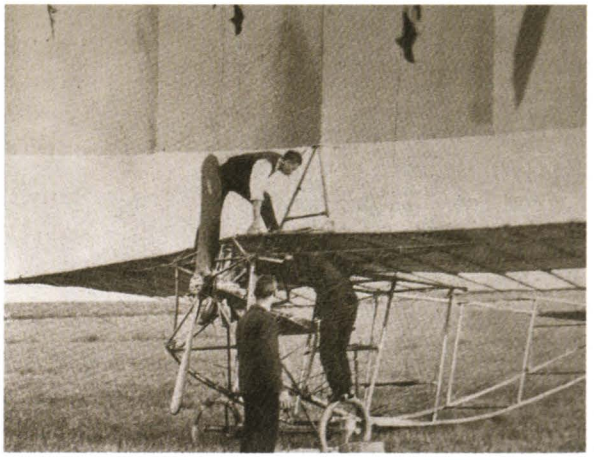
Steglavs is credited with having been the first constructor to use veneer instead of fabric for covering the bearing surface of airplane wings, a detail which in 1916 was more widely employed on *Fokker* aircraft manufactured in Germany. Usually unnoticed thereby is the fact that the all-wooden wing used by Anthony Fokker on some of his airplanes from 1916 onwards had originally been manufactured by the firm *Brüning* in Hanau, Germany, designed by the firm's chief engineer, the former RPI-student Villehad Forssman [344].

Another constructor who needs to be mentioned, also because of his connections with Kalep, is Alexander von Willisch who in 1913 built a monoplane similar to an *Etrich Taube* called *Schwalbe des Nordens / Северная ласточка* (Swallow of the North). According to Sharov, the aircraft had been built in Reval. From the outset, the apparatus was powered by a 35-hp engine, which was soon considered to be too weak. Therefore, in July 1913, a 60-hp *Kalep*-rotary was installed. Willisch's *Swallow* had a width of 16.5 meters (wing area 41 m^2), length of 9 meters, weighed 300 kg (without pilot), could reach a speed of 100 km/h and carried fuel/oil for a 3-hour flight [345]. Willisch, after

some successful flights in Libau on Courland's west coast, planned to make an overland flight from Libau to St. Petersburg [346]. On 14 July, however, facing a motor-stop at an altitude of 500 meters he was forced to land in the Baltic Sea. The aviator was soon picked out of the water by fishermen, his aircraft having sustained minor damages. In the local press Willisch's machine («in all its parts a Russian construction») was hailed as representing nothing else but the «first type of Russian aircraft»; in hindsight, this was possibly exaggerated [347]. In September 1913, Willisch planned to participate in a military competition in St. Petersburg. However, his apparatus, damaged by the crash mentioned, was not restored in time. After that, Willisch's aeronautical endeavors appear to have stopped.

Already in early 1908, the *Franz Kluge Gummifabrik* (Rubber Factory) in Riga started to advertise among its products envelopes for dirigibles, spherical balloons and other kind of aeronautical equipment including airplanes. At that time, those items were in all likelihood not included among the products either manufactured or sold by the factory, the ads having been nothing but trial-balloons for testing the reaction of potential customers. Other businesses in Riga started to take an interest in aeronautics and aviation as well. In 1909, for example, the trading house *Jochen* advertised both aerostats and airplanes, all from respectable foreign manufacturers. For Riga, these and similar attempts were possibly made too early [348].

Among the few companies located in Riga actually engaged in manufacturing aero-equipment used for aerostats and airplanes was the Riga branch of Russian-American rubber manufacturing company *Treugolnik* [349]. Another company in this same industry was



74 Willisch and his *Swallow of the North* monoplane, Libau (*Liepāja*) 1913.

Russian-French company *Provodnik*, which in addition to rubber boots, car tires and other similar products supplied fabric and other materials used in aircraft production [350]. The company *Fenix*, which specialized in manufacturing farm equipment, fell into this same category [351].

Summary. Summarizing the development between 1910 and 1914 with regard to aeronautical equipment imported to Riga from abroad, manufactured in Riga or designed and produced abroad by constructors related to Riga, the following picture emerges.

- Airplanes brought to Riga from abroad in 1910:
  - *Wright* biplane, Kalep & Arntzen;
  - *Grade* monoplane, Leutner et al.;
  - *Blériot* monoplane, Feitelberg et al.
- Airplanes and engines manufactured by the *Motor* factory in 1910–1914:
  - Kalep's monoplane (1);
  - *Wright-Farman* derivative (9);
  - Dybobvsky's *Dolphin* (1);
  - Aero-engines:
    - *Wright*-derivatives (several);
    - *Gnôme*-derivatives (several);
    - *Kalep*-rotary engines (several).
- Airplanes manufactured by the *RBVZ* in 1911–1912:
  - *Sommer* biplanes (8);
  - *Kudashev-4* (1);
  - *Gakkel-V* (1);
  - aero-engines (number unknown).
- Airplanes manufactured by Slyussarenko's *Helios* in 1913–1914:
  - *Farman* – different models (10).
- Airplanes produced by other local constructors:
  - exact types and numbers unknown.
- Equipment constructed abroad:
  - 1909–1911, Forssman's dirigible (2);
  - 1913–1914, Forssman's *Bulldogge* monoplane;
  - 1914–1915, Forssman's 4-engine biplane;
  - 1915–1918, Forssman's 10-engine triplane;
  - 1918, unmanned aerial vehicles (*Forssman, SSW, Idflieg*).

During a relatively short period of 3–4 years, Riga experienced the upstart of local airplane production, mostly based on foreign models, and the design and production of indigenous aero-engines. Underlying this development was the breakthrough of flight heavier-than-air, with specialized workshops being established all across Europe, public flight demonstrations captivating large crowds, aviators becoming household names and flight records being broken. The driving force, thereby, in

addition to the curiosity and inventiveness of scientists, constructors and workshop owners, was an increasing interest shown by military establishments, state organizations, which at that time were the only potential customers able to place larger orders. Thus, it was primarily the military who encouraged engineers and workshops to continue developing their machines. During World War I, this slumbering symbiosis of aviation and military would come into full bloom.

In pre-war Riga, the Russian military showed an interest both in Kalep's aero-engines and *RBVZ's* airplanes. In the end, though, French *Gnôme*-engines became the preferred choice, while the *RBVZ*, having manufactured a small number of machines in its Riga-plant, was relocated to St. Petersburg. In this scenario, Slyussarenko and others played minor roles, while the forward-looking designs of Forssman materialized outside the Baltics.

2.4 Zander's Awakening Interest in Space

In the early years of the 20th century, aeronautics and aviation starting to receive wide-spread public attention, interest in outer space and its phenomena was more restricted to small circles of scientists and others who like Zander had taken a special interest in these matters. During 1908–1914, for example, the only space-related article in the *Rigasche Industrie-Zeitung*, despite its editorial board consisting of members from RPI's faculty, is a short reference to the Swedish physicist Svante Arrhenius' book *Das Schicksal der Planeten* (The Destiny of Planets) published in 1911 in Leipzig [352]. In those days, the *Technischer Verein* (Technological Association) in Riga organized not a single lecture concerning the cosmos, its elements or other characteristics. The situation was not much different in other societies. In the *Naturforscher-Verein*, for example, the only reference to space was a lecture held on 3 September 1912 by the engineer Richard Swinne (1885–1939) about *Radioaktivität und Kosmos* (Radioactivity and the Cosmos) [353]. At that time, Swinne worked as an assistant at the RPI, having graduated with a Diploma in Chemistry in 1912. He later became known as a chemist and physicist, working for the *Siemens* firm in Germany.

The universe, apparently being of limited interest for Riga's learned circles, received some more attention in the local press, compared to aeronautics and aviation, however, on a far lower scale. Looking at the *Rigasche Neueste Nachrichten* for the years 1909–1911 one finds 15 space-related articles, 6 in 1909 followed by 8 in 1910 and 1 in 1911. All except one were unsigned while – without exception – displaying a level of expertise that went far beyond the scientific understanding

of ordinary journalists. Given Zander's interest, it could very well have been the case that he had been one of the authors of the following articles:

- *Geschwindigkeitsmasse im Weltall* (Speed of mass in the universe) (27.02.1909);
- *Ist das Weltall begrenzt oder unendlich gross?* (Is the universe bounded, or infinite?) (03.07.1909);
- *Flammenausbrüche auf der Sonne* (Flame eruptions on the surface of the Sun) (21.07.1909);
- *Mars-Beobachtungen* (Observations of Mars) (25.08.1909);
- *Halley's Komet* (Halley's Comet) (02.09.1909);
- *Halley's Komet* (Halley's Comet) (from *Frankfurter Zeitung*, 27.11.1909);
- *Mars-Opposition* (Mars Opposition) (07.09.1909);
- *Die Sonnenfinsternis vom Mai* (The Solar Eclipse in May) (15.01.1910);
- *Halley's Komet*; (Halley's Comet) (from *Umschau*) (30.03.1910);
- *Wann und wo ist Halley's Komet in Riga zu sehen?* (When and where can Halley's Comet be observed from Riga?) (from *Riga Tageblatt*, signed by Adolf Richter, 13.04.1910);
- *Die Entdeckung des Saturnrings* (The discovery of Saturn's rings) (23.07.1910);
- *Sind die Kometenschweife gekrümmt?* (Are the tails of comets curved?) (20.08.1910);
- *Die Geschwindigkeit der Sonne* (The speed of the Sun) (from *Astronomical Journal*) (04.09.1910);
- *Mondfinsternis in Wissenschaft, Geschichte und Anekdote* (Lunar eclipse in science, history and anecdote) (04.11.1910);
- *Gibt es Leben auf den Planeten?* (Is there life on planets?) (03.12.1910);
- *Eine interessante Erscheinung am nächtlichen Himmel* (An interesting phenomenon in the sky at night) (03.08.1911).

The *Rigasche Neueste Nachrichten* stopped publication at the end of September 1911. Continuing with the *Rigasche Rundschau* from September 1911 to July 1914, two more space-related articles appeared:

- *Die zentrale Sonnenfinsternis vom 17. (4.)* April 1912 (signed A.-R./ A. Richter) (The central Solar eclipse) (21.03.1912);
- *Die physische Beschaffenheit der Sonne* (The physical composition of the Sun) (from *Illustrierte Beilage der Rigaschen Rundschau*) (June 1912).

In RPI's library, Zander had access to the results of ongoing research in astronomy and astrophysics published abroad, thereby being able to consult the *Jahrbuch der Astronomie und Geophysik* (Year Book of

Astronomy and Geophysics), Leipzig, 1890→; *Vierteljahresschrift der Astronomischen Gesellschaft* (Quarterly Journal of the Astronomical Society), Leipzig, 1866–1891; *Wochenschrift für Astronomie, Meterologie und Geographie* (Weekly Report of Astronomy, Meteorology and Geography), Halle, 1867–1991; and *Zeitschrift für populäre Mittheilungen aus dem Gebiete der Astronomie und verwandter Wissenschaften* (Journal for Popular Information from Astronomy and Allied Sciences), Altona, 1860–1969 [354]. It is, of course, difficult to judge if and to what extent Zander contacted these sources, or enabled him to ask more poignant questions.

According to Zander's autobiography of 1927, he made his first calculations concerning interplanetary travel in 1908, the «computations on the discharge of gas from a vessel, the work necessary for overcoming the attraction of the Earth» [355]. In his diary on 18 September 1908 one can read the following:

> «Given today's level of technology, it is interesting to investigate if one can carry along enough energy (resources) necessary for reaching another star. The movement is most likely brought about by the reactive power of escaping gas. Therefore, the apparatus should be able to carry the necessary amount of gas (in compressed or, even better, fluid state) in addition to its own weight, which would principally solve these problems. It is now necessary to calculate the acceleration at any given distance from the Earth, and the power necessary for moving the mass to ... the desired distance from Earth. It is $g = g' * R (2) / R' (2)$, with $g = 981$ cm/s^2... being the acceleration on the Earth, where R is the Earth's radius; R' is the distance of the respective point from the Earth's center; and g' is the acceleration of the respective point» [356].

Zander's first ideas about what he called the *Weltschiff / W.S.* (Earth-Ship, by Zander also called *Ätherschiff* / Airship) originated during that same period when he listed a number of principal issues, which he felt needed to be studied more closely:

> «Conditions, which decide the shape of the vessel; The number of outer walls; Departments inside the vessel; Devices to keep the floor level (...); Currently existing air compressors; Carbonic acid and other substances absorbing developing gases; Regeneration of oxygen; Processing of waste; A small garden in the W.S.; Space for fuel; Processing of solar heat; The choice of reactive power; Building used for constructing and storage of the W.S.» [357].

In 1908, having turned 21, Zander received a larger sum of money from his family which he invested in an astronomical telescope

75 Zander in the mid- to late 1910s.

(length 1.5 m, lens diameter 4 inches) from Germany. The following year, in September, when the planet Mars moved close to Earth (Mars-Opposition), Zander found ample opportunity to demonstrate his instrument to other students at his institute [358].

One of few times Zander's name was mentioned in the press during his student days was in connection with the Solar Eclipse on 4 (17) April 1912. Thereby, Zander together with Leonid Arefjew, another RPI-student, joined Adolf Richter on an excursion to the eclipse's «zone of centrality» located outside Riga along a line between the two railway stations *Cēre* and *Stende*. From *Tukums*, where the Riga-group met an expedition coming from Mitau led by the Head Teacher Zlatinski, they proceeded to the *Cēre* station in the vicinity of which they set up their arsenal of different scientific instruments, including Zander's, according to Richter «vortreffliches, parallaktisch montiertes Münchener vierzölliges Fernrohr» (an excellent, mounted for parallactic compensation 4-inch telescope from Munich) [359]. At 13.25 and 29.5 seconds, Zlatinski announced that it had started, the Moon moving in front of the Sun. At 14.23, with darkness slowly settling over the

76 Observation of the Solar Eclipse on 17 April 1912 by groups of students from Mitau and Riga at *Cēre* railway station. Zander is standing in the background (3rd from right).

landscape, a flock of crows came screeching out of a nearby forest, at 14.40 roosters started to crow at nearby farmsteads.

According to Zander, who was following the process through his telescope with a chronometer in his hand, the climax took place at exactly 14.41 Petersburg time, a moment described by Richter as follows:

> «The sacred moment had arrived, which all of us will not forget during our whole lifetime ... we all cried out when on the Western side, at first between the mountaintops of the Moon fiery rays of the Sun broke through, uniting with lightning speed around the Moon into a prominently indented wreath ...» [360].

At 15.54 and 53 seconds it was all over, Richter and the two RPI students returning to Riga.

At the turn of the century, one of the largest telescopes in Riga was placed in RPI's observatory: it was an achromatic refractor from *Fraunhofer* with a lens diameter of 97 mm and a focal length of 137 cm. After its operation by Professor Alexander Beck at the end of the 19th century, the telescope was neither used for research nor made accessible to the general public [361]. According to Richter, Zander's instrument from *Reinfelder & Hertel* had a lens diameter of 102 mm.

Several amateur astronomers operated their own small observatories that time, among them Adolf Richter who in 1910, using a powerful refractor from *Frauenhofer* (75 mm lens), was able to closely observe Halley's Comet. Richter's private observatory was located in *Hagensberg* (presently *Āgenskalns*), close to one of the main bridges across the river

Daugava. His telescope, which was powerful enough to observe double stars, bright nebulae, the moons of Jupiter or sunspots, came from the director of Berlin's observatory Wilhelm Foerster (1832–1921), who had used the instrument in his youth. Later, Richter added a small astronomical clock and other telescopes to his instruments.

Richter, a correspondent for the *Düna Zeitung* which published his articles about space (see before), became more widely known in the Baltics by publishing *Adolf Richters Kalender, ein Zeit- und Himmels-Weiser für Riga als Herausgeber und Kompilator* (Adolf Richter's Calendar, 1896–1914). Widely used were also his *Adressbücher, herausgegeben von Richter – Richter's Baltisches Verkehrs- und Adressbücher* (Directories, edited by Richter; Richter's Baltic Transport; and Address Books), published between 1900 and 1913. In 1919, Richter was shot by local Bolsheviks, believed to be a German spy [362].

Here can also be mentioned *Alfrēds Žagers* (*Žaggers*, 1878–1956), who in 1904–1906 operated an observatory and precise clock at the Nautical School in *Mangaļi* outside Riga. *Žagers* enrolled in RPI's Chemistry Department in 1898 (No. 5624) and graduated in 1913 with a Diploma in Chemical Engineering. In 1920, *Žagers,* who already during his student days at the RPI worked as astronomy teacher, joined the University of Latvia, in time becoming a well-known astronomer.

In late May 1912, Zander had the opportunity to add his own comments to Richter's at a session of the *Naturforscherverein* in Riga [363]. Following a presentation by Associate Professor R. Meyer from the RPI, showing photographs from the eclipse, Zander mentioned the following:

> «...when the mountains on the Moon became clearly visible, only a small part of the Sun was still to be seen; the mountain tops already reached up to the ring of the Sun at 25 places, when between them the disk of the Sun was still shining in bright patches. The duration of the ring formation had been underestimated. A drop of the thermometer was observed also on the instrument placed in the shadow» [364].

After Zander's presentation came Professor H. Pflaum from the RPI, the Head Teacher A. L. S. Werner and the conservator E. F. Stoll, all three talking about different aspects of the eclipse. That day, *studiosus* Zander was in a prominent company.

Friedrich's father Arthur Zander, as told, was a long-standing member of the *Naturforscherverein*, donating numerous books and natural specimen such as «several trans-Caspian lizards: porencephalies, a frog, and young American swamp-turtles». Another member of the society was Kurt Zander, Arthur's oldest son and like his father and

younger half-brother Friedrich interested in scientific discovery and observations. Kurt, the same as his father, presented many of his findings to the society's collections including «a common toad, 4 young toads, a whip snake, a grass snake, three dice snakes from South Tyrol».

In 1913, the Zander family moved to *Ernestine Strasse 1* (presently *Ernestīnes iela*) where Friedrich started to grow vegetables in a corner of the garden. His interest had been caught by the conditions of life in space without oxygen, trying to assure normal metabolism. Was it possible to set up a greenhouse and grow vegetables inside a spaceship? Zander would continue his practical experiments after having moved to Moscow in 1915.

3

FRIEDRICH ZANDER IN MOSCOW (1915–1933)

In 1914, having graduated from the RPI, Friedrich Zander found a job at the *Проводник-Рижский завод резиновых изделий* (Provodnik Rubber Manufacturing Factory) in Riga, remaining in its employ until 1918, from August 1915 in Moscow. Zander's move to Moscow turned out to be more decisive than he had possibly intended: he never returned to his hometown on a permanent basis. His life and work in Russia, from 1922 the Soviet Union, has been the subject of numerous monographs and articles and need not be retold in any greater detail [365].

In Moscow, while working for *Provodnik*, Zander started to experiment with greenhouse gardening, using flowerpots filled with charcoal (three times lighter than earth), trying to simulate spaceflight-like conditions. In addition, he continued with his calculations for interplanetary travel including rocket trajectories, flight times and speed [366].

In early 1918, Zander was employed at Plant No. 4 called *Motor* in Moscow, meaning at Kalep's former *Motor* factory, which after the outbreak of war had been moved from Riga to Moscow. There, Zander headed the firm's technical office, participating in the development of the first Soviet airplane engine *M-11*, later also the *M-15, M-26* and *M-5*. In the beginning of 1921, Zander was ready to publicly demonstrate the first design of a spacecraft engine at a regional conference of inventors in Moscow, an event attended by Lenin who personally encouraged Zander to continue his efforts. From mid-1922 to late summer of 1923, Zander took time off from his work at *Motor*, enabling him to more intensively engage in his space studies.

In autumn 1923, Zander got married to the Russian girl Alexandra Feoktistovna Milyukova. The couple had two children, the daughter

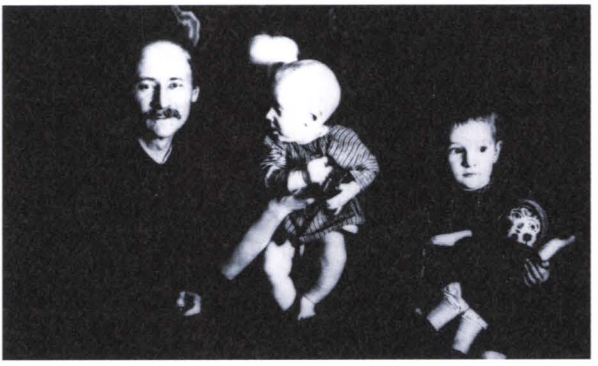
77 *Russian-French Partnership Company Provodnik (ПРОВОДНИК – Товорищество Русско-Французкихъ Заводовъ)* in Riga, where Zander started to work after graduating from the RPI in 1914.

Astra and the son Merkur, who were born in short order, something, which according to Zander «considerably slowed down the work».

In late 1923, Zander returned to work for *Motor*. The following year, in 1924, he was among the organizers of the *Общество изучения межпланетных сообщений* (Association for the Study of Interplanetary Communication) in Moscow, a short-lived association, which among its many members boasted Professor Konstantin Tsiolkovsky, Felix Dzerzhinsky, the Head of the Soviet Secret Police (Cheka), and Yakov Perelman, a well-known science-writer.[1] That year, Zander also published his first article titled «Flights to other Planets» in the journal *Техника и жизнь* (Technology and Life), therein summarily outlining his idea of combining a rocket-engine with an airplane, and using metal parts taken from the aircraft for fueling the engine. In late 1924

[1] Yakov Perelman (1882–1842) was a well-known author of many science books and articles, including the ones on astronomy and space. He was highly appraised by Tsiolkovsky. Perelman died of starvation during the siege of Leningrad.

78 Zander sitting at his desk in Moscow, early 1920s.



79 Zander with his two children Merkur and Astra, Moscow, late 1920s.

80 Zander with his daughter Astra in Moscow, late 1920s.

and early 1925, Zander delivered lectures on travelling into space to audiences in Moscow and other Russian cities, one in Leningrad being chaired by Professor Sergei Glasenapp (1848–1937) [367].

In early 1927, while finishing a short autobiography, Zander also readied for print a lengthy monograph holding his theories and calculations concerning spaceflight, a project, which in the end, despite the support he received from prominent scientific circles, was turned down by *Glavnauka*, the chief administrative institution responsible for scientific publications. The headlines of the main chapters in Zander's magnum opus can indicate the intense intellectual development he had undergone over the previous 12-year period [368].

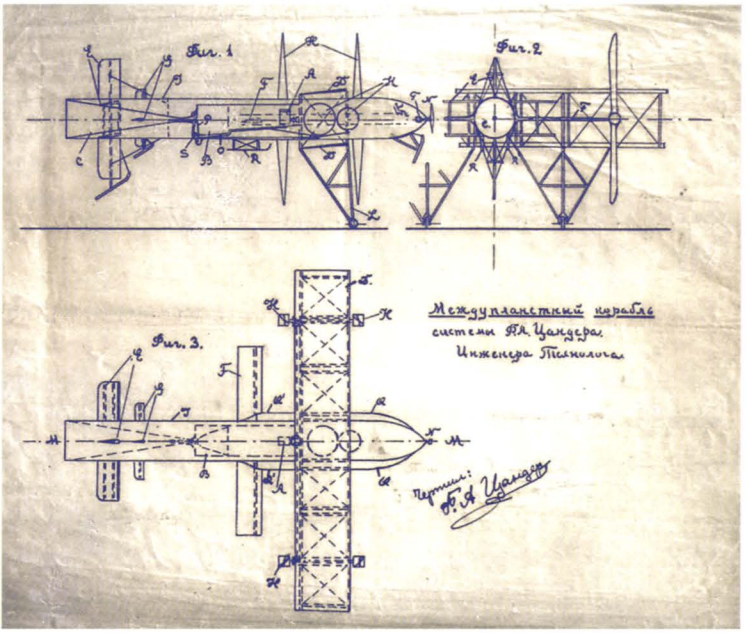
I. Preface. Investigator's and inventor's path.
II. Introduction. Subject of the book. Outline of the problem.

III. Calculations for the design of rockets and spaceships.
IV. Theory of interplanetary flight.
V. Calculations for rocket flights through outer space around a large part of the terrestrial globe. Minimum velocities to be given to a rocket to ensure a given range of flight. Numerical data.
VI. Calculations for flight in outer space with the aid of light pressure.
VII. Apparatus for the conversion of solar rays into low-velocity cathode rays. Flight with the aid of cathode-ray pressure.
VIII. Calculations of charged spheres repelled by the planets and the Sun. Stresses in the material of these spheres. Repulsion and attraction forces. Attainable velocities. Methods of charging the spheres.
IX. Design and calculation for a spaceship and its engine.
X. Use of lightweight hothouses and the closed cycle necessary to sustain life in airtight quarters in a spaceship, in an interplanetary station, on the Moon, and on other planets possessing an atmosphere.
XI. Approximate outline of theoretical and experimental investigations of materials and structures suitable for interplanetary flight. Conditions of life in interplanetary space.
XII. Brief survey of results achieved.
XIII. Prospects for the future. 1) Near future. 2) Distant future.

Zander's first monograph «Problems of Flight with the Aid of Jet Propulsion Machines» was published only in 1932, while several of his articles were printed only after his untimely death in 1933 [369]. Trying to summarize these studies in the context of present study is neither possible nor necessary [370]. In 1973, Y. Moshkin, who in 1934 headed a group of stenographers trying to decode Zander's notebooks from the 1920s written in a special type of German shorthand, summarized Zander's scientific achievements under the following main headings: Interplanetary spacecraft (rocket engine, metal fuel); Investigation of fuels; Study of processes within the (reaction-) chamber and cooling conditions; Increasing specific impulse and efficiency; Reaction engine *OR-1*; and Rocket engine *OR-2* [371].

Zander's principal ideas and proposals are most aptly summarized in his own words:

> «As far as I know, I was the first to make the following suggestions.
>
> 1. To provide rockets with wings for flight in the atmosphere, for attainment of cosmic speeds of approximately 8 km/sec in the upper layers of atmosphere, and also for landing in a glide upon



81 Zander's technical drawing of his spaceship, Moscow, mid-1920s.

return from inter-planetary space to the Earth or some other planet possessing an atmosphere.

2. To equip such an airplane rocket with engines for flight in the lower layers of the atmosphere, where the efficiency of rockets is very small due to the low flight speed. The engines should be of special design, it being best if they are designed to operate for half an hour without breakdown.

3. To simultaneously use rocket propellants giving solid and gaseous products of combustion. The first kind of propellant (particularly because methods, proposed by others, of assembling rockets involve enormous initial weights and are therefore not cheaper but more dangerous than my airplane rocket, since the design of pure lifting rockets has not yet been studied) may consist of parts of the interplanetary spaceship, e. g., girders, surfaces, etc., made of alloys of aluminum, magnesium, lithium, etc. These parts become superfluous because of the weight reduction due to the consumption of part of the propellant. It is thus an advantage for building a very strong spaceship capable of carrying a sufficient amount of propellant.

4. To use combinations of rockets and concave mirrors concentrating the sunlight inside the spaceship in order to

increase the gas-outlet velocity, i.e. the power of the rocket during the flight in interplanetary space.

5. To use a ring (solenoid) in which an electric current flow, and the pressure of the solar radiation on a cloud of iron filings maintained inside the ring by the electric current for propulsion in interplanetary space. It is an advantage that meteors passing through this cloud will scarcely affect the flight.

6. To concentrate the sunlight in parallel beams by means of huge convex and concave mirrors designed as described in point 4, in order to obtain high speeds and permit flights to other solar systems (at present this is the only possible method which offers hope for such flights).

7. To use a sphere made of very thin metal sheets, charged by the Earth's electricity and repelled from it by electrostatic forces, for the purpose of interplanetary flight. This is possible if the Earth carries an electric charge.

8. To circle round a planet in- or outside its atmosphere in order to increase the flight speed (obtaining energy gratuitously during flight to other planets). To accelerate the interplanetary spaceship when its flight speed is high (for the same purpose).

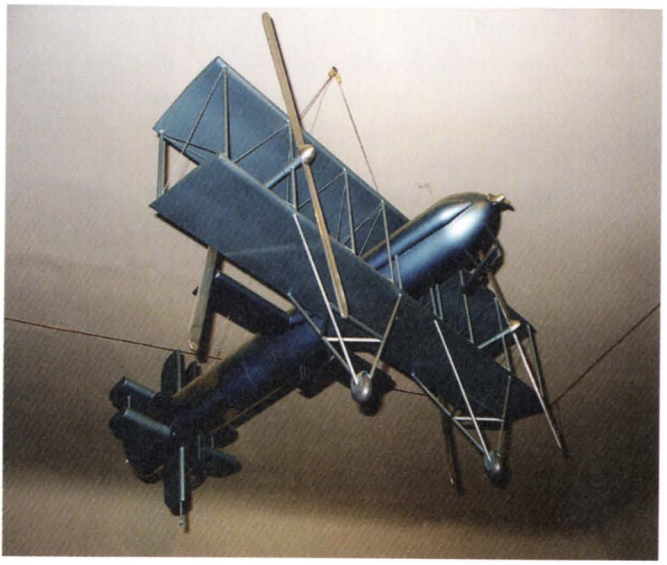
9. To deflect meteors by means of electrostatic energy emitted by the spaceship as cathode rays in the direction of the meteors, the spaceship being located inside an electrically charged sphere.

I have several other suggestions to make on the design of interplanetary spaceships, their engines, rockets, etc., as well as other proposals which I have not yet worked out sufficiently» [372].

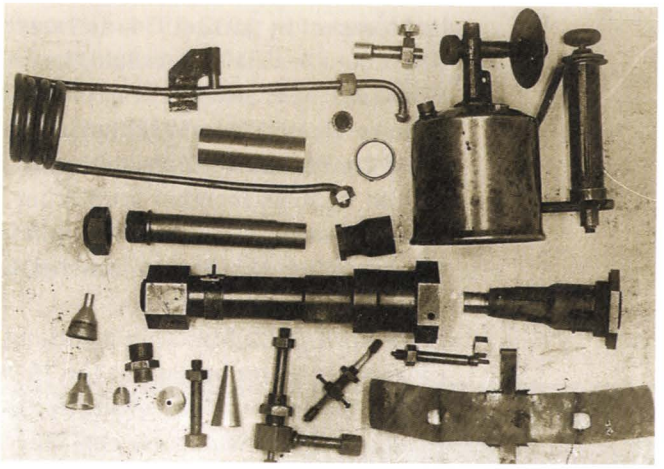
Between 1924 and 1930, Zander was employed as senior engineer in the Central Design Bureau of *Авиатрест, завод No. 24* (Aviation Trust's Factory No. 24), from 1928 onwards working on his first rocket engine *OR-1* (Russian *OP-1*), which was to be powered by compressed air in combination with gasoline. This engine is considered to have been the first Soviet liquid-fuel engine. In late 1930, Zander started to work for the *Центральный институт авиационного моторостроения, ЦИАМ* (Central Institute of Aviation Engine Construction, TsIAM) which allowed him to continue his work on the *OR-1*.[1]

In 1931, the *Общество содействия обороне, авиационному и химическому строительству, ОСОАВИАХИМ* (Central Council of the Union of Societies of Assistance to Defense and Aviation-Chemical Construction of the USSR, OSOAVIAKhIM) followed Zander's proposal

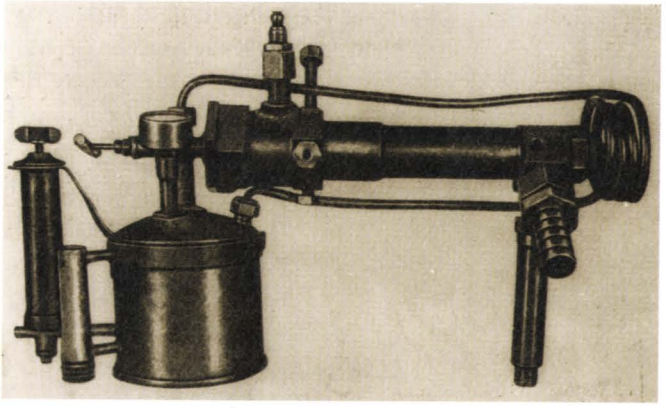
[1] In Russian OP-1, OP-2, or *Опытная ракета*.



82 Small-scale model of Zander's spaceship, designed during the late 1920s.



83 Parts of Zander's *OR-1* rocket engine, Moscow, late 1920s–early 1930s.



84 Rocket engine *OR-1* designed by Zander, Moscow, early 1930s.

and established a jet section, appointing him the director. The section was re-organized in September that year and thereafter called the *Группа изучения реактивного движения, ГИРД* (Group for the Study of Jet Propulsion, GIRD). At first Zander headed this group, which played a decisive role in early Soviet rocketry; in April 1932, the later well-known Sergei Pawlowitsch Korolev (1907–1966) took over this position.

It is likely that Zander's initiative received the support of *Roberts Eidemanis* (1895–1937), who was the Chairman of *OSOAVIAKhIM* from 1932. *Eidemanis*, born in Lejasciems in Livonia, had enrolled in RPI's chemistry department in September–October 1914 [373]. After having left Riga he continued his studies at the Institute for Forestry in Petrograd. In 1916, he enrolled at a military college in Kiev, participating thereafter as Second Lieutenant in the war. *Eidemanis* joined the Red Army in 1918. During the Civil War, he fought for the Bolsheviks on different fronts, in the end as Corps- and Army Commander. In 1924, after the internal strife had ended, he commanded the Siberian Military District; from 1925 to 1932, he lectured at the Frunze Military Academy in Moscow. In 1932–1934, he was a member of the Revolutionary War Council; in 1932, as told, he became Chairman of *OSOAVIAKhIM*. *Eidemanis* was also a member of the Latvian section of the Soviet Writers' Union since 1932, having several literary works to his credit [374]. On 22 May 1937, during the Great Terror, *Eidemanis* was arrested and on 11 June, together with other high-ranking military officers, i.e. Tuchatshevsky, Jakir and Uborevitsch, sentenced to death and shot the following day. In 1957, during Khrushchev's thaw, *Eidemanis* was posthumously rehabilitated.

In April 1932, Zander in addition to his own research had organized courses on jet propulsion at the *Моско́вский авиацио́нный институ́т, МАИ* (Moscow Aviation Institute, MAI).[1] He also joined *GIRD* on a full-time basis, continuing testing the *OR-1* engine and in October 1932 starting to work on the *OR-2*, the first Soviet liquid-fuel reaction engine that used a combination of liquid oxygen and gasoline. This engine was intended to be installed on the *GL-1* glider (flying-wing type) designed by B. I. Cheranovsky. Real-life tests with the *OR-2* started on 18 March 1933 without Zander being present due to him undergoing medical treatment away from Moscow.

In late 1932, Zander started working on a new and more powerful liquid-fuel engine with a proposed thrust of 600 kg, and with models having thrusts exceeding 5 tons.

[1] One notices that both *ЦИАМ* and *МАИ* were founded in 1930, Zander thereby having been among the first resesarchers/teachers working there for the development of Soviet rocketry central institutes.

85 Zander (third from right) and his colleagues at *GIRD*, Moscow, early 1930s. Korolev is standing 2nd from left.

The outcome of Zander's design work (bench-testing prototypes had uncovered shortfalls in design which necessitated modifications) was a 220-cm long rocket called the *GIRD-X*. On 25 November 1933, the Soviet Union's first liquid-fuel rocket, designed by Zander and completed after his death by his team at *GIRD*, was successfully launched in the outskirts of Moscow [375].

In spring 1933, Zander showed signs of severe overwork and was sent to a sanatorium in Kislovodsk. On the journey to his destination he

86 Zander's burial ceremony at Kislovodsk, USSR, 1933. Portraits of Voroshilov and Dzershinsky hanging on the wall (right).

87 *GIRD-X* rocket, designed by Zander and his team in Moscow, 1933.

contracted typhoid fever. From his sickbed at the rest home, possibly sensing that the end was near, he sent a letter to his colleagues at *GIRD* which ended with the following words:

> «Forward, comrades, and only forward! Raise the rockets ever higher, higher and higher, closer to the stars!» [376].

Friedrich Zander, 46 years of age, died during the early morning hours of 28 March 1933 at a sanatorium in Kislovodsk, not being allowed to witness the tests of his *OR-2* engine or the successful launch of the *GIRD-X* rocket.

4

ACTIVITIES COMMEMORATING FRIEDRICH ZANDER (1953–2017)

1953–1960 Zander, like other well-known scientists, has been the recipient of numerous honors. Already in 1953, shortly after the death of Stalin, the 20th anniversary of Zander's death was remembered by *Правда* (Pravda), the Soviet Union's most influential newspaper. According Pravda, Zander had dedicated his life to the development of interplanetary vessels, hoping that in the future, rockets having started to move into space, one of these craft would carry his name [377]. Today, reflecting on Zander we realize that the former citizen of Riga also retains a lasting place in the collective memory of the city's inhabitants. As this tome is dedicated to Zander, a former Riga-citizen, most honours listed in this chapter are connected with Riga and Latvia.

Interest in Zander's life and work intensified in 1957 with the launch of *Sputnik*, and in 1961 after Jury Gagarin's first manned spaceflight. While most honors and other acknowledgements concerning Zander have been connected with different anniversaries and similar events, there were also other celebrations: on 11 August 1959, for example, Zander's birthday according to the Gregorian calendar, his friends and former colleagues in Kislovodsk inaugurated a monument to Zander at the Brothers' Cemetery close to the graves of Soviet soldiers.

On 23 August 1960, Zander's 73rd birthday anniversary, a memorial plaque was affixed to the former Zander residence at *Frīdriha Candera iela 1* in Riga, informing about his childhood and youth. At this festive event, the Mayor of Riga *Ēriks Baumanis* (1923–1980), from the outset duly observing the significance of the Communist Party, praised Zander's work and its importance for scientific progress. Other speakers on this occasion were Iveta Sprunka, Deputy Secretary of the Komsomol section

at the RPI, and *Juris Birzvalks* (1926– 1995) from the Institute of Physics of the Academy of Sciences of the Latvian SSR [378].

1962–1975 The first major celebration in Zander's honor was organized together with the anniversary of his 75th birthday on 23 August 1962. This happened at a time the Soviet Union was reaching major milestones in its space program, let be that Zander's early dreams about flying to Mars were still far off in the distant future. Following a proclamation issued by the Academy of Sciences of the USSR, Zander's birthday was widely celebrated across the Soviet Union [379]. The widespread public enthusiasm regarding the space program, boosted by numerous articles about space published shortly before the Zander-anniversary, was thereby reinforced by the first successful tandem-flight in space by the two cosmonauts Pawel Popovitsch (1930–2009) and Andrijan Nikolajev (1929–2004) in mid-August that year. All this together, of course, influenced the commemoration of Zander.

Commemorating Zander's birthday, the Riga Philatelist Association issued special letter envelopes with Zander-stamps, which could be validated at Riga's Central Post Office only on that very date (23 August 1962) [380]. A total of 3 500 envelopes were printed, of which 2000 were eventually stamped and 800 sent to 15 cities in the Soviet Union, becoming specially valued collectors' items also abroad [381]. One notices that the Russian and Latvian texts imprinted on the envelopes differ, the Russian one referring to Zander as pioneer of Soviet rocketry, the Latvian text pointing out Zander as prominent Soviet scientist and inventor in the field of rocket technology.

On 23 August 1962, Zander's birthday, a bust was unveiled at RPI's Faculty of Mechanics [382]. At that time the Dean's office was located at *Leņina iela 1* (presently *Kaļķu iela 1*), in the same building that housed RPI's administration. Speeches were held on the occasion by RPI's Vice Chancellor *Aleksandrs Mālmeisters* (1911–1996), Oleg Ryazanov, a student and Deputy Secretary of the Komsomol at the institute, and by Pavel Ribakov (1910–1991), an Associate Professor of the Faculty of Mechanics who at length spoke about Zander's scientific career [383]. Zander's bust had been sculpted at the atelier of the Latvian artist *Voldemārs Rapiķis* (1921–1985).

The same year the RPI celebrated its 100th anniversary, the Council of Ministers of the Latvian SSR decided that the Faculty of Mechanics, where Zander had studied, was to carry Friedrich Zander's name [384]. However, the faculty never used this new designation on its stationary. It was considered an honor to have been bestowed such a special name – while, this addition would considerably lengthen the institute's name and was therefore considered impractical.

88 Memorial plaque at Zander's former residence on *Frīdriha Candera iela 1*, early 1960s.

89 Memorial bronze bust of Friedrich Zander at the Friedrich Zander Museum of Space Exploration of the University of Latvia.

That same year, at a session of the Council of the Institute of Physics at the Academy of Sciences of the Latvian SSR, a special event was organized to honor Zander. Deputy Director of the institute *Viktors Veldre* (1924–1967) held a lengthy speech about Zander's contribution to rocket technology [385]. In addition, an exhibition was set up in the library of the Academy informing visitors about Zander's life and work [386].

On 26 September 1962, former *Bārtas iela* in Riga-Zasulauks was renamed and has ever since been called *Frīdriha Candera iela [387]*. By coincidence, Riga city bus No. 22, which runs from the city center to Riga airport, passes along this street, stopping at a bus-stop called *Frīdriha Candera iela*. In one of the buildings along that street Zander had spent his childhood, No. 1 having belonged to the Zander family from 1890 to 1913. The wooden structure had been designed by the architect Wilhelm Bockslaff (1858–1945), a graduate of RPI's Department of Architecture who had played an important role in shaping the cityscape of Riga, which

still today is dominated by different architectural styles ranging from Eclecticism over Gothic Revival to Art Nouveau.

Another *Candera iela* is found in Gauja, a village some 30 km from Riga's center situated by the river Gauja, having a multitude of dachas built in Soviet times. Among its former residents were also members of RPI's faculty and other staff who were granted plots for putting up their dachas, growing fruit trees and vegetables. Streets named after Zander are found also in various former Soviet cities such as Almaty, Kislovodsk and Moscow.

In 1890, when Arthur Zander acquired the property on *Bartschen-strasse*, the building on plot No.1 had but one floor. Soon a second floor was added, providing space for Arthur's many children. Rumours tell that this reconstruction had been planned by the family. However, this is difficult to believe – one can assume that Bockslaff had designed the addition as well. In 1923, the street was renamed *Bārtas iela* (*Bārta* is a village in Courland, nearby the city of *Liepāja*).

From 27 to 29 November 1962, historians of science from the Baltic Republics organized their 4th conference in Riga, dedicating the event to the 100th anniversary of the foundation of the Riga Polytechnic, today Riga Technical University. Zander's daughter Astra (Star – in Latin) was invited as a guest of honor. Among the subjects discussed was Zander's scientific heritage [388].

In April 1963, the journal *Padomju Students* (Soviet Student) published the poem *Raķešu pionierim Canderam* (To Zander – the rocket pioneer), lyrics written by the Latvian poet *Tālivaldis Treicis* [389].

1964 In 1964, the 50th anniversary of Zander graduation from the RPI, the Soviet Postal Authorities issued a commemorative stamp dedicated to Zander. That year, the Zander family's former residence at *Fridrīha Candera iela 1* was nationalized, an underlying ambition being to set up a museum.

1965 In 1965, the *Jauno lidotāju klubs* (Young Aviator's Club) was founded in Riga, which is considered to have been the beginning of the *Riga Aviation Museum.* Situated close to Riga International Airport, the museum holds a large collection of Soviet civil and military airplanes, helicopters and other aviation equipment [390].

1966 In *Riga School No. 47* a small exhibition was organized dedicated to Zander's life and work.

1967–1980 In April 1967, the Academy of Sciences of the USSR appointed a special commission tasked to investigate the development of Zander's scientific contributions to the space sciences. In addition, it was decided to organize Zander conferences [391].

A meeting held at *Frīdriha Candera iela 1* in Riga regarding the opening of Zander museum at the premises led to no concrete results.

90 Commemorative stamps issued by the Soviet Postal Authorities in 1964 to honor Friedrich Zander, and by the Latvian authorities in 2012.

Instead, on Zander's 80th birthday, a museum was opened at *Ausekļa iela 5* in central Riga on the initiative of RPI's Faculty of Mechanics [392]. Despite not having any permanent staff its curator kept in contact with other Soviet museums and institutes, gathering additional material for the collections.

At Kislovodsk, where Zander and later Soviet/Russian cosmonauts went for recreation, a large meeting was organized (mentioned are 3000 participants) by the journalist Kiril Belij (1900–1986), a well-known Zander-specialist. Belij, who between 1959 and 1980 gave some 400 presentations about Zander to students, workers and other audiences around the country, stayed in close contact with Riga [393].

By order of *Latvijas PSR Augstākās un vidējās speciālās izglītības ministrs* (Minister for Higher and Secondary Education of the Latvian SSR) of 4 November 1967, two Zander-grants for students at the RPI were instituted, each with a monthly allowance of RR 50, later RR 65. Students enrolled at RPI's Faculty of Mechanics and Machine Construction (Zander's former department) and also other faculties were eligible to receive this grant. The first students who received this grant were *Egils Samovičs* und *Ēvalds Prīmanis*, who later joined RPI's faculty; *Prīmanis* is today still working at the RTU [394]. Among the students who received this scholarship were *Sigurds Jaundālders* from the Faculty of Electrical Energy (1976/1977), who is currently Associate Professor at the RTU; Aleksandrs Kohno (1977/1978); and Sergej Sevtschuk (1978/1980). Needless to add, all three were first-rate students [395]. Zander-grants were also received by numerous other students including *Vladimirs Kušnirs*, Israils Bravo, *Vladimirs Čamanis* and *Aleksandrs Bokšs*. Female students received the grant as well, like Marina Pugatjeva for the academic year 1985/1986 [396].

Each year, on 23 August, newspapers in both Riga and other Soviet cities would publish articles about Zander and his contribution to the Soviet space sciences [397].

On 7 December 1967, the Academy of Sciences of the Latvian SSR instituted the *Frīdriha Candera balva* (Friedrich Zander Prize), which was to be awarded for outstanding achievements in the engineering sciences. Since 1998, the Latvian Academy of Sciences (LAS) has been awarding the Friedrich Zander Prize for research in mechanics and astronomy. Today, this prize is the highest academic honor in Latvia awarded in these two fields of study [398]. A table listing the recipients of this prize, providing additional information about scholars who have been related to the RPI/RTU, is found below [399].

Recipients of LAS Friedrich Zander Prize (1971–2015)

Year	Name, surname	Field of science, academic and scientific activities
1971	**Elmārs Blūms** (1936)	Physics; graduate of UL* (1959); Institute of Physics of UL: Senior Researcher, Head of Laboratory.
	Jurijs Mihailovs (1927–1999)	Physics; graduate of UL (1951).
1972	**Gundaris Teters** (1928–2015)	Civil engineering, architecture; graduate of UL (1953); RPI/RTU: Professor.
1976	**Roberts Maksimovs** (1938)	Physics and mechanics of polymeric materials; graduate of RPI (1960); Institute for Mechanics of Materials of UL: Senior Researcher.
1978	**Egons Lavendelis** (1934)	Mechanical engineering; graduate of UL (1957); RPI/RTU: Professor, Rector (1985–1999).
1981	**Aleksandrs Mālmeisters** (1911–1996)	Construction, construction mechanics; graduate of UL (1937); RPI: Professor, Rector (1961–1963).
	Vitauts Tamužs (1935)	Physics; graduate of Moscow State University (1959); RPI: Assistant, Assistant Professor (1963–1967); UL: Assistant Professor, Professor (from 1967).
	Gundaris Teters (1928–2015)	Civil engineering, architecture; graduate of UL (1953); RPI/RTU: Professor.

1985	**Eduards Jakubaitis** (1924–2006)	Electrical engineering; graduate of the Rostov Institute of Railway Transport Engineers (1949); RPI: Professor (part time 1962–1969).
1989	**Aleksandrs Bogdanovičs** (1950)	Physics; graduate of UL (1972); works in USA.
1991	**Jurijs Geļfgats** (1936)	Physics; graduate of RPI (1959); Institute of Physics of UL: Senior Researcher.
	Eduards Ščerbiņins (1939– 2005)	Physics; Institute of Physics of UL: Senior Researcher.
1994	**Agris Gailītis** (1935)	Physics; graduate of UL (1958); Institute of Physics of UL.
1996	**Pēteris Prokofjevs** (1925–2000)	Physics; graduate of UL (1950); Institute of Physics of Latvian Academy of Sciences.
	Rolands Rikards (1942)	Civil engineering; graduate of RPI (1966); RPI/RTU: Assistant Professor (1974–1986), Professor.
1998	**Jevgenijs Kotomins /** Eugene Kotomin (1949)	Physics ; Graduate of UL (1971); Institute of Solid State Physics of UL.
	Jurijs Tarnopoļskis (1929–2003)	Mechanical engineering; graduate of UL (1952); RPI/RTU: Assistant Professor (1964–1969), Professor (1968–1997).
2000	**Māris Ābele** (1937)	Astronomy; graduate of UL (1960); Institute of Astronomy of UL: Senior Researcher.
	Albīns Skudra (1952)	Physics, construction engineering; graduate of RPI (1977); RPI/RTU: Lecturer (1982–1989), Assistant Professor (from 1989).
2002	**Valerijs Poļakovs** (1941)	Institute for Mechanics of Materials of UL: Senior Researcher.
	Juris Žagars (1949)	Astronomy; graduate of Moscow State University; Ventspils University: Senior Researcher, Professor.
2004	**Arturs Balklavs-Grīnhofs** (1933–2005)	Radioastronomy; graduate of UL (1956); UL: Director Institute of Astronomy (1997–2005).
	Jānis Vība (1937)	Mechanical engineering; graduate of RPI (1960); RPI/RTU: Lecturer (1960–1971), Assistant Professor (1973–1982), Professor (from 1982).

2007	**Kazimirs Lapuška** (1936–2013)	Physics; graduate of UL (1960); UL: Rsearcher (1957–2007).
	Kārlis Rocēns (1939–2017)	Construction engineering; graduate of RPI (1963); RPI/RTU: Assistant Professor (1981–1984), Professor (1984–2012), Senior Researcher.
2009	**Aivars Lagzdiņš** (1937)	Mechanical engineering; UL Institute of Polymer mechanics: Senior Researcher.
2011	**Jānis Andersons** (1964)	Mechanics; graduate of UL, UL Institute of Polymer mechanics: Senior Researcher.
2015	**Andrejs Krasņikovs** (1956)	Mathematics; graduate of UL (1978); RPI/RTU: Associate Professor (1987–2006), Professor (from 2006).

* University of Latvia / State University of Latvia.

1969 Scientific research by students of the RPI was usually carried out under the supervision of professors and others at the institute. During the Soviet period, results achieved by students were to be recognized according to Regulation No. 995 issued by the Chairman of the Main Administration for Higher Education of the Soviet Union [400]. Students participating in scientific research were organized in teams attached to faculties, some faculties having more than one team. At the RPI, such student teams also joined the *Frīdriha Candera Studentu zinātniski tehniskā biedrība / Студенческое научно-еухническое общество имени Ф. Цандера* (Friedrich Zander Student Scientific Technical Association). The association had originally been founded way back in 1909, or at the same time as the 1st Riga Student Association for Aeronautics and Aviation Technology at the Riga Polytechnic Institute (Knopp & Zander's association). In 1969, the association celebrated the 60th anniversary, adding *Friedrich Zander* to its name [401]. Members of the association participated in competitions for the most significant scientific achievements, at first in Latvia and later also in the Soviet Union [402]. After the dissolution of the association this tradition was discontinued. Still, RPI-students have continued to strive for excellence, the results of which (from 1994 to 2011) were published by the Friedrich Zander Student Scientific Technical Association [403].

1970 In May 1970, the first *Friedrich Zander Conference* was organized in Riga by the Academy of Sciences of the Latvian SSR, thereby starting a series of conferences dedicated to Zander which until 1989 were regularly held in Riga, Moscow, Leningrad and in other Soviet cities. About 200–300 scientists and also cosmonauts participated

91 Zander's daughter Astra Zander (3rd from left) visiting the Zander Museum at RPI's Faculty of Mechanical Engineering in 1970.

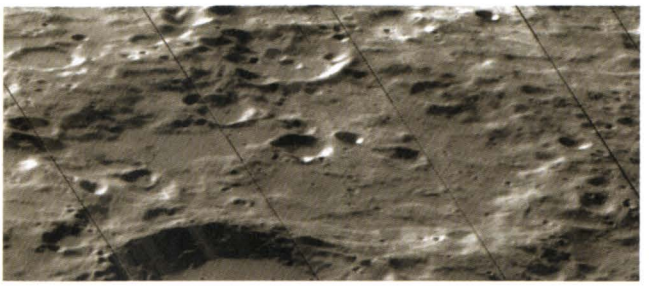
at the first conference, where the Latvian Academician *Jānis Stradiņš* held a speech about Zander's time in Riga, pointing out the scientific and industrial heritage of this period [404]. Presentations given at the conference were published in a special booklet [405]. The participants were also given the opportunity to visit the Zander Museum at RPI's Faculty of Mechanical Engineering [406].

Zander's daughter Astra (b. 1925), his daughter-in-law Ludmilla and the wife of his son Merkur were often invited to the Friedrich Zander conferences. In autumn 1970, Zander's sister Margarethe Jürgensen-Zander visited Riga. Remembrances of her childhood days spent in Riga together with Friedrich have been included in a short Zander biography published at a later date [407].

One of the attempts to commemorate Zander was trying to convince the Ministry of the Merchant Fleet of the USSR to name one of its vessels «Friedrich Zander». Jevgenij Dolinino-Ivanskij, an associate professor at the RPI was asked to take contact with the authorities in Moscow in this respect.

In 1970, an impact crater on the far side of the Moon was named the *Tsander-Crater* (transliterated from the Cyrillic spelling *Цандер*). The crater, a heavily worn formation with a diameter of 160 km, lies to the southeast of the Dirichlet-Jackson Basin (Latitude 5.39, Longitude –149.69) [408].

1971 On the occasion of *GIRD's* 40th anniversary, Zander had played a leading role in this organization during the early 1930s (see above), the newspaper *Rīgas Balss* published an article about Zander written by J. Birjukovs, Scientific Secretary of the section for History of Aviation and Cosmonautics [409].



92 The *Tsander-Crater* on the far side of the Moon.

1972–1985 In 1972, on Zander's 85th birthday anniversary, he was again remembered by various articles appearing in the press [410]. A comprehensive study published that year was a *Zander Bibliography*, compiled in Russian by RPI's Associate Professor J. Dolinino-Ivanski together with staff from RPI's library [411]. That year, Mirdza Zibens, a history teacher at *Riga School No. 17*, organized a modest exhibition devoted to Zander, displaying material which included photographs and other items received from Zander's sister Margarethe.

In 1973, *Mārtiņš Rozentāls* from *Telefilm*, while making a movie about Elisabeth Dubelstein, the sister of Jekab and Arvid Dubelstein who had participated in the 1905 Revolution, considered producing a movie about Zander. *Rozentāls* was acquainted with Mstislav Keldisch, at that time President of the Academy of Sciences of the USSR [412].

93 Exposition about Zander at RPI's (presently RTU's) History Museum during the 1970s and 1980s.

Anna Šmite, resident and former owner of the house at *Frīdriha Candera iela 1*, successfully prevented the demolition of a small barn on the premises.

1974 On 28 September 1974, one of Southern Russia's largest museums opened to the public in Kislovodsk, the *Музей истории космонавтики им. Ф. А. Цандера* (Friedrich Zander Museum of History of Cosmonautics). Zander's widow Alexandra was present at the opening. Over the years, this museum received numerous donations, including personal items from cosmonauts brought back from spaceflights. In Soviet times, the museum was visited by over 35 000 visitors each year, students, teachers, scientists, engineers, cosmonauts and others. It also stayed in close contact with Riga, including RTU's Museum of History. The latter has for many years been assembling newspapers clippings and other material dealing with different events in Kislovodsk honoring Zander, keeping a special file for this purpose [413]. Today, one of the streets in Kislovodsk, a youth group as well as a pioneer group still carry Zander's name.

In 1974, the XVth RPI Student Scientific Conference was organized, an event dedicated to the 65th anniversary of the foundation of the 1st Riga Student Association for Aeronautics and Aviation Technology at the RPI, an organization considered to have been the forerunner of the Zander Student Scientific-Technological Association. Over the years, 1 572 presentations and plenary meetings were organized at these conferences, divided into 83 different sections [414].

94 Zander memorial in Kislovodsk, Russia.

95 Identification button of the Zander Student Scientific-Technological Association at the RPI.

96 Soviet motor-vessel *Фр. Цандер*, 1960s.

97 Official stamp of the *Fridrihs Canders Shipping Company Ltd*, registered in La Valletta, Malta, 1998.

Associate Professor J. Dolinino-Ivanskij from the RPI participated in the 3rd Zander Conference organized in March that year, holding a speech about Zander's heritage at the RPI [415].

In late 1974, a Soviet seagoing vessel used for regular services in the Baltics was given the name *Фр. Цандер* (Fr. Zander) [416]. Representatives from RPI's Faculty of Mechanical Engineering kept in close contact with the crew of the vessel, and together with the crew organized a «Zander-corner» onboard the ship [417]. RPI-representatives often visited the vessel, photographs of the ship being put on display at RTU's Museum of History. In the late 1990s, new computers were ordered to be installed on the ship [418]. However, soon thereafter, during the early years of the new millennium, the vessel was written-off.

It can be added that many years ago the *Rigasche Börsen-Comitee* (Committee of the Riga Stock Exchange) had owned a tugboat called *Zander*, most likely called after Zander's grandfather Constantin who was closely involved in the activities of the Riga docks, and who was Vice-President and later President of the Riga Stock Exchange [419]. In 1937, the tug was acquired by the company *Vairogs* and renamed *Vairogs* (Schield).

Closer to our own days one finds Zander's name associated with a shipping company registered in Malta's capital La Valletta, the company's relationship to Zander being unknown. In 2000, the tanker *Friedrich Zander*, launched in 1974 (IMO number 7435709), was taken off the Latvian register after having been sold to the *Fal Shipping Co. Ltd.* of the United Arab Emirates.

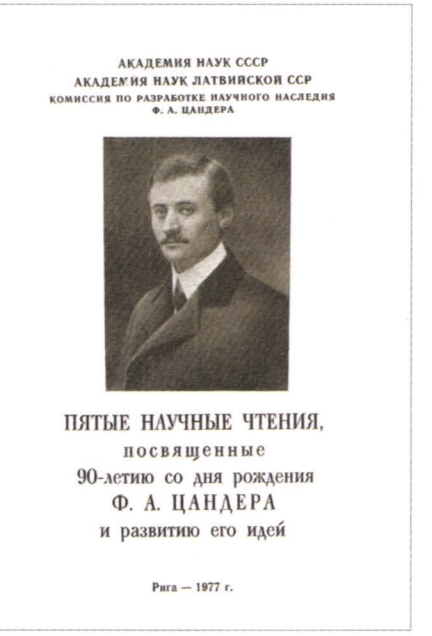
1975 In the attic of the premises at *Frīdriha Candera iela 1*, pioneers of Riga School No. 17 arranged a Zander museum, and in spring

and autumn took care of the garden. That same year the engineer and historian of science Juriy Klytshnikov, having started his efforts in 1969, had finalized the deciphering of a large part of Zander's stenographic manuscripts, the results of which allowed a better understanding of Zander's thoughts and scientific achievements [420].

1977–1990 In April 1977, on the occasion of Zander's 90th anniversary, a Friedrich Zander Conference was organized in Riga attended by scientists, engineers, cosmonauts and Zander's daughter Astra Zander [421]. One of the presentations was given by Jevgenij Dolinino-Ivanskij, an associate professor at the RPI who would talk about Zander as organizer of the 1st Riga Student Association for Aeronautics and Aviation Technology at the RPI, the first scientific student society founded at the institute [422]. Dolinino-Ivanskij also gave some short presentations to visitors at RPI's Museum of History and at other institutions.

Special notice deserves *Gundaris Teters* (1928–2015), RPI-Professor and Head of the Institute of Polymers of the Academy of Sciences of the Latvian SSR, who in 1977 signed responsible for the publication of Zander's main works in Russian; the publication included an article about Zander's biography [423].

98 The Zander museum at *Frīdriha Candera iela 1*, Riga, 1970s.


АКАДЕМИЯ НАУК СССР
АКАДЕМИЯ НАУК ЛАТВИЙСКОЙ ССР
КОМИССИЯ ПО РАЗРАБОТКЕ НАУЧНОГО НАСЛЕДИЯ
Ф. А. ЦАНДЕРА

ПЯТЫЕ НАУЧНЫЕ ЧТЕНИЯ,
посвященные
90-летию со дня рождения
Ф. А. ЦАНДЕРА
и развитию его идей

Рига — 1977 г.

99 Program of Friedrich Zander conference, 1977.

100 Exhibition at the Zander museum at *Frīdriha Candera iela 1*, Riga, 1980s.

1979 Various unofficial proposals were put forward that year with suggestions to use the premises at *Frīdriha Candera iela 1* for a laboratory, while Astra Zander addressed the Secretary General of the Central Committee of the Latvian SSR *Augusts Voss*, asking him to set up a Zander museum in the building, including in her request a plan for the proposed exhibition.

Material which had been collected by Mirdza Zibens for her Zander museum in Riga was transferred to the Museum of Cosmonautics in Moscow [424]. In late October, the Head of RPI's History Museum *Skaidrīte Salceviča* participated at the XIIth Baltic Conference on the History of Science and Technology held in Vilnius with a presentation about Zander entitled «Pioneer of Soviet rocketry Friedrich Zander – student of the Polytechnic Institute in Riga [425].

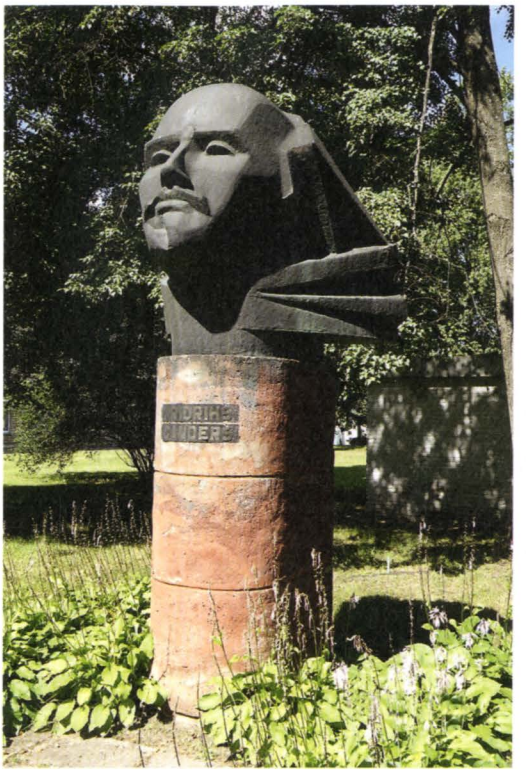
1980 In August 1980, the Communist Party of the Latvian SSR decided to set up a new section at the Latvian Museum of National History, the Zander Museum at *Frīdriha Candera iela 1*.

1982 On the anniversary of Zander's 95th birthday, a museum started to be organized in the former Zander residence, planned to become a section of the Museum of History of the Latvian SSR. Work started in April that year and was headed by *Roberts Ankipāns*, the institution's new director, assisted by *Ilmārs Enītis*. The ambition was to have the museum up and running by 1987, Zander's 100th birthday anniversary. However, at that time four families were living on the premises, no one having spent much thought on providing new quarters for these tenants. In addition, there were other questions to be solved such as finding material for the new exhibition, given that Zander

101 Commemorative envelopes issued by the Postal Authorities of the German Democratic Republic and USSR in 1983 and 1987.

memorabilia were spread out over different institutions in the country including RPI's Museum of History, the Zander Museum in Kislovodsk, RPI's Faculty of Mechanical Engineering, the Museum of History of Riga, Latvia's Museum of Natural History and several museums in Moscow [426].

1983 Trying to find material for his collection, *R. Ankipāns* contacted the Zhukovsky Museum in Moscow, the State Museum in Leningrad and the Tsiolkovsky Museum in Kaluga. The last one mentioned was prepared to hand over some of its small-scale models. In addition, Zander's original manuscripts being kept in the archive of the Academy of Sciences of the USSR, the archive in Kaluga could provide copies of some of these originals. In October, Zander's daughter Astra wrote to the Head of the Communist Party of the Latvian SSR *Augusts Voss* and the Head of the new Zander Museum, informing them that she still kept in her possession her father's photo camera, his diploma paper and a few books, items she had not yet handed over to the Museum of Cosmonautics in Moscow, adding that she was willing to hand these items over to the new museum. She also asked the Museum of Cosmonautics in Moscow to return the items she had previously deposited there, a request the museum politely refused!



102 Zander monument, erected on the premises of the former *Motor* factory, Riga-Sassenhof.

103 Bronze plaque commemorating Zander's studies at the Riga Polytechnic Institute.

In November that year, a Zander memorial was unveiled on the grounds of Kalep's former factory *Motor*, now called the *Rīgas eksperimentālā tehnoloģisko rīku rūpnīca* (Riga Experimental Factory for Technical Apparatus).

1985 During July that year, the new Zander Museum in Riga was included on the list of Museums of Cosmonautics of the USSR.

1986 Renovation work started at *Frīdriha Candera iela 1*. Thereby, Professor *Jānis Stradiņš* forwarded a proposal to the director of the museum regarding how to organize the exhibition. By the end of the year, a staffing list had been established consisting of 18 persons including guards, gardeners, cleaners and personnel for other service functions.

1987–1989 On 19 May 1987, the anniversary of Zander's 100th birthday was duly celebrated at the opening of the 10th Zander Congress held at the Academy of Sciences of the Latvian SSR in Riga. Various sessions at the congress were attended not only by scientists from Latvian

institutions but also from other Soviet cities such as Leningrad, Kiev, Novosibirsk and Kaluga, presentations being given by amongst others Academician *J. Stradiņš*, Zander's daughter Astra Zander, Academician V. Mishin, Chairman of the Zander Heritage Commission at the Academy of Sciences of the USSR, and by the cosmonaut L. D. Kizim [427]. During one of the sessions, curiously enough, a scientific dispute arose when Academician Valentin Gluschko (1908–1989), a well-known Soviet rocket scientist, openly questioned the significance of Zander's scientific contributions while boasting about his own results. He was answered by *J. Stradiņš* who had been working on Zander's biography for quite some time, and who had been in contact with Zander's sister in Germany. *J. Stradiņš'* answer to Gluschko was later published in an article [428].

On 19 May 1987, in the entrance hall of the main building of the University of Latvia located at *Raiņa bulvāris 19,* a building which previously had belonged to the RPI and where Zander had studied, a memorial plaque to Zanders was unveiled. Present on the occasion was Zander's daughter Astra.

Today the plaque is displayed in the Friedrich Zander Museum of Space Exploration of the University of Latvia.

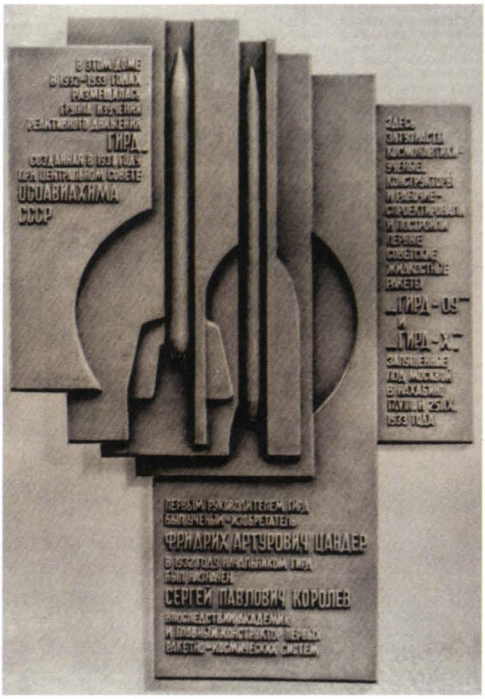
On 10 September that year, later than planned, the Zander Museum at *Fridriha Candera iela 1* in Riga finally opened its doors to the public [429]. The museum, as told, was organized as a section of the Museum of History of the Latvian SSR. It stayed open until 1990, receiving visitors from all around the country including the Riga-born cosmonaut Anatoly Solovjov in 1988. That same year, Solovjov had taken Zander's photograph along on his spaceflight, handing it over to the museum on the occasion of his visit together with the autographs of all cosmonauts who partook on that flight. The following year, in summer 1989, a meeting with the two cosmonauts A. Solovjov and A. Savinykh was held at the museum.

During summer 1987, RPI-Associate Professor *Teodors Ķirsis* and a group of mountaineers, on having discovered a new mountain pass over the Pamir Range in Central Asia, named it the *Zander Crossing* [430].

1990 The Zander Museum at *Frīdriha Candera iela 1*, being confronted with an increasingly difficult economic situation together with the political situation in Latvia as it then unfolded, was forced to close down.

1991 The University of Latvia purchased the collection of the former Zander Museum, adding it to its Astronomical Observatory.

1992 Descendants of *Anna Šmite*, the former owner of the building at *Frīdriha Candera iela 1*, stepped forward with a legal request to repossess the property. Countering this move, Academician *J. Stradiņš* together with the Vice-Chancellor of the University of Latvia *Rihards*



104 Memorial plaque dedicated to Zander, Korolev and *GIRD* at *GIRD's* former premises in Moscow.

Kondratovičs proposed to have the building declared a historical monument, property which cannot be privatized.

The following year, the Zander-collection kept by the University of Latvia was supplemented with historical items found in a planetarium (a former Orthodox church) at *Brīvības iela* in Riga. The Orthodox Church, at that time, had received back its property.

1995 The Zander-collection, headed by the astronomer *Juris Žagars*, was moved to the Museum of Science and Technology of the University of Latvia. The collection as such was still kept at *Frīdriha Candera iela 1*, the intention being to have the building officially declared as a Latvian cultural object. When *Anna Šmite's* heirs officially regained the property, the University of Latvia expressed a wish to acquire it by purchase, a plan which in the end failed due to a lack of public funds available to both ministry and university.

During the 1990s, the Zander museum counted more than 1000 visitors each year, a number which after the turn of the millennium decreased to 400–600. By that time, the majority of visitors were groups of schoolchildren from Latvia. The museum also participated in the organisation of so called Olympics in Astronomy, an event for schoolchildren.

1996 The Russian Academy of Sciences' Division of Machine Engineering, Mechanics and Control Processes Problems has since 1996 been awarding the *Премия имени Ф. А. Цандера* (Friedrich Zander Prize) for outstanding theoretical results achieved in missile technology and space science. Until the year 2014, 14 scientists have been honored with this prize [431].

2004 The property at *Frīdriha Candera iela 1* was sold that year (the heirs had officially repossessed the building in 2003). The new owner, who at first showed some interest in Zander and the exhibition, agreed to reserve two rooms for the museum. Most of the exhibits, including the furniture, were at the same time moved to the main building of the University of Latvia at *Raiņa bulvāris 19* in Riga. Later, also the two rooms initially kept by the new owner for the museum would be closed. In 2011, the property was resold.

2005 On 11 February 2005, the *Latvijas Universitātes Fridriha Candera kosmosa izpētes muzejs* (Friedrich Zander Museum of Space Exploration of the University of Latvia) opened its doors to the public in the main building of the University of Latvia in Riga, displaying many of the items which previously had been exhibited at *Frīdriha Candera iela 1*.

105 The Friedrich Zander Museum of Space Exploration of the University of Latvia, located in the main building of the University of Latvia, Riga, 2017.

106 Memorial stone set up adjacent to the graves of Zander's father Arthur, mother Helene and uncle Robert in Riga Large Cemetery.

During summer that year, a small Zander exhibition was again set up in the former Zander residence.

Already during the 1990s, Academician *J. Stradiņš* had been talking to Zander's relatives living abroad about setting up a Zander memorial in Riga, proposing to have it located at the *Lielie kapi* (Large Cemetery) next to the graves of Zander's father Arthur, mother Helene, brother Robert and grandfather Constantin. *Stradiņš'* initiative was supported by the Council of the Academy of Sciences of the Latvian SSR. In 2005, the daughter of Zander's sister Margarethe Jutta Sintenius, who lived in France, agreed. Jutta Sintenius, trying to honour both her mother Margarethe Jürgensen and twin-brother Johann Jürgensen (1938–2004), a designer who was said to have been very fond of Latvia, donated money for the project. Financial support was also received from one of Latvia's largest companies, the gas importer *Itera-Latvija*. *Itera's* President *Juris Savickis*, an RPI-graduate (1970), has also been active at the Academy of Sciences [432]. The memorial stone, unveiled on 4 November 2005 at the cemetery, had come from the atelier of the Latvian sculptor *Indulis Ranka*.

2008 On 29 July 2008, *Ilgmārs Eglītis*, director of the Astronomical Observatory of the University of Latvia, and the Lithuanian astronomer *Kazimieras Černis* discovered Asteroid *2008 OS18 = Nr. 332530*. This space object, with a diameter of 2 km, was on 5 January 2015 named *(332530) Canders=2008 OS18* [433].

2009 On 26 June 2009, at the International Astronomy Center in *Irbene* (part of Venstpils University College), an informative meeting was organized under the headline *Friedrich Zander and Latvia's historical achievements in space technology* [434]. A small Zander exhibition was

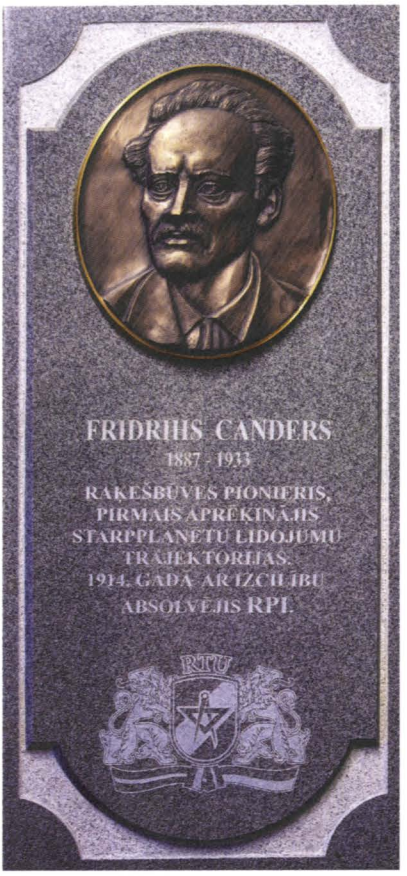
107 Zander painting by the Latvian artist *Alberts Goltjakovs* (1924–2016). Today the painting is exhibited in Friedrich Zander Museum of Space Exploration of the University of Latvia.

organized at the center with the help of Professor *Juris Žagars*, who previously headed the Zander Museum in Riga, and who brought several items from the museum to *Irbene* to be put on display.

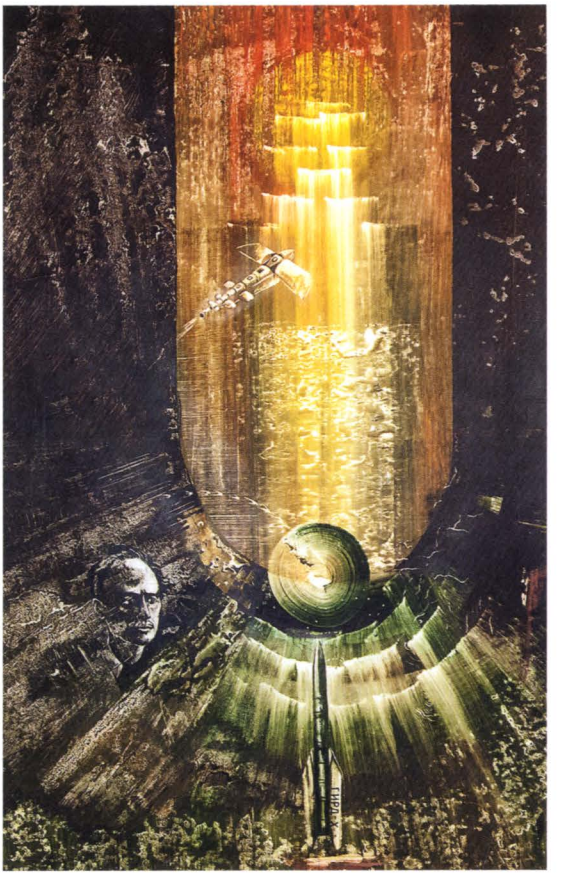
2011 On the 50th anniversary of Jury Gagarin's first human spaceflight in 2011, a conference was organized in Riga's Museum of Medical History to commemorate this epic event. Key speaker at the conference was Academician *J. Stradiņš*, who traced the origins of man's advances into space back to aeronautics and its beginnings in late 18th century France. Riga, according to Stradiņš, had found a place in both aeronautics and spaceflight at an early date. In addition to the two Russian cosmonauts A. Solovyov (born in Riga-*Bolderāja*) and A. Kaleri (born in *Jūrmala*), *Stradiņš* mentioned Riga-born Mstislav Keldysh (1911–1978), a well-known mathematician and space engineer, and Friedrich Zander, who already during his student years at the RPI had started to formulate ideas about spacecraft and interplanetary travel. According to *Stradiņš*, who had known Zander's half-sister Margarethe, public interest in space, including Zander, has been steadily on the decline since the early 1990s, both in Latvia and Russia. Nevertheless, Zander's memory, a symbolic figure for Riga as well as mankind's everlasting dream to reach beyond its planet, needed to be kept alive.

2012 On the occasion of Zander's 125th birthday in 2012, the RTU celebrated its 150th anniversary. At the ceremony, Friedrich Zander was elected (post mortem) Honorary Member of Riga Technical University.

On 28 September, during *Researchers' Night*, Zander's 125th birthday was specially noted by the Friedrich Zander Museum of Space Exploration of the University of Latvia. That year also witnessed the



108 Memorial plaque honoring Friedrich Zander. The plaque can be seen in the administrative building of Riga Technical University, *Kaļķu iela 1*.



109 Zander in the perception of the contemporary Latvian artist *Juris Zvirbulis*.

opening of the exhibition *Friedrich Zander – 125: Forward, to Mars* in the Scientific Library of the RTU. The exhibition was organized in cooperation with the Friedrich Zander Museum of Space Exploration of the University of Latvia.

In the space sciences, 2012 marked a new beginning in Mars research: in November 2011, an *Atlas 5* rocket lifted off the Kennedy Space Center in Florida carrying the Mars-rover *Curiosity* which reached Mars in August 2012. This happened during the very month of Zander's birth 125 years ago, or more than a century after Zander had started to conjecture about how to reach this far-away planet.

In 2012, the Postal Authorities in Latvia and Russia issued special commemorative stamps in honor of Zander (*Michel-Katalog, 840 and 1852*).

110 *Alīda Zigmunde* Associate Professor at RTU read the report «Friedrich Zander is remembered in Latvia» in Kislovodsk, 2017.

2013 In January 2013, a memorial plaque honoring Friedrich Zander, an Honorary Member of the RTU since the previous year, was unveiled on the first floor of RTU's main administrative building at *Kaļķu iela 1* in Riga's old town. The plaque came from the atelier of the sculptor *Viktors Suškēvičs*. It can be noted that Zander was born in a building nearby the present university.

A memorial plaque commemorating Zander is also found at *Медовый переулок* (Medovy Pereulok) in Moscow where Zander had lived from 1926 onwards.

2015 On 19 September 2015, the *Fr. Zander Museum for Cosmonautics* was reopened in a new locality in Kislovodsk in Russia. Currently, the Museum works as a department of the Kislodovsk Museum of Local History *Fortress*.

2017 On 19 September 2017, on the occasion of the 130th anniversary of Zander's birthday, a special exposition – *The dream of flying. Friedrich Zander 130* – was organized at the Friedrich Zander Museum of Space Exploration of the University of Latvia. On display were several paintings by the Latvian artist *Juris Zvirbulis*, which originally had been prepared for the opening of the Zander Museum in 1987, focusing on the subject of spaceflight. Other items on display concerned different periods of Zander's life.

In October 2017, celebrating the 130th anniversary of Zander's birthday, a scientific conference was organized at the Fr. Zander Museum of the History of Cosmonautics, currently a department of the Kislodovsk Museum of Local History *Fortress*.

CONCLUSIONS

Zander's early life was greatly influenced by the political development of this period, the 1905 Revolution having direct repercussions on everyday life, causing riots and social upheavals, and the temporary closing of the RPI. Some agitators were captured and shot at the banks of the river Daugava. RPI's students were not immune to this turmoil, including Zander, who was arrested for distributing political leaflets. Many students, trying to continue their studies, moved from Riga to universities and institutes abroad, Zander to Danzig-Langfuhr.

The curriculum offered by the RPI focused on the requirements of a modern and rapidly industrializing society: it included study programs in the engineering sciences, economics, agriculture and architecture. The breakthrough of flight heavier-than-air around the turn of the 20th century, airplanes starting to cross the skies in ever increasing numbers, an air mindedness took hold of the public, an interest which led to the formation of aviation societies also in Riga, including one among some students at the RPI, one of Russia's first. While students organized an aero-association, members of RPI's faculty partook in public debate about flight. A clear difference of opinions emerged, some of the members seeing a great future for the airplane while others believed in the further development of balloons and airships. A third group, again, was outright sceptical regarding this new technology. RPI's Professor Maximilian Glasenapp, also the President of the *Technischer Verein zu Riga*, for example, considered flight heavier-than-air to be nothing but a break-neck enterprise, something dangerous and not very useful either in civil life or for the military. One of his colleagues at the institute, Professor Pfuhl, on the other hand, strongly believed in the future potential of the airplane, its general usefulness and cultural effects. This principal divergence in views, expressed in debates and articles, was one factor causing the exclusion of aeronautics from RPI's curriculum. Another limiting factor could have been a policy adopted by the Ministry of the Enlightenment which decided to position aeronautics only at certain institutes in the empire.

Riga's citizen, at odds with academic conservatism, showed a great interest, even enthusiasm, for the new technology from early on, following its exploits in Europe and overseas in newspapers and journals, flocking to public lectures about flight, joining one of the aviation associations in town or partaking in great numbers in public flight demonstrations. Quite apart from the ambivalence shown by some at the RPI was the purchase of airplanes abroad by some of Riga's citizens, using these craft for public air shows. The introduction of airplanes, and the attempts by local inventors to build their own planes, was soon followed

by the start-up of an indigenous aircraft industry. Central to this development were the *Russia-Baltic Waggon Factory* (*RBVZ*) with its production of *Sommers* biplanes, and the *Motor* factory producing airplanes and aero-engines.

The onset of war in 1914 had profound effects not only on Riga's industry but also its institutions. Strategically important factories, their engineers and workforces, were moved to Russia's inner provinces the same as institutes of higher learning such as the RPI with its professors, students, library, laboratories and other belongings. Zander, who graduated in spring 1914, soon thereafter found employment with the rubber manufacturing factory *Provodnik*, a firm which in 1915 was relocated to Moscow. What looked like a temporary measure turned out to become a permanent solution. While many Latvians after the war returned to their homeland, now newly independent Latvia, Zander stayed in Russia, soon to be encouraged by none less than Lenin, continuing his efforts in rocketry and spaceflight.

In Zander's biography, one of the most tragic elements is his absence at the successful launch of the *GIRD-X* rocket in 1933, the constructor having succumbed to his illness just a few weeks before launch. What remains today is paying honor to a great engineer and his achievements, a man who since early childhood had dreamt about and believed in man's eventual conquest of space.

Friedrich Zander has not been forgotten by his alma mater, his honorary membership bearing witness to this remembrance. Some believe that Zander's popularity has faded over the years, that new times have brought along new scientists and their discoveries. It is said that in Soviet times publications about Zander were far more numerous than later. One should not forget, however, that in those days there was no internet, a channel which occupies a prominent place in today's flow of information.

That Zander's name was not used by the RPI in 1988 was a clear sign of people distancing themselves from the practice of having their institutions connected with the names of state functionaries unrelated to their work, like Arvīds Pelše's with the RPI – this was not a downgrading of Zander. In 1990, it suddenly became possible to remove all titles bestowed on institutions during Soviet times. This opportunity was used at once by the RPI, which from then on has been called Riga Technical University (RTU). Zander, it was felt, could be honored in other ways – one was to make him an Honorary Member of the RTU, another is the publication of this book. Zander has not been forgotten in Latvia. Also in Russia, Zander's name is still remembered, and honored – as late as in 2017, Natalja Lasutova from Moscow State University published a study about one of her country's most well-known space pioneers [435].

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[118] *Rigasche Rundschau*, 29 July 1913, 31 July 1913.

[119] The following list of Knopp's patents was retrieved from German *DEPATISnet* and European *Espacenet*, databases which do not include Russian patents registered before 1914: 1) DE 494 982, 31. März 1930, Verfahren zum Sichten von Zellstoff, Papierstoff u. dgl.; 2) DE 503 954,

31.Juli 1930, Säurepartie einer Stoffveredelungsmaschine, inbesondere einer Pergamentiermaschine oder Vulkanfibermaschine; 3) DE 535 589, 14. Oktober 1931, Hochdruckstoffauflauf an Langsiebpapiermaschinen; 4) DE 537 059, 28.Oktober 1931, Hochdruck-Stoffauflauf an Langsiebpapiermaschinen; 5) DE 584 661, 22.September 1933, Kollergang; 6) DE 585 147, 11. Oktober 1933, Langsiebpapiermaschine; 7) DE 601 090, 25.Juli 1934, Verfahren und Einrichtung von Bleichen von verdünntem Fasergut, insbesondere Zellstoff; 8) US 1,829,660, Oct. 27, 1931, Machine for manufacturing multiple course-papers, cardboards and the like; 9) US 1,925,722, Sept. 5, 1933, Method of and apparatus for treating pulp stock; US 1,964,992, July 3, 1934, Centrifugal Separator.

[120] *Beilage der Rigaschen Rundschau*, 1 March 1910; *Rigaer Tageblatt*, 15 April 1912, 21 May 2012; *Baltische Sport-Zeitung*, 1913, Heft 4, p. 78.

[121] *Baltische Sport-Zeitung*, 1913, Heft 4, p. 78.

[122] LSHA Fund 7175, Description 1, File1909, p. 17.

[123] *Baltische Sport-Zeitung*, 1913, Heft 4, p. 78.

[124] *Rigasche Rundschau*, 8 March 1910; *Rigasche Neueste Nachrichten*, 8 March 1910.

[125] S-y. Die erste Flugmaschine in Riga. *Beilage der Rigaschen Zeitung*, 8 March 1910.

[126] *Baltische Sport-Zeitung*, 1913, Heft 4, p. 78.

[127] Щипалов, Ю. К. Озмидов Николай Максимович – https://www.isuct.ru/about/hist/golden_fond/html/golden_fond.htm?article=ozmidov (retrieved April 2017).

[128] Озмидов, Ростислав Всеволодович. http://dic.academic.ru/dic.nsf/ruwiki/1585167 (retrieved April 2017).

[129] LSHA Fund 7175, Description 1, File 1908, pp. 18, 77.

[130] Taranda's photographs are found in amongst other the *Illustrierte Beilage der Rigaschen Rundschau*, 1911, Nr. 3, p. 21 and the *Rigasche Zeitung* 1911, Nr. 67, p. 95.

[131] 1. Rigaer studentischer Verein fur Luftschiffahrt und Flugtechnik. Polytechnikum, Auszug aus dem Protokoll der letzten Generalversamlung vom 23. May 1913. LSHA Fund 7175, Description 1, File 349.

[132] LSHA Fund 7175, Description1, File 349, p. 166; LSHA Fund 7175, Description 1, File 347, p. 211.

[133] *Album Academicum des Polytechnikums zu Riga 1862–1912*. Riga, 1912.

[134] Rosenkranz, M. & Stieda, E. (Hrs.) *Album der Landsleute der Fraternitas Baltica 1865–1910: zweite Auflage*. Riga, 1910.

[135] *Beilage der Rigaschen Rundschau*, 28 March 1909. Bertels' association had so far hardly been noticed; see for example Виноградов, Р. И., Шестаков, В. З. *История развития авиационной науки в Латвии*. Рига, 1989.

[136] *Beilage der Rigaschen Rundschau*, 11 August 1909.

[137] *Rigasche Rundschau*, 11 August 1909, 7; *Rigasche Rundschau*, 26 March 1909, 10; *Album Academicum des Polytechnikums zu Riga 1862–1912*. Riga, 1912, p. 608.

[138] Туманова, А. С. Власть и технический прогресс воздухоплавательные и автомобилные общества дореволюционной России под наблюдением департамента полиции. *Вопросы истории естествознания и техники*. Москва, 2002, No 4, pp. 787–794.

[139] *Rigasche Neueste Nachrichten*, 16 November 1909.

[140] In the *Russian Educational Society* in Riga a lecture about aeronautics was held by A. Batzmann on 7 October 1912, see Отчет Русского общества просвещения в Лифляндской губернии за 1912 год. Рига: 1913, p. 41.

[141] *Rigasche Neueste Nachrichten*, 5 February 1910, 16 February 1910.

[142] *Rigasche Neueste Nachrichten*, 13 April 1910.

[143] *Rigasche Neueste Nachrichten*, 11 March 1911, 13 March 1910. The Riga Aero-Club could have been the same as the aeronautical circle (*Luftschifferkreis*) said to have been established by Russian officials, merchants and academics; see *Rigasche Zeitung, Sport-Beilage*, 11 March 1910.

[144] *Beilage der Rigaschen Rundschau*, 13 March 1910.

[145] *Beilage der Rigaschen Rundschau*, 9 April 1909. This subscription, organized by a committee chaired by Grand Duke Michailowitsch, was launched in March 1910; see *Beilage der Rigaschen Rundschau*, 3 March 1910.

[146] *Rigasche Neueste Nachrichten*, 22 April 1910.

[147] *Beilage der Rigaschen Rundschau*, 9 October 1910.

[148] *Rigasche Zeitung, Sport-Beilage*, 9 March 1911.

[149] *Rigasche Rundschau*, 28 February 1912.

[150] *Rigasche Rundschau*, 8 July 1910; *Rigasche Neueste Nachrichten*, 8 July 1910.

[151] *Baltische Sport-Zeitung*, 1913, Heft 2, pp. 31–32; 1914, Heft 2, p. 1.

[152] *Baltische Sport-Zeitung*, 1913, Heft 8, p. 159.

[153] *Baltische Sport-Zeitung*, 1914, Heft 5, p. 67.

[154] *Rigaer Tageblatt*, 19 April 1913.

[155] *Rigasche Rundschau*, 10 May 1912; *Rigaer Tageblatt*, 10 May 1912.

[156] *Rigaer Tageblatt*, 8 June 1913; *Baltische Sport-Zeitung*, 1914, Heft 5, pp. 67–68; Jahrbuch des I. Baltischen Automobil- und Aero-Klubs. Riga: A. v. Grothuss, 1913.

[157] *Baltische Sport-Zeitung*, 1914, Heft 12.

[158] *Rigaer Tageblatt*, 5 February 1912.

[159] *Beilage zur Rigaschen Zeitung*, 19 February (4 March 1910); *Rigasche Zeitung, Sport-Beilage*, 11 March 1910.

[160] *Rigasche Rundschau*, 22 February 1910, 27 March 1910; *Rigasche Neueste Nachrichten*, 19 February 1910.

[161] *Baltische Sport-Zeitung, 1913*, Heft 4, pp. 77–78; *Rigasche Zeitung, Sport-Beilage*, 3 March 1911.

[162] *Rigasche Neueste Nachrichten*, 26 March 1909.

[163] *Rigasche Neueste Nachrichten*, 9 October 1909.

[164] In November 1908, B.N. Delaune, professor at the Kiev Polytechnic Institute, published a brochure about the construction and operations of gliders (*Как построит дешевый и легкий планер и науиться летать*

на нем); see Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 65; Бычков, В. Н. *Летопись авиации и воздухоплавания*. Москва: Издательство Academia, 2006, p. 235.

[165] Renckulbergs. Pirmie latvju lidotāji. *Spārnotā Latvija*, 1937, Nr. 4, p. 103.

[166] *Rigasche Neueste Nachrichten*, 8 March 1910.

[167] *Rigasche Zeitung, Sport-Beilage*, 3 March 1911.

[168] *Rigasche Zeitung, Sport-Beilage*, 24 November 1910. The article mentioned the following measures for the apparatus: width 9 m; length 6 m; height 1.7 m; wing surface 13.5 m^2; weight 60 kg; weight with pilot 140 kg.

[169] *Rigasche Rundschau*, 8 June 1910.

[170] Irbītis, K. *Of Struggle and Flight: The History of Latvian Aviation*. Stittsville, 1986, p. 7. Irbītis makes no mention of any heavier-than-air flight attempts, or the construction of an airplane.

[171] Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 122; Renckulbergs. Pirmie latvju lidotāji. *Spārnota Latvija*, 1937, No 2, p. 39.

[172] Irbītis, K. *Of Struggle and Flight: The History of Latvian Aviation*. Stittsville, 1986, p. 10; an illustration of Ābrams, Vīzinš & Treibergs' apparatus is found in Irbītis and Renckulbergs.

[173] Irbītis, K. *Of Struggle and Flight: The History of Latvian Aviation*. Stittsville, 1986, p. 11.

[174] Irbītis, K. *Of Struggle and Flight: The History of Latvian Aviation*. Stittsville, 1986, p. 11.

[175] *Album Academicum des Polytechnikums zu Riga 1862–1912*. Riga, 1912, p. 664; Renckulbergs. Pirmie latvju lidotāji. *Spārnotā LAtvija*, 1937, Nr. 4, pp. 103-107; Irbītis, K. *Of Struggle and Flight: The History of Latvian Aviation*. Stittsville, 1986, p. 12.

[176] *Rigasche Zeitung, Sport Beilage*, 18 July 1912.

[177] *Baltische Sport-Zeitung*, 1913, Heft 7, p. 135.

[178] *Beilage der Rigaschen Rundschau*, 16 October 1909, 27 October 1909; *Rigasche Neueste Nachrichten*, 28 October 1909, 9 November 1909.

[179] Зильманович, Д. Я. *Теодор Калеп (1866–1913)*. Москва, 1970, p. 87; Sollinger, G. Development of Aviation in Riga 1909–1914: Pioneers, Organizations, Aeroplanes, Flights. *Scientific Proceedings of Riga Technical University: History of Science and Higher Education, Vol.11,* Riga, 2007, p. 85.

[180] *Вестникъ воздухоплавания*, 1911, No. 5, p. 35.

[181] Die Zeit der Schauflüge. *Rigasche Zeitung, Sport-Beilage*, 9 March 1911.

[182] Die ersten öffentlichen Flüge in den Ostseeprovinzen. *Rigasche Zeitung, Sport-Beilage*, 16 March 1911.

[183] S-y. Blauer Dunst. *Rigasche Neueste Nachrichten*, 28 February 1911.

[184] S-y. Missglückte Schauflüge. *Rigasche Neueste Nachrichten*, 21 March 1911.

[185] *Rigasche Neueste Nachrichten*, 25 April 1911, 26 April 1911, 2 May 1911.

[186] *Rigasche Neueste Nachrichten*, 21 July 1911.

[187] *Вестникъ воздухоплавания*, 1911, No. 5, p. 35.

[188] *Rigasche Neueste Nachrichten*, 13 June 1911.

[189] *Rigasche Neueste Nachrichten*, 17 June 1911.

[190] *Rigasche Zeitung, Sport-Beilage*, 15 June 1911.

[191] *Rigasche Zeitung, Sport-Beilage*, 9 December 1909; Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 46.

[192] *Rigasche Neueste Nachrichten*, 2 July 1911, 11 August 1911; also Supf, P. *Das Buch der deutschen Fluggeschichte: Vorzeit, Wendezeit, Werdezeit.* Berlin, Hermann Klemm AG, 1935, p. 495. According Supf, Hazly (also Hösli) was born on 21 August 1891 in Riga.

[193] *Rigasche Zeitung, Sport-Beilage*, 18 January 1912.

[194] *Rigasche Neueste Nachrichen*, 20 April 1911.

[195] P. Aviatik in Riga. *Rigaer Tageblatt*, 21 May 1912.

[196] Sollinger, G. Development of Aviation in Riga 1909–1914: Pioneers, Organizations, Aeroplanes, Flights. *Scientific Proceedings of Riga Technical University: History of Science and Higher Education, Vol. 11*, Riga, 2007, pp. 79–104; also articles in *Rigaer Tageblatt*, April–June 1912.

[197] *Rigasche Zeitung, Sport-Beilage*, 13 July 1912.

[198] P. Aviatik am Strande. *Rigaer Tageblatt*, 6 June 1912.

[199] P. Zu den Schauflügen. *Rigaer Tageblatt*, 2 April 1912.

[200] P. Zu den Schauflügen in Riga. *Rigaer Tageblatt*, 20 April 1912.

[201] P. Zu den Schauflügen. *Rigaer Tageblatt*, 7 May 1912.

[202] *Gustavs Vanags un organiskā ķīmija Latvijā.* Rīga: Poligrāfijas infocentrs, 2005, p. 132.

[203] *Rigaer Tageblatt*, 30 April 1913.

[204] *Rigaer Tageblatt*, 18 June 1913.

[205] *Baltische Sport Zeitung*, 1913, Heft 8, pp. 160–161.

[206] *Baltische Sport Zeitung*, 1914, Heft 9, pp. 129–130; *Rigasche Rundschau*, 5 May 1914, 7 May 1914.

[207] *Baltische Sport Zeitung*, 1914, Heft 10, p. 149; *Rigasche Rundschau*, 19 May 1914.

[208] *Rigasche Rundschau*, 25 June 1914, 26 June 1914, 27 June 1914.

[209] *Baltische Sport Zeitung*, 1914, Heft 2, p. 1.

[210] *Rigasche Rundschau*, 8 March 1910.

[211] *Rigasche Rundschau*, 21 May 1910; *Rigasche Neueste Nachrichten*, 11 May 1910; 21 May 1910. On 21 August 1910, the *Rigasche Neueste Nachrichten* included a long article from Hans Grade about his experiences in aviation, Grade, H. Meine Flugerfahrungen.

[212] *Rigasche Rundschau*, 3 March 1910; 18 June 1910; *Rigasche Neueste Nachrichten*, 16 June 1910. Feitelberg's car dealership and garage was in late 1910 taken over by A. v. Kuhlberg; see *Rigasche Rundschau*, 25 October 1910. A long article about Louis Blériot is found in *Rigasche Neueste Nachrichten*, 14 August 1910.

[213] *Firmenregister der Stadt Riga für das Jahr 1910 mit einem alphabetischen Verzeichnis aller zu den beiden Gilden Steuernden unde der Firmen derselben. (Hrsg. vom Rigaschen Handels- und Gewerbeamt:* . Riga, 1910.

[214] *Album Academicum des Polytechnikums zu Riga 1862–1912.* Riga, 1912, p. 205. Not much is known about Kalep other than what has

been reported in the press; Latvian archives are not holding any primary sources. Kalep was a member of both the *Technischer Verein* and *Naturforscherverein*. The only biography published so far is Зильманович, Д. Я. *Теодор Калеп (1866–1913)*. Москва, 1970.

[215] Plans by Guyot to fly in Riga on 8 November 1909 came to naught when his apparatus got damaged during a demonstration in St. Petersburg; see *Rigasche Neueste Nachrichten*, 28 October 1909, 9 November 1909.

[216] *Rigasche Zeitung, Sport-Beilage*, 26 May 1910; the article contains a short technical description of the *Wright*. About Arntzen, see *Rigasche Neueste Nachrichten*, 25 May 1910.

[217] *Rigasche Neueste Nachrichten*, 21 May 1910.

[218] *Rigasche Neueste Nachrichten*, 15 May 1910; *Rigasche Nachrichten*, 15 May 1910.

[219] *Rigasche Neueste Nachrichten*, 31 May 1910.

[220] *Rigasche Neueste Nachrichten*, 6 July 1910; *Rigasche Rundschau*, 6 July 1910.

[221] Supf, P. *Das Buch der deutschen Fluggeschichte: Vorzeit, Wendezeit, Werdezeit*. Berlin, Hermann Klemm AG, 1935, p. 492; also *Rigasche Neueste Nachrichten*, 21 August 1910.

[222] *Rigasche Zeitung, Sport-Beilage*, 23 February 1911.

[223] bt. Vom Flugfelde in Sassenhof. *Rigasche Rundschau*, 28 September 1910.

[224] *Beiträge zur Geschichte der Industrie Rigas. Herausgegeben vom Technischen Verein zu Riga*. Heft III. Riga, 1912, pp. 55–60.

[225] S-y. Die Schaffung eines Flugplatzes. *Rigasche Neueste Nachrichten*, 12 June 1910, 18 June 1910; *Rigasche Rundschau*, 7 July 1910; Forssman, V. Die Aussichten des Luftsports in Riga. *Rigasche Rundschau*, 22 May 1910.

[226] S-y. Schauflug des 'Grade'-Eindeckers. *Rigasche Neueste Nachrichten*, 7 Juli 1910; *Rigasche Rundschau*, 12 July 1910.

[227] *Rigasche Neueste Nachrichten*, 5 January 1911.

[228] *Rigasche Neueste Nachrichten*, 23 September 1910.

[229] *Rigasche Rundschau*, 21 February 1911.

[230] *Rigasche Zeitung, Sport-Beilage*, 3 March 1911.

[231] *Rigasche Zeitung, Sport-Beilage*, 9 March 1911; also Supf, P. *Das Buch der deutschen Fluggeschichte: Vorzeit, Wendezeit, Werdezeit*. Berlin, Hermann Klemm AG, 1935, pp. 492–501; *Вестникъ воздухоплавания (Библиотека воздухоплавания)*, 1911, No 5, p. 35.

[232] S-y. Ein wunderhübscher Flug. *Rigasche Neueste Nachrichten*, 11 January 1911; *Rigasche Rundschau*, 11 January 1911; *Rigasche Neueste Nachrichten*, 12 January, 1911.

[233] *Rigasche Rundschau*, 4 March 1911; *Rigasche Neueste Nachrichten*, 7 March 1911.

[234] *Rigasche Neueste Nachrichten*, 14 March 1911.

[235] *Rigasche Rundschau*, 7 March 1911.

[236] *Rigasche Neueste Nachrichten*, 11 March 1911, 14 March 1911.

[237] *Rigaer Tageblatt*, 2 April 1912.

[238] *Rigasche Zeitung, Sport-Beilage*, 10 February 1910.

[239] *Rigasche Zeitung, Sport-Beilage*, 10 February 1910, 24 February 1910.

[240] *Rigasche Zeitung, Sport-Beilage*, 5 January 1911.
[241] А. П. М. Воздухоплавательная промышленоссть в России. *Вестникь воздухоплавания (Библиотека воздухоплавания)*, 1910, No 17, pp. 37–38.
[242] Шавров, В.Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, pp. 52–53, 627.
[243] Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 53.
[244] *Rigasche Zeitung, Sport-Beilage*, 3 March 1911; А. П. М. Воздухоплавательная промышленоссть в России. *Вестникь воздухоплавания (Библиотека воздухоплавания)*, 1910, No 17, pp, 37–38.
[245] *Rigasche Neueste Nachrichten*, 26 March 1911, 28 March 1911.
[246] y. Der erste gelungene Passagierflug in Riga. *Rigasche Neueste Nachrichten*, 1 April 1910.
[247] y. Unser einheimischer Flieger Herr Max Trautmann. *Rigasche Neueste Nachrichten*, 7 April 1911.
[248] *Вестникь воздухоплавания (Библиотека воздухоплавания)*, 1910, No 17, p. 38.
[249] Балдинь, С. Воздухоплавательные двигатели. *Воздухоплаватель*, 1909, No 8, pp. 489–516, No 9, pp. 563–601.
[250] *Rigasche Industrie-Zeitung*, 1909, No 23, p. 366.
[251] *Rigasche Zeitung, Sport-Beilage*, 26 May 1910; *Rigasche Neueste Nachrichten*, 22 March 1910. *N.A.G.* manufactured the *Wright* engine, for which it had acquired a license in 1907, during 1908–09; see Lange, B. *Das Buch der deutschen Luftfahrtechnik: Textteil.* Mainz: Verlag Dieter Hoffmann, 1970, pp. 380–381.
[252] *Rigasche Industrie-Zeitung*, 1913, no 7, p. 110. No patents for Kalep were found in the Germany *Depatisnet* or the European *Espacenet*.
[253] *Rigasche Industrie Zeitung*, vol. 38, no 5, 1912, p. 75.
[254] *Rigasche Neueste Nachrichten*, 5 July 1911.
[255] *Воздухоплаватель*, 1911, no 2, p. 127.
[256] Рынинь, Н. Моторь 'Гномь'. *Воздухоплаватель*, 1911, No 6, pp. 362–371.
[257] Зильманович, Д.Я. *Теодор Калеп (1866–1913).* Москва, 1970, pp. 193, 155–116; Дузь, П.Д. *История воздухоплавания и авиации в России: Период до 1914 г.* Москва, 1995, p. 369.
[258] *Rigaer Tageblatt*, 18 April 1912; *Rigasche Rundschau*, 26 April 1911.
[259] *Rigasche Rundschau*, 26 April 1912; Зильманович, Д. Я. *Теодор Калеп (1866–1913).* Москва, 1970, p. 135; Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, pp. 149–153.
[260] *Воздухоплаватель*, 1912, No 2, pp. 229–231, No 3, pp. 309–322.
[261] *Rigaer Tageblatt*, 28 May 1912.
[262] Зильманович, Д. Я. *Теодор Калеп (1866–1913).* Москва, 1970, p. 143.
[263] *Rigasche Rundschau*, 14 October 1913, 21 November 1913.
[264] *Rigasche Rundschau*, 22 April 1914.
[265] Багратинов, В. *Крылья России: Полная иллюстрированная энциклопедия.* Москва: Эксмо, 2005, pp. 75–76.

[266] *Rigasche Rundschau*, 1 October 1913, 2 October 1913; Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, pp. 115–116.

[267] Зильманович, Д. Я. *Теодор Калеп (1866–1913).* Москва, 1970, pp. 152–153.

[268] *Rigasche Rundschau*, 28 February 1912.

[269] *Beiträge zur Geschichte der Industrie Rigas: Herausgegeben vom Technischen Verein zu Riga.* Heft III. Riga, 1912, pp. 40-53. A long article about *RBVZ's* automobile branch and its foreign director, the Frenchman Julien Potterat, is found in *Rigasche Zeitung, Sport-Beilage*, 3 March 1911.

[270] *Rigasche Neueste Nachrichten*, 23 February 1909, 14 August 1909, 17 August 1909.

[271] *Rigasche Rundschau*, 10 January 1912.

[272] *Rigasche Neueste Nachrichten*, 15 June 1910; also Соболев, Д.А. *История отечественной авиапромышленности.* Москва: Русавиа, 2011, pp. 9–10.

[273] Rigasche Flugmaschinen. *Rigasche Zeitung, Sport-Beilage*, 9 March 1911.

[274] *Rigasche Neueste Nachrichten*, 27 February 1909.

[275] *Rigasche Nachrichten*, 28 February 1912.

[276] *Rigasche Neueste Nachrichten*, 9 July 1910.

[277] *Rigasche Rundschau*, 2 November 1910; Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 157; Соболев, Д. А. *История отечественной авиапромышленности.* Москва: Русавиа, 2011, p. 9.

[278] *Вестникъ воздухоплавания*, 1910, No 18–19, p. 62; На Гатчинскомъ аэродроме. *Вестникъ воздухоплавания*, 1910, No 20, pp. 39–41 (with illustration).

[279] *Rigasche Neueste Nachrichten*, 26 February 1911, 26 March 1911.

[280] *Rigasche Neueste Nachrichten*, 7 March 1911 (translation from German by G.S.).

[281] *Rigasche Neueste Nachrichten*, 7 March 1911.

[282] *Rigasche Neueste Nachrichten*, 9 March 1911.

[283] *Rigasche Neueste Nachrichten*, 11 March 1911.

[284] *Rigasche Neueste Nachrichten*, 16 May 1911; *Rigasche Zeitung, Sport-Beilage*, 9 March 1911.

[285] Supf, P. *Das Buch der deutschen Fluggeschichte: Vorzeit, Wendezeit, Werdezeit.* Berlin, Hermann Klemm AG 1935, p. 493.

[286] *Rigasche Neueste Nachrichten*, 15 March 1911.

[287] *Rigasche Neueste Nachrichten*, 9 February 1911; Багратинов, В. *Крылья России:*. Полная иллюстрированная энциклопедия. Москва: Эксмо, 2005, pp. 23–24. In late 1911, Blériot applied for a Russian patent for his airplane (Application No 46006, Aeroplan); see *Rigasche Industrie-Zeitung*, No 11, p. 175. If Kudashev had built his machine based on a license agreement is not known.

[288] Дузь, П. Д. *История воздухоплавания и авиации в России: Период до 1914 г.* Москва, 1995, pp. 356–357; Багратинов, В. *Крылья России:* Полная иллюстрированная энциклопедия. Москва: Эксмо, 2005,

p. 9; Бычков, В, Н. *Летопись авиации и воздухоплавания*. Москва: Издательство Academia, 2006, pp. 261–264.

[289] Багратинов, В. *Крылья России*. Москва: Эксмо, 2005, p. 24; Бычков, В. Н. *Летопись авиации и воздухоплавания*. Москва: Издательство Academia, 2006, pp. 261–261. In 1913, Kudashev received a Russian patent for a rotary engine: No 57244, Rotations-Wärmemotor; see *Rigasche Industrie-Zeitung*, 1913, no 17, p. 270.

[290] Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 133; Багратинов, В. *Крылья России:* Полная иллюстрированная энциклопедия. Москва: Эксмо, 2005, p. 29; Petrov, G. *Seaplanes of Russia*. Moscow, 2004, p. 6.

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[296] *Rigasche Neueste Nachrichten*, 20 May 1911; *Вестникь воздухоплавания*, 1911, Nr. 10, p. 36.

[297] *Rigasche Neueste Nachrichten*, 25 May 1911. When this move was happened is unclear. However, in December 1912 it was announced that the firm might relocate its administration back to Riga; see *Rigasche Rundschau*, 8 December 1912.

[298] *Rigasche Rundschau*, 20 April 1912, 21 April 1912. Regarding Goedecker, see Lange, B. *Das Buch der deutschen Luftfahrttechnik. Textteil.* Mainz: Verlag Dieter Hoffmann, 1970, pp. 27–28.

[299] *Rigasche Neueste Nachrichten*, 29 June 1911.

[300] *Rigasche Rundschau*, 10 April 1912, 18 August 1912, 4 September 1912.

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[308] *Rigasche Rundschau*, 27 October 1912, 15 March 1913.

[309] *Rigasche Rundschau*, 10 September 1912, 11 September 1912, 13 September 1913.

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[311] *Rigasche Rundschau*, 22 November 1912.

[312] *Rigasche Rundschau*, 29 July 1913.

[313] *Baltische Sport-Zeitung*, 1913, Heft 13, p. 255 (including illustration of a *Farman XXI*). Shavrov mentioned 14 aircraft: 4 *Farman IV* trainers and 10 *Farman XVI*; see Шавров, В. Б. *История конструкций самолетов в СССР до 1938 г.* Москва: Машиностроение, 1994, p. 627.

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Published by RTU Press
Printed by RTU Printing House

ISBN 978-9934-10-999-7