The Flying Man, Stanko Bloudek (1890-1959)

Technical Museum of Slovenia

Tehniški muzej Slovenije

_Contents

A_Preface

Irena Marušič, Project Leader

In 2009, the Technical Museum of Slovenia marked the 50th anniversary of Stanko Bloudek's death with an exhibition called The Flying Man, Stanko Bloudek (1890 – 1959) and publishing an accompanying catalogue with the same title.
Both in Slovenia as well as abroad, the name of Stanko Bloudek is most often linked with Planica, ski jumps and ski flying. In the exhibition however, we wished to portray Bloudek as a man with a great many other talents; he was in fact a designer, an athlete, constructor, inventor, a sports manager, aircraft pioneer - the list could go on and on Bloudek's first creative engagement was in the field of aircraft design, and he finished his career with ski jumping and ski flying hills which also inspired the title of the exhibition and catalogue – the Flying Man.

We believe that both experts as well as the general public will find Bloudek's multi-faceted creative endeavours interesting. Therefore certain chapters from the Slovenian edition of the catalogue have been adapted and translated to English. This is our contribution towards disseminating awareness of Bloudek and his achievements in the fields of design and innovation beyond Slovenian borders.

The English edition is published on the Technical Museum of Slovenia website (www.tms.si).

We would like to take this opportunity to thank the authors. A special thank you goes to Candy Hoover which financed the English translations.

B_Timetable

Sandi Sitar

#1
Stanko Bloudek v Planici, 1956. Muzej športa.
Stanko Bloudek in Planica, 1956. Museum of Sport.

1890-94 IDRIJA

1890: Stanko Bloudek born on 11th February.
1894: The family moves to Bohemian city of Most (German: Brüx).

1894-1904 BOHEMIA

1904: Bloudek's father dies, the family returns to Slovenia.

1904-08 SLOVENIA

1906: Commences constructing aircraft models.
1908: Graduates at First National Gymnasium, Ljubljana.

1908-12 PRAGUE

1908/09: Studies painting.
1909-13: Studies mechanical engineering.
1909/10: Constructs first glider aircraft.
1910: Bloudek's mother dies; he chooses his mother's homeland Slovenia over his father's Bohemia.
1910: Construction of Racek (Sea gull) in Prague; test flying in Plzen.
1910/11: Draws blueprints for Libela (Dragonfly) during his winter holidays in Idrija.
1911: Construction of Libela in Vienna; test flying in Wiener Neustadt.
1911: Bloudek and Čermák in Zagreb.

1911-13 TRUTNOV/TRAUTENAU

1911-13: Works at the Etrich plant in Trutnov.
1912: In August he becomes a member of S.K. Ilirija (Ilirija Sports Club).

1913 LEIPZIG and MUNICH

1913: Works in Leipzig at Deutsche Flugwerke Lindenthal, and in Munich.

1914 VIENNA

1914: Chief-constructor at Thone & Fiala aircraft plant, Vienna.

1914-16 WIENER NEUSTADT

1914-16: Works as constructor at Oesterreichnische Flugzeugwerke in Wiener Neustadt.

1916-18 BUDAPEST

The manager of construction department at Ungarische Flugzeugwerke A. C.

1918-59: RESIDES IN LJUBLJANA UNTIL HIS DEATH

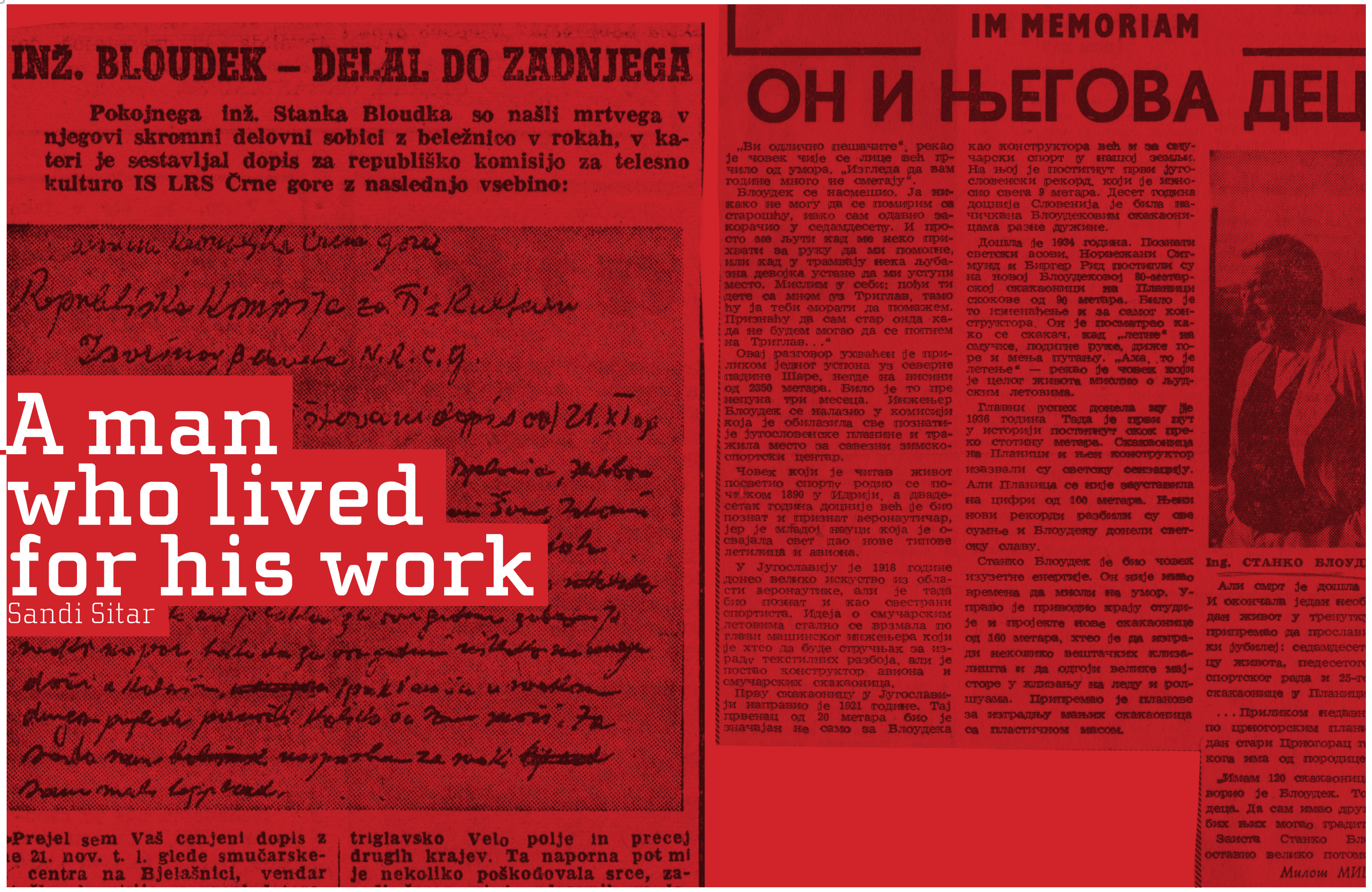
Address: Tyrleva 17 (present-day Slovenska Cesta)
1918/19: Strives to establish Slovene aircraft industry at Ljubljana airfield.
1919: Given Czech citizenship because of his father.
1919: Employed as technical director of vehicle repair workshops in Ljubljana.

1920: Bloudek-Chladek-Lopac Company.
1920: Slovene champion in discus throwing.
1923: Issued with a patent for a special freight wagon lock; starts his activity with an aero club.
1923-25: Years of design, construction and upgrading of the Sraka (Magpie) aircraft.
1926/27/29: Wins the national figure skating championship.
1926: Wins the Ljubelj car race.
1928-34: Years of design, construction and flying with Lojze.
1928: Member of the National Olympic Team at the 2nd Olympic Games in St. Moritz.
1929: Yugoslav citizenship acquired; inauguration of the Ilirija baths.
1932: Begins to construct the 'mammoth' ski jumping hill in Planica.
1933: Bloudek's workshop joins the Automontaža factory; arranges Ilirija's football ground.
1934: Planica's large jumping hill, named after Bloudek.
1934: Manufacturing of Triglav car
1936: 100m for the first time is surpassed in Planica.
1938: Disposes of his stake in Automontaža, remains technical director until the beginning of the war.

1941: 118m jump in Planica.
1941-45: Activist for the Liberation Front (imprisoned in 1942 and 1945).
1947: President of the Yugoslav Olympic Committee; a series of high positions in sport.
1947: President of Fizkulturna Zveza Slovenije (Physical Training Association of Slovenia) and a member of the chief board of Physical Training Association of Yugoslavia (FZJ).
1947: Ski jumping hill in Planica renovated; Bloudek refuses the directorship at Letov aircraft plant.
1948: 120m attained at Planica; a new 80m hill constructed in Planica following Bloudek's design; elected a member of the International Olympic Committee.

1954: Awarded Planica 1934-54 Memorial Emblem.
1957: His last event in Planica.
1958: Appointed a constructor of sport facilities.
1959: Renovation of Ljubljana-Bežigrad football stadium, originally designed by the renowned Slovene architect Jože Plečnik.
1959: Bloudek dies on 26th November.

1965: The beginning of the Bloudek Awards, the highest national recognition in the field of sport.
1969: Inauguration of the memorial in Tivoli sports park (work by Stojan Batič who was also the author of Bloudek's death mask); stolen in 2008.



INŽ. BLOUDEK – DELAL DO ZADNJEGA

Pokojnega inž. Stanka Bloudka so našli mrtvega v njegovi skromni delovni sobici z beležnico v rokah, v kateri je sestavljal dopis za republiško komisijo za telesno kulturo IS LRS Črne gore z naslednjo vsebino:

Prejel sem Vaš cenjeni dopis z 21. nov. t. l. glede smučarske- centra na Bjelašnici, vendar

triglavsko Velo polje in precej drugih krajev. Ta naporna pot mi je nekoliko poškodovala srce, za-

IM MEMORIAM

ОН И ЊЕГОВА ДЕЦ

1_A man who lived for his work

Sandi Sitar

Stanko Bloudek, universal athlete, inventor, pioneer aeroplane designer and the first constructor of ski-ski-flying hills, was born on 11th February 1890, in Idrija, Slovenia. The town was renowned for its mercury mine which employed many foreign experts, including a number of Czech engineers. Thus, Jaroslav Bloudek, a Czech engineer from Telče (Moravia) found employment there as a mining surveyor. He felt at home in Idrija and eventually married a local woman, Minka Lapajne.

Her family, who lived in the village of Vojsko above Idrija, had moved down into the valley when her father opened a lace shop in the mining town.

Between two homelands

In 1890, the population in Idrija numbered 5,000 people, of which there were 1,000 miners and others, permanently employed in the mine, though their number occasionally increased by 300 to 400 individuals, including women and children.

From about 500 tonnes of ore excavated per year, they extracted about 40 tonnes of mercury. The primary objective of the mine management however, was profit, and the town suffered catastrophic health conditions resulting in the highest mortality rate in Europe. In 1894, the Vienna Parliament identified Idrija as the unhealthiest of all European towns. That same year, Stanko's father Jaroslav – who had been promoted to mine manager – was transferred to the Czech city of Most (German: Brüx). The city, located in the northwest of the country had a population of 10,000 people, dominated by Sudeten Germans. Jaroslav was posted there because of his Slavic ethnicity, but he missed the Slavic culture and mix that had been far more prevalent in Idrija. Whilst in Most, the Bloudek family had two more girls, which made four sisters for Stanko. Jaroslav survived only ten years with the unfavourable living conditions and the hard work mining the brown coal, made additionally dangerous by the explosive gas. Jaroslav already had a heart condition, and when he suffered a stroke in 1904, Stanko, aged just 14, lost his father.

Stanko's mother was left to support five children and asked for help from Jaroslav's relatives, living in Bohemia. Although some of them were quite wealthy, not one of them offered to help her. She did get some help from her relatives in Slovenia, where two of

Stanko's uncles, both construction engineers, lived. Thus Stanko, who had finished elementary school and four grades at the Gymnasium in Most, transferred first to the Gymnasium in Kranj and then Ljubljana.

In order to help the family, he was forced to do various odd jobs when not studying and consequently was an average student. Interestingly, the future mechanical engineer only excelled at drawing and physical education, whereas in mathematics and physics he actually struggled to reach even D grades.

It was probably his school experiences, and connections with artistic circles, that influenced his decision to study painting. As a student, Bloudek went to the private painting school of Rihard Jakopič, the most prominent Slovene impressionist.

After his graduation in 1908, he went to Prague and was enrolled at the Academy of Fine Arts for the academic year of 1908-09. He then moved to the German Technical High School, Prague. At this time his only financial resource was some cash from the Lapajne family, therefore he had to look for a part-time job, and after two years of studies he found employment.

In 1910, his mother died of cancer in one of the Vienna hospitals. He found solace for this terrible loss in his work and his studies. He finished studying but never formally graduated. However, this never affected his career; due to his innate ability and the quality of his work, he was always acknowledged with the title of engineer, and even senior engineer.

Mechanical engineer chooses aeroplanes

Bloudek's decision to study mechanical engineering can undoubtedly be attributed to his interest in aviation. He was a huge fan of aeroplanes from his early student years. At the time, the newspapers published exciting news about the Wright brothers' flights with powered airplanes, as well as other aircraft and flying pioneers from the States and Europe.

Bloudek started building models, studied bird flight and even dissected pigeons, to learn more about flying. Once he had acquired more physical and technical experience, his models made several successful flights in 1906, when he was 16 years old; this was the year that also saw the first powered aircraft in Europe. Additional stimuli in Bohemia, finally encouraged the painting student to go for engineering and this also led him to a decision in 1909, to build with friends, a flying model large enough to grasp during takeoff and fly with, for a short time.

#2

Idrija, the birthplace of Stanko Bloudek, in 1890, was renowned for its mercury mine as well as the technical achievements of the mine engineers, and undoubtedly had a huge impact on Bloudek's professional career. House in which Bloudek was born, about 1900. Idrija Municipal Museum.

After the success of this unpowered aircraft, Bloudek made a model of a powered monoplane, Demoiselle, in early 1910. The original was constructed by the Brazilian-French aviation pioneer, Alberto Santos-Dumont. At the time, this was the smallest aeroplane in existence, and was only suitable for lighter pilots of small stature. Just such a man was the Czech racer Jan Čermák, who was immediately enthusiastic about the Santos-Dumont aircraft and later the Bloudek model, to the extent that he ordered the construction of a full-sized version. Bloudek didn't hesitate for a moment and without having any prior experience in this field, took on the job. He connected with the right people, Čermák arranging the supply of the engine, and the aeroplane was finished in no time, proving itself airworthy in test flights.

Bloudek designed his second powered plane, to Čermák's order, in the winter academic holidays of 1910/11, which he spent in Idrija. He made blueprints for a small biplane, which proved to be the most successful design from any Slovene aircraft constructor, until 1914.

At the Blaha plant in Vienna, Bloudek's biplane Libela (Dragonfly) went into construction even before the

#3
Bloudek constructed his first powered aircraft Racek (Sea gull) in 1910, with the assistance of friends. At Plzen airfield. National Museum of Contemporary History.

detailed blueprints were drawn. Bloudek brought along new sketches each time he came to the workshop, or he worked on them on the spot. Soon, aircraft enthusiasts started to visit the workshop and loved the aeroplane as well as the trailer that Bloudek constructed to transport it to the airfield. This trailer, which during the day served as a workshop, provided overnight accommodation for two men. The outer skin of the trailer was a linen covering that protected the plane.
In April 1911, Libela was transported to the Wiener Neustadt airport where it was assembled, had the dope coating applied to the fabric covering, was fitted with an engine and by May was under test.

In July 1911, Čermák passed his pilot certification on Libela. In August of that same year, the entrepreneur Mihajlo Merćep – who had been the partner of the first Slovene aeroplane constructor and pilot, Edvard Rusjan, at the time already deceased – invited Čermák and Bloudek to his base, in Zagreb.
On Merćep's request, Bloudek helped with the final construction work of the second Merćep-Rusjan aircraft, the last that this pioneer had designed before his tragic death. Bloudek embarked on the assignment with respect as well as a determination to improve the plane's performance and safety.
At this point, Bloudek and Čermák went separate ways. Čermák embarking on a Balkan tour, throughout which Libela constantly proved its flying abilities, whilst Bloudek returned to Prague to meet his overdue obligations at the faculty and simultaneously started to look for suitable employment.

Between the autumn of 1911 and 1913, Bloudek was employed in Trutnov, (Trautenau) Bohemia by the Etrich family. The father and son had decided to invest some of the revenue from their textile manufacturing into the aircraft industry. Bloudek was the third such expert from Slovenia who worked for thr Etrich family (after Franz Wels from Maribor and the model aeroplane builder, Pavel Podgornik, alias Paul Hermuth).
Bloudek's main task was to remodel the famous single-seat monoplane Taube (Dove) into the several-seat Schwalbe (Swallow) model, distinguished by its speed, into the first fully closed aerodynamic three-passenger cabin plane, with a military version as well.
During his service in Trutnov, Bloudek travelled frequently between Vienna, Prague and Ljubljana, upgrading his expertise and expanding the circle of his acquaintances. Back in his early student years, he associated with student groups in Ljubljana that were huge football fans. Bloudek was attracted to many sports that he was later competitively or recreationally engaged in or he assisted in the organisation of.

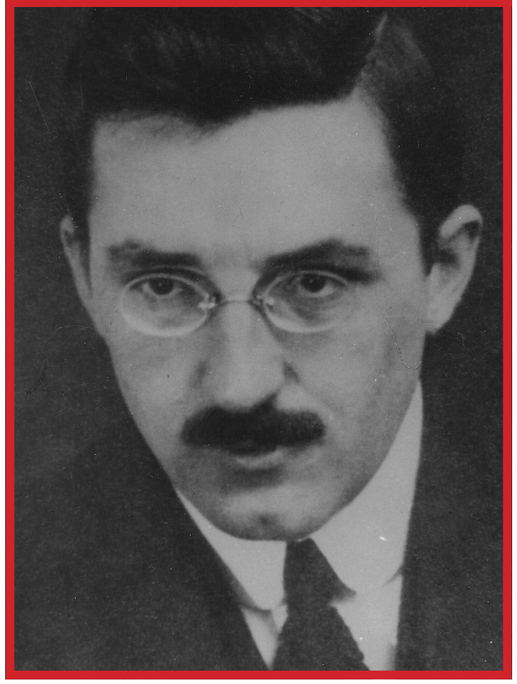
Bloudek described his attempt to join together elements of ski jumping and aviation, as symbolically predicting the synthesis of his aviation-related work with his design and construction of ski jumping hills. In the winter of 1912, he claims to have performed an experiment for which he improvised a small ski jumping hill. He wore a metal helmet on his head fitted with wings – following the example of the Roman god Mercury (it's rather difficult to believe that each wing had a surface area of six square metres) that could be operated manually. When he descended the slope and took off, he set the wings so that they lifted him in the air once he left the jump. But it all ended in a painful landing, which stopped him from doing similar experiments ever again.

In the aircraft industry during the First World War

During his employment with the Etrich family, Bloudek at first loved the opportunity for varied and creative work. However, he gradually became dissatisfied, because the German-Czech factory owners, in compliance with his employment contract, claimed the rights over all his technical innovations and solutions. As a result, in 1913, after the completion of his mechanical engineering studies, he set off for new adventures.

When in 1911, he decided on the profession of aircraft constructor, the armed forces of the technically most developed countries, already employed aircraft as well as other technical innovations, such as submarines and chemical warfare. Aircraft manufacturers soon identified the armed forces as their largest potential customers. This was nothing new in aviation: the tradition of balloons in the supervision of battlefields stretched way back to 1783, whilst aerial bombing was introduced in 1804. Giant airships constructed by the German Count Ferdinand von Zeppelin from 1900, competed for air domination with airplanes until 1937.
The modification of the single-seat Etrich designed Taube aircraft into a two-seater model – one of the major tasks Bloudek undertook at Trutnov – was primarily of interest to the armed forces, due to the fact that the combat use of airplanes required a two-member crew. The pilot was fully occupied flying the machine, whilst the military operations (reconnaissance, bombing and shooting – in particular backwards) were left to the other member, who during World War One often had a higher rank than the pilot and was the flight director. It became necessary to synchronise forward machine-gun firing with the rotation of the propeller, something that Bloudek worked on during his last two years of service in Budapest.

#4
Stanko Bloudek as a juvenile. Author's archive.



#5
Between 1916-18, Bloudek was the head of a construction team in the Ufag aircraft plant, Budapest. Author's archive.

During World War One, the air was largely dominated by biplanes, which whilst somewhat slower than monoplanes, were more agile and of a more solid construction. Some triplanes were even designed. In addition to landplanes, seaplanes were also used (Bloudek dealt with these technically and production-wise), as well as bombers that carried a few tonnes of bombs. The military aircraft industry strived to produce better aircraft than the opposite side, and what counted most with fighter planes was their takeoff speed, agility and in particular flying speed. At the beginning of the war, some planes exceeded 100 km/h, whilst by the end this had increased to 200 km/h which could be attributed to the increased engine power rather than improved aerodynamics. Both sides learnt from each other by studying brought down and captured planes, and Bloudek preserved in his archive the photographs of aircraft and their parts from the enemy forces.
At the outbreak of the World War One, the countries involved had about 600 airplanes in total, whilst by the end of the war, which then included the USA, they manufactured around 200,000, the major portion of which can be attributed to Great Britain, France and Germany. Austria-Hungary, which started the war with a total of 36 planes, had produced by the end 3,400 aircraft and acquired about 2,000 from Germany.

Just before and during World War One, Bloudek changed places and companies of employment four times. He was first employed in Germany at Deutsche Flugzeugwerke (DFW) in Lindenthal near Leipzig, followed by Thoene & Fiala in Vienna, Oesterreichische Flugzeugfabrik (Oeffag) in Wiener Neustadt and finally Ungarische Flugzeugwerke (Ufag) in Budapest.

There is also mention of him visiting the Berlin-based Albatros Werke plant where he was most likely sent for further training. The Albatros were one of the most renowned German airplanes from the war.
Although Bloudek's frequent transfers might seem chaotic at first sight, it did have some inner logic. He was sent to Lindenthal due to the connections being forged between the Austro-Hungarian and German aircraft industries and for further training in technology and management. In the Vienna-based plant which had just started the production of complete aircraft (previously it had just manufactured individual parts) he gained modern technological expertise in metal processing, and simultaneously shared some of his vast knowledge and experience. Then he was transferred to Oeffag in Wiener Neustadt where he could expand his specialised technical expertise on aircraft production as well as observe their performance at the local airport.
Bloudek could have stayed at Oeffag until the end of the war, but he was transferred to Ufag (Budapest) at his own request. During the period 1916-18, he held one of the top positions in this large aircraft plant: he provided support for the mass production of various types of craft, independently designed different aircraft which could successfully compete with the enemy, and worked on the development of a helicopter. He could have remained actively involved in the foreign aircraft industry after the war to develop civil aircraft due to his pre-war experience in the construction of a passenger plane, but his life brought him back to Slovenia where he stayed until his death.

There is only basic information on Bloudek's work from the war period and practically nothing about his private life. The war probably took its toll on Bloudek – the same as on other people – and he postponed his personal plans until after the war.

Attempts to establish a Slovene aircraft industry

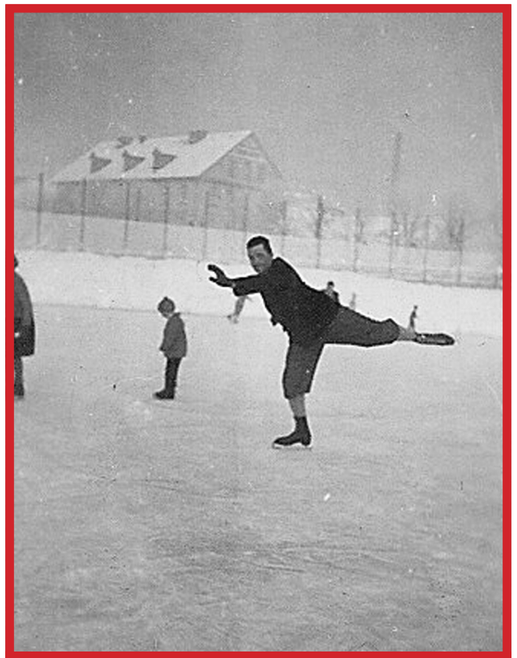
Following World War One, an artificial state provisionally known as SHS, was formed within the territory that later became known as Yugoslavia. Between 1918-20 there was fighting with Austria along the northern Slovene ethnic border, in which air forces from Ljubljana and Maribor participated. Ljubljana Squadron was a group of airplanes which remained in the present-day capital of Slovenia following the collapse of the Austrian-Hungarian Empire. In addition, near to the airport, were workshops for aircraft servicing and repair. These facilities exceeded the local requirements and so were able to provide services for military aircraft from Slovenia and other parts of the SHS. Forward-thinking individuals, including Bloudek, saw these workshops as the potential cradle of a Slovene aircraft industry. The plans failed however in 1924 when the military headquarters moved the equipment and personnel to inland Serbia (Novi Sad and Zemun).
Whilst awaiting the outcome of the aircraft workshop project, Bloudek was employed in a car repair workshop in Ljubljana. The major portion of the vehicle fleet and the associated workshops were also remnants of the former Austrian-Hungarian armed forces. He retained this job until 1921, whilst looking for an opportunity for more creative work.
In 1920, with Czech partners, he founded the Bloudek-Chladek-Lopac Company to supply the Zagorje coalmine with timber. Due to fraud by one of the partners, the company went bankrupt in 1924.
Bloudek was responsible for technical services within the company and his ambitious plans included the construction of cable railways and other original equipment for timber handling.
He also turned his inventive mind to other fields. He invented and patented a special lock for the protection of freight wagons against theft. This invention earned him quite a substantial income that Bloudek invested in his own workshop, which soon turned into a small factory for the production of metal products (hair combs and buttons, hooks for the installation of telephone and telegraph wires etc.) intended to ease the post-war shortages.
Bloudek was also engaged in the invention of a device to prevent a person from sliding backwards when walking with skis uphill, as well as attempting to invent a method to reduce the thrust produced by trains on the joints of railway tracks.
By 1923, when living conditions had slightly improved and the demand for his products decreased, he focussed his attentions more towards the motor industry.
In Slovenia, the interest in aircraft and flying during the war was shared by young people in aero clubs called Naša Krila (Our Wings), where they constructed and flew both training, and high-performance, gliders. Powered aircraft were still the domain of just a few wealthy individuals.
Between 1923-25, Bloudek designed an aeroplane that would combine the characteristics of both gliders and powered aircraft. It was a single-seat monoplane called Sraka (Magpie). Unfortunately, this had an underpowered engine that offered just 13 kW (18 HP) and actually delivered even less, and on top of that, was unreliable. Bloudek and his team struggled with the many problems, repairs and rebuilding of this aircraft until 1932, when they finally gave up on it. Sraka didn't spend much time in the air.

In 1928-29, Bloudek designed the Bloudek XV; a two-seater low wing sports plane, called Lojze that he hoped would successfully participate in air competitions. After its inauguration in August 1930, the aircraft, fitted with a 59 kW (80 HP) engine, reached a speed of 200 km/h. A young engineer, Anton Kuhelj, who went on to became an aircraft constructor and a renowned theoretician, worked on the strength calculations of Lojze.
In 1934, the pilot Janko Colnar competed with the plane in Zagreb. Whilst performing a corkscrew turn, he fell into a spin, and due to a lack of height, he couldn't recover from this and was killed.
The accident hurt Bloudek badly and he ceased constructing planes, although he continued to make sketches of various ideas, in particular helicopters, and conducted experiments with models.

A universal sports pioneer

Bloudek was interested in aircraft primarily in terms of the technology involved, rather than in actually piloting them. In 1909 or 1910 he only flew in his small glider or occasionally with his first powered airplane, Racek (Seagull), during 1910. Later on, he is only mentioned as an aircraft designer and constructor, not as an aviator.
However, Bloudek truly was a universal athlete – not only because of the number of disciplines he was involved in, but because of his modus operandi. Apart from his active involvement in competitive and recreational sports, he introduced new sporting disciplines to Slovenia, was engaged as a sports event organiser and as a coach, and last, but not least, he was a designer of various sport grounds and facilities.

In his early student days he occasionally played football in Ljubljana, and was one of the co-founders of the Hermes football club in 1909. In 1912 he became a member of S.K. Ilirija (Ilirija Sports Club). He was a regular member of this club, until the outbreak of war in 1914. From the very beginning of his membership, Bloudek pursued the idea of introducing athletics and swimming to the club's activities. In the winter of 1912 he performed a famous ski jump wearing a helmet fitted with wings. He had started to ski in Bohemia by the age of 22 at the latest.



#6
Bloudek was a versatile athlete. As the Slovene champion in figure skating, he broke fresh ground in this field. Musem of Sport.

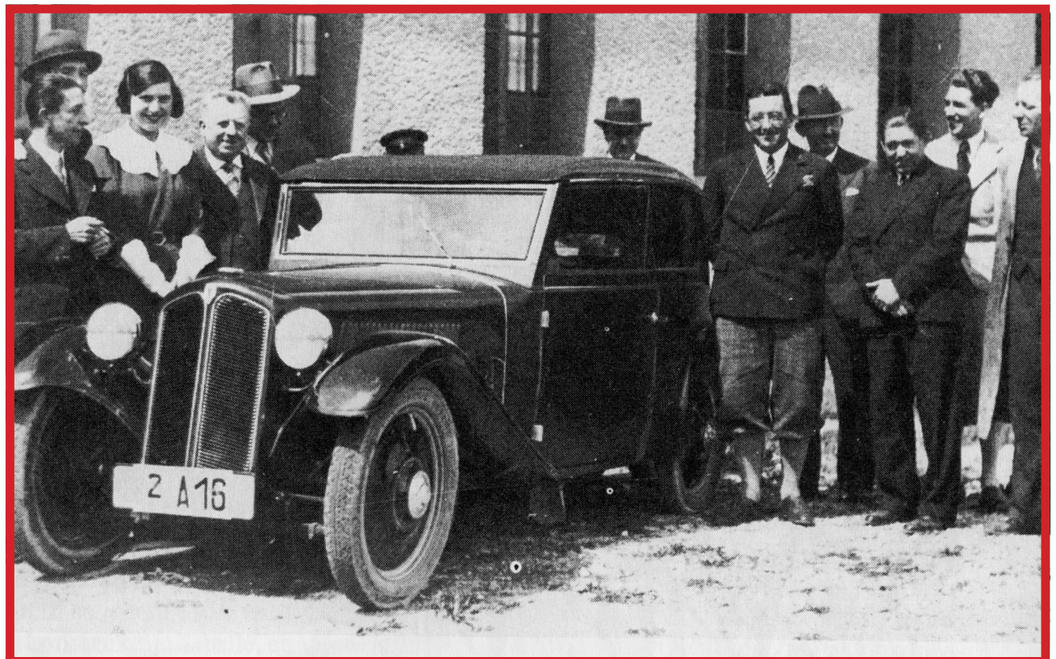
At the end of World War One and upon his return to Slovenia, Bloudek immediately re-established contacts with his old club and became its first post-war president. In 1919, the club refurbished the football ground and Bloudek occasionally made playing appearances. The uneven ground was the reason behind his knee injury, from which he never fully recovered, and which was to prevent him from participating in some disciplines.
In 1919 he became a member of the Yugoslav Olympic Committee and held the position until his death. In 1920 the Ilirija Sports Club acquired light athletics facilities and so extended its activities to this field. The following year, Bloudek became the Slovene champion in throwing the discus.
In 1922 the club created tennis courts, and from 1924 onwards, these were flooded in winter to change them into an ice rink. Between 1926-29 (with the exception of 1928 when the competition wasn't held), Bloudek was the Slovene champion in figure skating. He didn't compete in this discipline until 39 years of age.
Occasionally, he participated in other competitions as well. In 1926, he was the winner with his Ford Model T in the motor race to Ljubelj, and was again successful the following year driving a Buick Cabriolet.

In 1929, the Ilirija Sports Club, now with a total of nine sporting sections, reached its high point. Bloudek strove for the advancement of light athletics, swimming and skating sections together with hockey, and he also competed on the tennis courts and in table tennis. He was constantly providing things for the club and a major portion of these were at his own expense. In this way, the Ilirija Stadium acquired dressing rooms and a covered stand for 250 spectators, as well as flood-lighting equipment for night matches – the originality of their design winning Bloudek a patent.
1928-30 was the period of the most intense construction work on the Ilirija Sports Baths, with the creation of an Olympic swimming pool (50 x 17m), indoor pool and 10m diving platform.
In addition, Bloudek designed a number of sport facilities for other Slovene clubs and locations and occasionally, in neighbouring countries. In the 1930s he invested most of his technical expertise into the motor industry and the construction of ski jumping hills.

Due to the failed attempt to establish a Slovene aircraft industry in 1924, Bloudek became involved in the motor industry. A documentary photography shows Bloudek in a motorcycling outfit before WWI, probably in association with the motorcycle and car racer Jan Čermák, who also ordered Bloudek's first two airplanes.

In 1920/21 Bloudek was the manager of a car repair workshop in Ljubljana. There is an interesting blueprint preserved from 1923 for a motorcycle with leg guards and a type of early predecessor to the roller blade.

In 1933 Bloudek joined his small metal products factory with Automontaza. From his arrival, until the 1970s, Automontaža primarily manufactured coachwork for buses, onto chassis fitted with the engines of renowned producers. In his role as the company's technical manager, Bloudek introduced different technological innovations, in particular the welding of steel coachwork, which replaced the screwing of panels onto wooden frames or riveting.
In 1934, the first 'Slovene' passenger car, Triglav, based on a DKW model was launched. At the time, Bloudek was also involved in the design of aerodynamically streamlined buses and a 'people's car' which would be accessible to less wealthy customers.
In 1937 he sold his stake at Automontaža but remained a partner and technical manager until 1941.



#7
With his work at Automontaža, Bloudek developed a new welded construction for coachwork, rendering wooden frames, screws and rivets, obsolete. In addition, he constructed the first Slovene car, and named it Triglav. Technical Museum of Slovenia.

Aircraft constructor designs ski jumping hills

Stanko Bloudek entered the history of ski jumping as an innovator, rebel and a man who combined a predominantly ballistic approach with aerodynamics, and thus contributed to the birth of a whole new sports discipline: ski flying.
The famous Slovene polymath, Janez Vajkard Valvasor (Johann Weichard Valvasor), a member of the Royal Society in London, made notes on ski jumping, way back in the 17th century with specific reference to the Carniolan peculiarity of using skis for descending hills, skiing between obstacles or jumping over them. Thus he provides a description of all three skiing disciplines, i.e. downhill, slalom and ski jumping. According to sources from the Norwegian region of Telemark, ski jumping had developed into a sport by the end of the 18th century. The first measured 9.5m jump can be traced back to 1808. The Norwegian record from 1860 (30.5m) remained unrivalled for 33 years. Ski jumping was performed on naturally elevated terrain until 1879, when the first hill was constructed in the Norwegian town of Oslo (formerly Christiania).
The increasingly larger hills resulted in the development of jumping techniques; the take-off accounted for most of the distance on the smaller hills, whereas on the larger ones, the jump length depended more on the skier's body position (which has witnessed many changes over time, from an upright position to a wide forward lean, from rowing movements with arms, to the arms extended at the front or placed backwards towards the hips; from skis kept parallel to each other to the V-style; the Telemark landing style replaced by more stable landings).

A scientific interest started to enter the world of ski jumping alongside the existing empirical approach. The key expert was the Swiss Dr. Reinhard Straumann, an aircraft engineer, who in his youth was a ski-jumper. In 1924 he started to consider air as a kind of gliding cushion, and in 1926, he investigated the correlation between in-run speed, jumping technique (in particular body position in flight) as well as jumping hill profile. He set up a theoretic basis for ski flying and anticipated the aerodynamic body style – at first described as 'fish-' or 'drop-like' – that jumpers only employed 20 years later.
With his theories, Straumann encouraged Bloudek – either by agreeing with his views or contesting them – in the design and development of a giant ski jumping hill which would allow skiers to achieve a series of world records and go beyond the magical boundary from ski jumping into flying.

Thanks particularly to Straumann and Bloudek, the development of ski flying was so rapid, that the International Ski Federation (FIS) couldn't keep up with the pace, and so set an artificial limit beyond which jumps were either not allowed, or not officially recognised. The reason – concealed behind an apparent concern for competitors' safety – was jealousy and rivalry between the ski jump constructors, and some personal resentment. The normally modest and reserved Bloudek opposed these limits and strove for solutions which would, with the manageable speed at the moment of take-off, allow the longest possible jumps without the skier lifting too much above the hill profile and allowing them to land at a favourable angle. Straumann worked to mathematically determined standards, whilst Bloudek's work was based on the observation of jumpers and adjusting the hills to suit their increasing capabilities. Due to their conflicting approaches, there was a rift between the two experts at first. Straumann wrote polemic articles, whereas Bloudek went ahead with the construction and expansion of the giant jump in Planica. Later, they were reconciled and established an amicable relationship, and this was one of the most dramatic,

#8
Bloudek designed the large ski-jumping hill in Planica, further developed this into a ski-flying hill, and as a result he can be credited with promoting and advancing a whole new sporting discipline. Museum of Sport.

and at the same time, humane episodes in the world history of ski jumping and ski flying.

It was of considerable significance to the development of ski jumping that both its key personalities, Straumann and Bloudek, were aircraft experts. The first ever successful powered aircraft, that of the Wright brothers in 1903, took off and landed on skids or runners, rather like a sleigh, and just like several types of unpowered and powered airplanes were to later take off and land during winter.

Among the Slovene aircraft pioneers, the physics professor Julij Nardin from Idrija, inspired by the lack of flat land in that area, considered the possibility of an aircraft using a hill similar to a ski jump. Bloudek and Nardin went on to exchange ideas and concepts. In 1912, during his time working for the Etrich family, Bloudek performed an experiment where he tried to combine a ski jump and flying with wings. Though his experiment failed, the 22-year old Bloudek through his synthesis of skiing and aviation, demonstrated for the first time his idea of the universal flying man.

His two pre-WWI aircraft addressed the issue of strength and drag, whilst with his two post-war aircraft he put the major emphasis on aerodynamics. After the Lojze accident and the death of its pilot in 1934, Bloudek transferred his experience in aviation, and in particular aerodynamics, to ski jumping where the 'airplane' of his flying man was reduced to the lift force of skis and the aerodynamic position of the athlete's body.

As a prominent expert in various sporting disciplines as well as aviation technology, Bloudek had a huge advantage over all his competitors in the construction of ski jumping hills, not only within Slovene borders, but also worldwide.

Planica from ski-jumps to flights

The origins of Slovene ski-jumping date back to before the World War One. The first documented jump made by a Slovene was Bloudek's of 1912, when he performed at Trutnov (Bohemia) his famous experiment wearing a winged helmet in the style of the god Mercury.
Following the Armistice, skiing, including ski-jumping, developed rapidly. The oldest ski-jumping hill is considered to be the Hannsen near Bohinjska Bistrica, dating from 1920, and named after the Norwegian who coached in our country.

In 1921 the first national competition was organised, and won by Jože Pogačar who jumped 9.5m. Skiers from Ilirija established an association in 1925 which was determined to develop a winter sports centre at Planica. This was the beginning of a new era for Bloudek, and soon resulted in his engagement in the construction of ski-jumping hills. His first documented blueprint for a hill, now kept at the Museum of Sport in Ljubljana, dates from 1931 (the year when the first International Ski-Jumping competition was organised in Bohinjska Bistrica). The hill would allow distances of about 30m to be attained.
By 1933, there were already about 40 ski-jumping hills recorded in Slovenia. At least two of them were Bloudek's work – one in Podkoren and one in Planica. The blueprints preserved prove that Bloudek was heavily engaged in the construction of these hills, including a 70m jump at Planica, dating from 1932, and which, in compliance with the FIS standards, limited the jumps to a 70m distance. Nevertheless, those within Bloudek's circle silently anticipated the chance to greatly surpass this artificially imposed limit. The group's most ambitious member was Joso Gorec, an excellent sport organiser, who in 1931 actually engaged Bloudek to work on the Planica hills.

The evolution of Planica is partially down to the excellent work of the building contractors who followed Bloudek's ideas, and with his guidance, performed earthmoving and other construction works. It was typical of Bloudek's character and his whole style of working, that he often provided only rough sketches with basic details, and these had to serve the contractors and his other associates to implement his plans.

One of these was construction technician Ivan Rožman, who in 1933, supervised the construction of an extended hill to one of Bloudek's designs, and also co-financed these works. In order to reinforce the snow on the hill, he may well have been the first to employ chemical agents (such as common salt, sal ammoniac), known since the 17th century for their effects on the freezing of water. However, attempts to attribute Rožman with the co-design of the large Planica hill are unsupported. The only known sketch by Rožman for the 80m jump, is not dated, includes corrections in another hand and fails to feature any details that suggest this drawing was proposing a development from a ski-jumping into a ski-flying hill.

Bloudek was familiar with Straumann's aerodynamic theory of ski-jumps ever since it had been first

#9
Bloudek considered his hill to be more than just a technical sports facility, as did his colleagues and the athletes who competed on it. National Museum of Contemporary History.

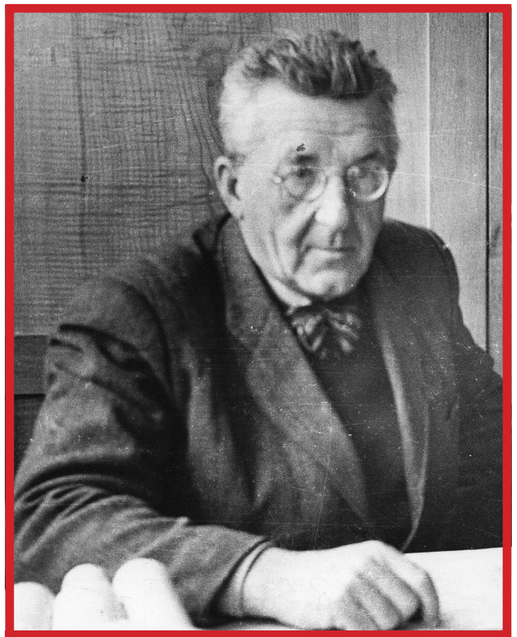
proposed in the 1920s, and as an aircraft expert himself he agreed with the theory of his colleague, but had slightly different views on the transfer of Straumann's principles into practice.
Bloudek emphasised that jumping technique should adapt to the characteristics of each hill, and that jump designers should learn from the jumpers' own experience. Bloudek's crucial contribution to the profile of jumping hills – which was thus far composed only of lines and parts of circular curves – were transition curves. As a result, the hill's profile was adapted to the parabolic curve of the flight, deformed due to the draft and lift, which allowed yet further development of jumping hills and the start of ski-flying.
The aviation knowledge of both Straumann and Bloudek combined with, their experience and apparently conflicting ideas, soon proved extremely productive and were of crucial significance in this phase of the development of ski-jumping hills worldwide.
In 1934, the first world record was set at the Planica giant: the Norwegian Birger Ruud jumped 92m. Bloudek constantly improved and upgraded the hill, and in 1936 – when it was 150m high and 350m long – the Austrian, Bradl, for the first time in human history, surpassed the magical boundary of 100m.
A 120m jump was first recorded by the Swiss, Fritz Tschanen in 1948. However for the next 21 years, Bloudek's giant (also called the 'mammoth ski-jump') missed all the world records.
The Slovene Jože Šlibar did set a 141-metre world record in 1961, but this was not at Planica, but in Oberstdorf. He jumped exactly as had been predicted by Bloudek, who had been dead two years by that time. He adopted an aerodynamic position, with arms extended to the front that allowed him to attain a long jump, he then felt the air cushion beneath him, lifted the points of his skis and managed to extend the jump into a flight, completed by a Telemark-style landing.

New world records were set again in Planica in 1969, this time upon the ski-flying hill upgraded by the Gorišek brothers, who were the inheritors of Bloudek's brilliant invention. In 1994, the Finn, Toni Nieminen was the first to surpass the doubly-magical boundary of 200m (203m), and in 2005, the Norwegian Bjoern Einar Romoeren made a flight of 239m, that remains at the time of this publication, the unrivalled world record.
The unparalleled number of world records set in Planica amounts to 40, of which, the first 12 were set on Bloudek's hill (from 92 to 120m, the zone which is generally considered as the boundary between jumps and flights). The Gorišek brothers' hill at Planica and the other largest hills in the world, are to a great extent extended versions of Bloudek's original.
The scientific approach now being adopted (precise measurement of real jumps and simulation in wind tunnels, computer analyses of this data followed by design work) promises even further advancement and even longer flights, provided that the jumpers' speed and the landing angle are not increased, and therefore compromising their safety – which was Bloudek's first principle.

Between and after the World War Two

By the end of the 1930s when Planica, and therefore, Bloudek's work had already become renowned, there were worrying signs of an inpending new world war, with technology promising even more horrifying effects.
When air raids commenced on Great Britain in mid-

August 1940, in preparation for an invasion, Bloudek conceived an idea for airborne protection of English cities on a principle similar to mines in the sea, and even met with the English consulate representatives in Zagreb and presented his idea to them. Although Bloudek was not a politically engaged person, he immediately opposed Nazism and Fascism, and joined the liberation movement. This wasn't merely a pose, as he actually put his principles to action.
When the Germans were engaged in the reconstruction of his jumping hill, he refused to go to Planica, and stayed in Ljubljana, which was at that time, occupied by the Italians.
In order to support the Liberation Front, Bloudek invented double-bottomed containers for the transfer of secret messages and designed secret bunkers and printing shops. He also constructed a tricycle with a secret compartment, designed for the distribution of illegal printed papers. His other inventions included a sound suppressor for firearms, and sharp-edged pyramids for puncturing the tyres of army vehicles. Special units of the partisan armed forces could fly to action using aircraft similar to modern hang-gliders.
The important railway viaduct at Borovnica near Ljubljana was heavily protected by the occupying forces, so he suggested pilot-free aircraft (drones) that would become air torpedoes.



#10
Bloudek remained creative to his last days. He died in 1959; not in bed but sitting at the desk, writing a letter about future ski-jumping hills. Museum of Sport.

Such activity couldn't go unnoticed for a long, and in April 1942, the Italians put Bloudek in jail for several months, and during the German occupation that followed he was imprisoned by the Slovene Home Guard in February 1945. This could easily have cost Bloudek his life, but he survived forced labour in Ribnica, from where he walked home on the very first day that Ljubljana was liberated.

At the end of the war Bloudek was 55 years old and he still had another 14 years to live. He was never active politically, except that he took sides during wartime, whereas in the post-war democracy he believed that everybody should do their work. In this period he particularly identified with the development of mass sporting activity for all – something he strove for all his life. With regard to physical exercise and sport he was a firm advocate of the healthy spirit in a healthy body, Olympic principle. His views were appreciated abroad, and in 1948 Bloudek became a member of the International Olympic Committee, participating at the congresses in London, Athens, Munich and Cortina.

After World War One, Bloudek was the first president of the Fizkulturni Odbor Slovenije (Physical Training Committee of Slovenia) and afterwards, under various titles, oversaw the construction of various sporting facilities. He and his colleagues designed a huge number of sports facilities and equipment. Bloudek designed over 100 ski-jumping hills, including some of the very largest, in particular Oberstdorf and Kulm, where he acted as a consultant.

His large hill at Planica, which immediately after the end of the World War Two was in a miserable condition, he renovated by 1947 and it was awarded a commendation by an FIS delegate (the FIS stubbornly opposed the construction of large hills). In 1948 Bloudek extended its profile to allow the Swiss Fritz Tschanen a 120m flight – a new world record, and the last one on Bloudek's facility. Bloudek was fully aware that any further records would require a new hill in Planica, and in 1954 he marked it out on the spot where the Gorišek brothers actually constructed it a while later.

Bloudek was a step ahead of nationalisation, and relinquished the proprietorship of both the Ilirija baths and his stake at Automontaža. Later, he was offered a position of director at the Letov aircraft plant, which he refused, explaining that he lacked the will and ability for administrative work.

He continued to develop his idea for a safe helicopter and tested it with models. He was particularly dedicated to skating and roller-skating and tried to offer skaters a quality training regime throughout the year and so worked on the invention of in-line roller skates.

Bloudek lived a life withdrawn from the public and publicity, and therefore nobody knew that he had suffered from a heart condition during his last years. Nevertheless he never avoided strenuous fieldwork and thus caught a fatal cold. He died on 26th November 1959 at his desk, writing a letter regarding the proposed construction of ski-jumping hills across Yugoslavia. The letter remained unfinished.

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2 Bloudek's Flying Man

Sandi Sitar

The development of aviation during the period of Stanko Bloudek's life (1890-1959) passed through a number of stages: the first attempts at flying with heavier-than-air devices; the pioneering era of flight; World War One; the domination of aeroplanes over airships and the development of the basic categories and types of flying machines; the Second World War; the breaking of the sound barrier and the domination of jet propulsion at the highest velocities. After actively participating in this development of flight for 25 years (1909-1934), Bloudek transferred his experience of aerodynamics across into ski jumping and – thanks to him – the development of ski flying.

Bloudek's first attempts at flight

The history of Slovenian aviation and Bloudek's attempts and achievements - of international significance - combine in Bloudek's concept of the 'flying man'. Four aeroplanes resulted from his own designs and construction work; Racek, Libela, Sraka and Lojze. The first two were constructed in the years before WWI and made Bloudek – together with Edvard Rusjan and Jože Zablatnik – one of the most important aviation pioneers in Slovenia.
Bloudek, Rusjan and Zablatnik, together with the somewhat older Franc Wels, soon outgrew their amateur status and became professional aircraft constructors.

Bloudek attributed his interest in aviation to the Wright Brothers who, on 17th December 1903, were the first in the world to take to the air in a powered aeroplane and in so doing enticed many pioneers to follow them. Due to a lack of information on the Wright brothers' aircraft, Bloudek constructed his first models by studying birds, which he – like Leonardo da Vinci 400 years earlier – dissected. When these early attempts failed, he started to geometrically simplify his observations from nature and in 1906 his models successfully flew. This happened in the same year that the Brazilian-French pioneer Alberto Santos-Dumont first flew a powered aircraft of his own construction in Europe. At the time, Bloudek was 16 years old and attending the Ljubljana Gymnasium. His models attracted a lot of attention over the ensuing years.

As it was for many other designers and constructors, scale modelling was Bloudek's first step towards

#11
In Bloudek's time – and to a certain extent nowadays – model making introduced young people to the higher levels of aircraft engineering. Bloudek with a glider model in 1930's. Museum of Sport.

constructing a full-sized aeroplane. At the beginning of his studies in Prague, he came across new sources of information which further enhanced his desire to fly. By early 1910, but more likely before the end of 1909, he constructed a glider capable of flying short distances. Lacking a detailed description or a picture of this glider we assume that it was a large model, that one had to run with downhill in order to eventually take off and fly for some (ten) metres. The German engineer Otto Lilienthal was the first to fly with similar machines between 1891-96. These are known as gliders, i.e. unpowered flying machines, and in these examples, the pilot hangs from below the craft and controls the direction of flight by shifting his body. Due to their simple construction, such machines were quite widespread in the late 19th and early 20th century. In mid-1909, the young Otmar Kanet built the first gliders in the territory of Slovenia, constructing some of them during his holidays in Ormož.

Galeb (Seagull) monoplane

There is a curious story about this craft. An uninvited guest somehow managed to take the machine and run with it downhill (it was a glider at this stage in its development). Completely unprepared to take off, he suddenly found himself flying over the Vltava River and let go of the machine; they both landed in the water and the remains of Galeb were carried away by the river.
In early 1910 Bloudek constructed a new version, this time following the example of the French powered aeroplane Demoiselle. Its constructor, Santos-Dumont made the prototype of this lightweight monoplane with a wire-braced wing mounted atop an open-framework fuselage built around a reinforced bamboo boom in November 1907, then upgraded it and mounted a more powerful engine in the frame (variants Nos. 19-22), and finalised it in 1909. Technical data for this aeroplane (variant No. 20) is as follows: wingspan 5.10m, length 8.00m, height 2.40m, wing area 10.2m2, power plant 1 x Darracq, 26.2 kW (35hp), gross weight 143kg, and maximum speed of 90km/h.

Santos-Dumont released the drawings of Demoiselle for free so that it could be more or less faithfully imitated without restrictions, and this resulted in the construction of about ten machines. In the USA, the glider versions were sold for 250 dollars, whilst powered machines cost 1,000 dollars. In Slovenia, there were three constructors who imitated Santos-Dumont's aeroplane: a few months prior to Bloudek's attempt, Edvard Rusjan constructed Eda V. Tests showed that Eda V was – even with a very light pilot – still not airworthy and in 1910 it failed Rusjan by not taking off in front of an audience at an air show. Based on comparative data, Bloudek's aeroplane was more successful than Rusjan's, and about as good as Santos-Dumont's.
In 1910, Maks Stupar constructed seven copies of the Demoiselle in the USA. Maks Stupar was an aviation pioneer born in Metlika in 1885, who moved to the States where he is considered the originator of the serial manufacture of aeroplanes.

In March 1910, Bloudek exhibited the model of his aircraft at the 7th Car Show in Prague. When Jan Čermak - the motorcycle and car racer who had wanted to buy Demoseille - saw Bloudek's plane, he linked up with Bloudek and the bicycle mechanic and racer Jaroslav Potuček. The three men immediately started
working together. Bloudek made the drawings, Potuček made his workshop available where they manufactured the airframe, and Čermak bought in France a 52-kilo engine rated at 23.5 kW (32hp).

#12
Bloudek's Racek (Sea gull) was one of many, but in this case successful improvements of the Santos-Dumont original, Demoiselle. 1910. Author's archive.

The enthusiastic trio also enjoyed help from other people. In four months the frame was finished, and in September a Chauviere propeller with a two-metre diameter was supplied from Paris. On 13th October 1910 the plane components were transported to the Bory airfield in Plzen.

The aeroplane was completed there, the frame was covered, the engine installed, and on 19th October 1910 they started test flying. The pilots were by turn Čermak, Bloudek and Potuček. At first, other pilots at the airfield laughed at their attempts with their small aeroplane and under-powered engine, but soon the flying potential of the machine was noticed. Bloudek and his company completed fifty-metre flights and were prepared for even better achievements until bad weather stopped them. However, there was some friction within the group and Potuček decided to leave the team. Bloudek upgraded the aeroplane and Čermak managed to fly 200 metres at a height of 50 metres and on 11th December he flew a kilometre at about 20 metres above the ground. All who watched their attempts were sure the aeroplane had even more potential, but at the end of 1910 the trio had gone their separate ways. Čermak took the engine and propeller that he and Bloudek intended to install in a new aircraft, whilst Potuček took the remainder of the plane which was later destroyed at the start of the First World War.

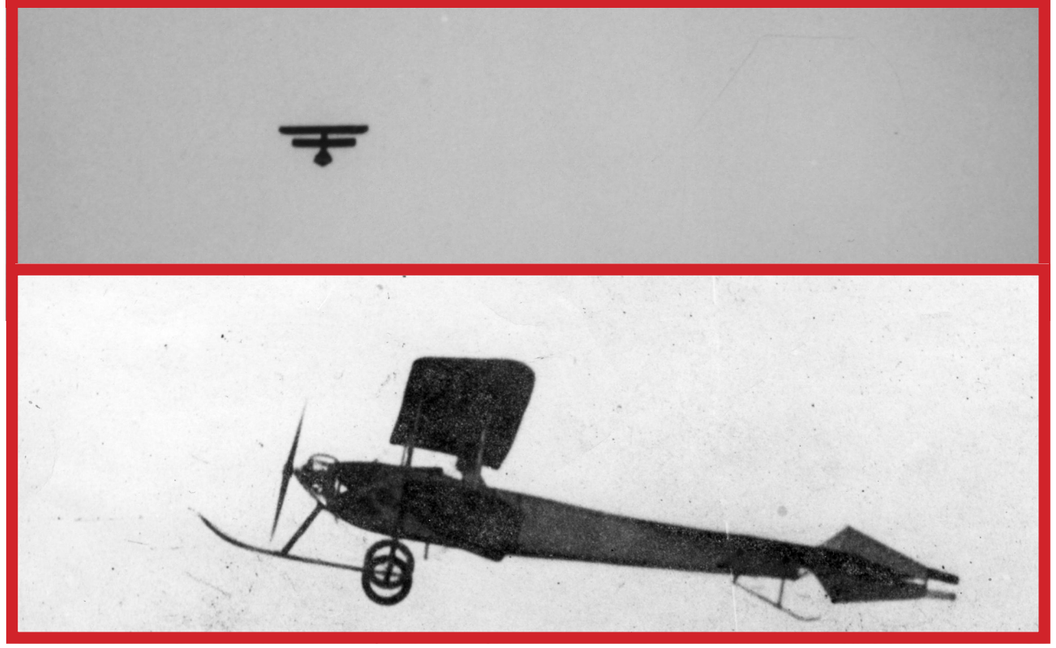
Bloudek's first powered aeroplane – which didn't have an official name, but was called Racek (Seagull) or Das (Devil) – is also treated as part of Czech aviation history. Due to the circumstances of its production, the twenty-year old constructor and its proven flying characteristics, Racek has earned great respect by both Slovene and Czech aviation experts. Detailed comparisons show that Bloudek to a great extent copied the Santos-Dumont aeroplane, but he significantly redesigned and augmented the wings and tail plane in order to gain extra wingspan without increasing the weight. The comparison between Bloudek's Racek and Rusjan's Eda V (which often failed the constructor because it wouldn't fly; its record distance was only 100 metres at a height of 10 metres) shows that Bloudek's design was more successful than Rusjan's, who made his aeroplane six months before Bloudek, who was also the younger of the two designers.

Libela (Dragonfly) biplane

During the construction of his first powered plane and after the experience of flying it in 1910, Bloudek thought about a new aeroplane which Čermak decided to finance and purchase. Bloudek made blueprints during his winter academic holidays in 1910-1911, which he spent in Idrija. This was the time of Rusjan's fatal plane crash in Belgrade (9th January 1911) which shocked all Slovene aviation pioneers, and in particular Bloudek and the Idrija-based physics professor, Julij Nardin. The latter, at the time, was working on a glider, and it was probably Rusjan's death that stopped him from completing and testing it. Nardin was an expert in modern physics and its application, including aerodynamics and aviation. As a theoretician he advised both Rusjan and Bloudek, whose blueprints for his second plane were based on a previously elaborated concept of a biplane with an enclosed fuselage. The biplane concept allowed him to increase the wing area, whereas the closed fuselage was an original idea contrary to most biplanes of that period which had open fuselages. This was Bloudek's most original aeroplane and which – similar to Santos-Dumont's Demoiselle in the category of monoplanes – proved to be the best small biplane of the time. It was called Libela - the dragonfly.

It was constructed in the period between January to May 1911, at which time Čermak first flew it. Libela soon proved to be a very successful construction with good flying characteristics. Its technical data was as follows: the upper wingspan 8.6m and lower wingspan 6.8m and a wing depth of 1.36m, the total wing area amounted to about 20m2. The fuselage was 8m long, whilst the total length with the landing ski

#13
Bloudek's Libela (Dragonfly) from 1911 proved to be one of the most successful small size biplanes from the pre-WWI period.
Ljubljana Historical Archive (top).
Libela in Zagreb, 1912. Museum of Sport (bottom).



which protruded out in front of the aeroplane nose to prevent it overturning, amounted to 8.6m. The tail was the same as that of the Seagull, whilst the engine was manufactured by the French company of Clement Bayard or Darracq and the propeller was the same as Bloudek used on his first aircraft. The net weight was 220kg and the gross weight with pilot amounted to about 320kg. It reached a maximum speed of 90km/h. Bloudek also constructed a trailer, equipped with tools for urgent repairs and maintenance work in the field. The trailer, which during the day served as a workshop, also provided overnight accommodation for two people. The outer skin of the trailer was a linen covering that protected the entire front part of the plane. Numerous aviation fans were almost as enthusiastic about the trailer as they were about the aircraft.

Libela flew over the airfield in Wiener Neuerstadt from May to June 1911. The small aeroplane was also laughed at first, but when people saw it flying they soon became enthusiastic. On 6th and 7th July Čermak passed his flying exam on the aeroplane. In August, he made about 25 flights over Zagreb, rising up to 300 metres and stayed in the air for about 10 to 15 minutes – as much as the fuel reservoir and overheating of a poorly lubricated engine would allow him. In late August, Čermak made an international tour with Libela to Romania, Hungary, Bulgaria and Serbia, making about 30 flights over Belgrade alone. By the end of 1911 he returned to Bohemia and in mid-1913 sold Libela which was subsequently destroyed during WWI. It was this war that also prevented the Blaha Company from mass producing this aeroplane which – due to its simple construction and good flying characteristics – undoubtedly would have become a commercial success.

Bloudek and Merčep

During their demonstration of Libela in Zagreb in the summer 1910, Bloudek and Čermak drew the attention of the photographer and sports enthusiast Mihail Merćep, who had, in mid-1910 entered into a partnership with Edvard Rusjan. Edvard and his brother Jože had worked in Zagreb since September 1910 and constructed a Merćep-Rusjan aeroplane, which by the end of the year had made successful flights over Zagreb. In early 1911 the partners took

this aeroplane to Belgrade for a demonstration to the Ministry of Defence and Military Command; the Serbs were interested in acquiring aeroplanes due to the imminent outbreak of the Balkan Wars. On 9th January 1911, Rusjan made a risky flight over the outfall of the Sava River into the Danube during very poor weather. During the landing, a strong gust of wind brought the aeroplane down from the sky and Rusjan didn't survive the fall.
Merćep decided to continue their work and tried to replace Rusjan with other partners. Jože Rusjan remained the most potential with regard to the construction of the aeroplane and test piloting. The second aeroplane, made by using blueprints of Edvard Rusjan and called Sokol (Hawk) awaited completion in Merćep's workshop. The final work on this plane – which was also intended for the Serbian army – was the charge of Stanko Bloudek, and Čermak did the test flying.

Edvard Rusjan designed his second Zagreb aeroplane along similar lines to the first which cost him his life. It was a single-seat monoplane with a shorter wingspan and fuselage and therefore smaller than his previous aircraft. The construction was reinforced, the chassis enhanced and a repaired power plant from the previous plane was installed; it was a seven cylinder radial rotary Gnome engine of 36.8kW (50hp). This aircraft was supposed to have the same controls as the first, but with one special characteristic: instead to the joystick, the height and incline controls were attached directly to the pilot's body. This would allow the pilot to fly the plane using his entire body and keep his hands free for firing a gun or dropping bombs – a fact that was of great interest to the army. Bloudek could not accept such an idea and he remodelled them in the normal manner with pedals and joystick. Other amendments and upgrades were executed according to his instruction, and Bloudek's final assessment was that although the aircraft was a work of a brilliant man, it was too light and not robust enough to sustain high air pressure; this was tragically corroborated in the event of the first Merćep-Rusjan aeroplane. Bloudek warned Čermak against flying it, but he tested it anyway. Although the flight went well, the pilot was so disturbed by the gyroscopic moment of the rotary engine which - with the majority of its mass and the propeller turned around the principal axes – that he was truly relieved when he was able to fly Libela, distinguished by far better flying capabilities and safety.

Sokol flew several times, and Novak even passed his pilot test with it. The Serb army purchased it for pilot training, and ordered three more, but none of them was very successful. Their main shortcoming was that they were single-seated, whereas in that time, the army favoured two-seater aircraft. The pilot was too busy flying the plane so that he could not engage in combat.

In the summer of 1913, Bloudek contacted Merćep to seek employment with him, but Merćep replied that he had no vacancies at that time, though he didn't exclude the possibility of a future cooperation. Thus Bloudek investigated other options in the aircraft industry due to his substantial knowledge, experience and reputation.

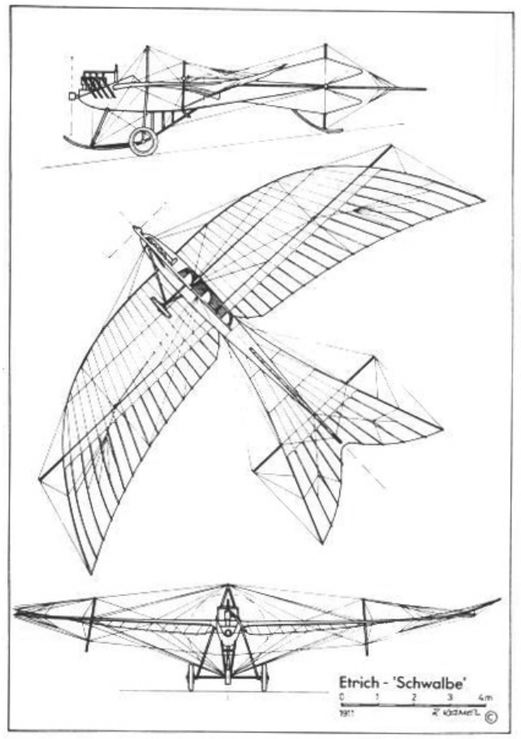
Employment at Etrich

The German family of Etrich came to Bohemia in the 18th century. They not only established a textile business in Tratenau (later renamed Texlen) but also left their mark upon European aviation history.
In 1898, Ignaz Etrich and his son Igo, purchased one or two gliders from the estate of Otto Lilienthal - the father of the modern flying - who had been killed two years earlier. Following Lilienthal's example, they constructed a machine in 1900, but it wouldn't fly. They were also much preoccupied with the textile industry - which funded their aviation endeavours – so they decided to engage foreign experts for their aviation workshop, and during the years 1903-13 these included three Slovenes: Franc Wels (1903-09), Pavel Podgornik (1901-10) and Stanko Bloudek (1911-13).

Based upon the shape of the seed of the Zanonia macrocarpa plant, Wels designed scale models and eventually a full sized tail-less glider. In Tratenau, on 6th October 1906, he was the first in the world to successfully fly with a so-called 'flying wing'. Etrich soon replaced Wels, due to conflicts over how to progress the design, and these including the model designer Podgornik who in early 1909 won an international competition in Vienna.
Through Podgornik's testing of scale models, he contributed significantly to the development of aircraft design, in particular with the Taube (Pigeon) powered aeroplane, which was a combination of the Wels flying wing shape, married to a fuselage and tail. This monoplane – the very first in Austria – started flying in Wiener Neustadt in the spring of 1910.

Stanko Bloudek was Etrich's principal constructor

#14
In 1911, the Bloudek's development, the Schwalbe (Swallow) set the Austrian speed record of 163km/h. Author's archive.



between 1911-13. The contract he signed on 3rd August 1911 not only offered a very low salary, but also demanded that he relinquish any technical ideas he came up with, over to his employer.
Bloudek was involved in upgrading the basic model of the Taube, and from the surviving documentation it would appear that he was particularly engaged in transforming the single-seater into a multiple seat aeroplane; developing two-seat versions with seats either side by side or inline.
In 1911, Bloudek constructed the Schwalbe (Swallow) aeroplane, which was particularly distinguished from the Taube by its semicircular wings that spanned 15m, and which distinctly pointed upwards and backwards. On 13th October 1911, the Schwalbe reached 163km/h which made it the fastest Austro-Hungarian aircraft of the time. However, its other features were less favourable; the manufacture of the wing – especially its pointed tips – was extremely demanding. This was also the reason why the Etrich plant in Oberaltstadt near Tratenau – where Bloudek worked - manufactured only a limited number of this type. Nevertheless, they also developed a three seater variant, in which the passengers sat side by side below the pilot.
In 1912, Bloudek planned a new version of the Taube, called the Luftlimousine, which was one of the first aeroplanes in the world to feature a fully enclosed cabin. The cabin was very well designed; it could seat three passengers and was glazed with ordinary glass. Two of these planes were manufactured. The first successful flight took place on 7th May 1912; the following day the aircraft, with two passengers, stayed in the air for an hour. During the demonstration of the Luftlimousine on 12th August 1912 in England, two world speed records were achieved: with three people in the cabin, the machine flew 106km/h, and with two persons, at 112km/h. Despite the extraordinary success of the design, further development of cabin planes remained theoretical until after WWI.

Taube was the first aeroplane to be used in combat operations; the Italian army used it in the bombardment of Libya in 1911. The Austrian army also first purchased these aeroplanes in 1911, and the following year placed a larger order for the Etrich aircraft, which enjoyed a reputation for being very safe planes, particularly suitable for pilot training and reconnaissance.
At about this time Bloudek was in charge of remodelling the Taube into a fighter plane. In addition to enhancing the rigidity of the airframe, one of his priorities was to simplify the assembly and dismantling of the major components for transport and use in combat situations.
Bloudek designed experimental planes known simply as EXP I., II. and III. In 1913, the aeroplane identified simply as NV-1913 was ready for mass production, and that same year, eight of these planes were

#15
Luftlimousine, one of the first multi-seated aeroplanes with fully enclosed glass cabin, was – according to the latest historical research – to a significant extent, Bloudek's construction. Author's archive.

manufactured and delivered to the army. Bloudek personally undertook their test flying in front of high-ranking representatives of the Austrian Air Force. Soon, orders for this plane were coming in from Germany, France, Italy, Russia and even China.
At the time, Etrich's aircraft were manufactured in various factories: in Fischamend and at Lohner in Vienna and Heiligenstadt; in Germany, they were constructed mainly at Rumpler – initially by licence, and upon the expiration of Etrich's patent, in their original versions. Rumpler manufactured the first fully metal version of the Taube – an idea that Bloudek had considered some time before.

Bloudek had a lot of grand ideas immediately prior to WWI. For instance, he planned an amphibian aircraft that could operate on water, on land and in the air, but he was ever-more concerned by the contractual provision that all copyrights must be attributed to Etrich. Due to the predominance of biplanes in combat, Bloudek also drew Etrich's attention to his own experience in the construction of such aircraft. Bloudek expected more independence in his work and wished to start biplane construction, but eventually he shared the same destiny as Wels had, four years earlier. Etrich insisted on monoplanes and dismissed Bloudek, who left in late July 1913.
The 23 year-old constructor had already gained a professional reputation in the field of combat aeroplanes, so he didn't have any problem in finding new employment.

In the military air industry

At the beginning of WWI, aeroplanes were undertaking mainly reconnaissance and courier work and they were not given a major strategic role, but soon it was realised that they were an effective means of combat. The aeroplane's abilities (speed, climbing, agility, load capacity) were improved, particularly due to the increased power of the engines. Their speed rose from the initial 100km/h to about 200km/h by the end of the war.
The German air force introduced a system that distinguished the role and type of aeroplanes, so type A were mainly monoplanes aimed at reconnaissance; biplanes of older construction were B; combat biplanes of recent construction were type C and single-seat fighters were D. The type F were single-engine planes with a rated power exceeding 350hp; and two-engine bombers and large multi-engine aircraft were type G, whereas seaplanes were type K.

#16
Ufag aeroplanes from the last years of WWI were to a large extent the fruit of Bloudek's construction skills. Author's archive.

Prior to WWI, 150 powered planes were manufactured throughout the Austro-Hungarian territory, whereas between 1914-18 eleven plants produced 3,400 aeroplanes, of which most were for combat.

As a constructor, Bloudek experimented with combat planes before the beginning of WWI, when he collaborated with Merćep and worked for Etrich. He was summoned to Vienna when the war broke out, and because of the pre-planned cooperation between the Austrian and German aircraft industries, he was sent at first to the Deutsche Flugzeugwerke (DFW) plant in Lindenthal, near Leipzig, which was among the most important aircraft manufacturers in Germany during the war, and directly cooperated with the Austro-Hungarian aircraft industry.
In 1914, DFW was among the German factories that manufactured the metal skeleton version of the Taube under licence. Being one of the best connoisseurs of Etrich's aeroplane, Bloudek was welcome in Lindenthal. Due to the fact that this plant also engaged in the manufacture of other aeroplanes, Bloudek became acquainted with the basics of the design and the organisation of mass production of many types of aeroplanes. In 1915, he was temporarily transferred to Vienna to the Thoene & Fiala company, which at the time was engaged in the manufacture of individual components and sub-assemblies. The plant was also preparing to start the manufacture of a more complex aircraft, the Knoller, in 1916 - after the departure of Bloudek - and the following year, the Aviatik Berg.

Between 1915-16 Bloudek worked at the Škoda Institutes in Wiener Neustadt, at Oesterreichische Flugzeugfabrik (Oeffag) becoming involved in the licence manufacture of reconnaissance and fighter aeroplanes as well as seaplanes fitted with engines from the nearby Daimler plant. They also attempted to develop their own fighter biplane and triplane, but the licensed aircraft were more successful. At Oeffag Bloudek further mastered his construction expertise and expanded his knowledge of various types of aeroplanes but he wanted to be more independent in his work, thus he took the first opportunity to request a transfer to Budapest.

There were three aircraft plants operating in Budapest. In mid-1916, Bloudek became the chief constructor at the Ungarische Flugzeugwerke A.G. (Ufag) in Albertfalva, established in 1912 by Camillo Castiglioni, the manufacturer and stock exchange speculator of Italian and Austrian origin.
Initially the plant cooperated with the Vienna-based Lohner factory and manufactured mainly training and reconnaissance aircraft, though later turned its production to land and sea fighters manufactured under licence from Castiglioni's Hansa-Brandenburg plant, and adapted to the special requirements of the army.

In 1917, Ufag developed its own fighter, the C1, under Bloudek's supervision. It was a double-seat biplane with a wingspan of 10.40m, a length of 7.50m and a height of 3.03m. Its net weight was 750kg and fully laden 1,150kg. The engine was a six-cylinder in-line liquid-cooled Hiero, producing 172kW (230hp). The Ufag C1 had a top speed of 180km/h and reached 6,500m. In August 1918, one of these became the thousandth plane to be manufactured in the Ufag plant; Stanko Bloudek was photographed in front of the specially decorated plane with maker's plate No. 161.121. Records from the period 1914-18 actually list 928 planes made by this factory.
The Ufag C1 was the most commonly produced type, with three constructed in 1917 and 123 in 1918. These saw action on the Isonzo Front.

The trio of Karl Balaban as director of research and development, engineer Bela Oravecz and Stanko Bloudek as senior engineer and head of the construction department, all collaborated in the development of a helicopter. The need for such a flying machine can be attributed to the great vulnerability of reconnaissance dirigibles, which were easy targets for the enemy's fighters. This is the reason why several Austrian aircraft manufacturers dealt with the development of a helicopter. At Ufag, they worked on a device with a six-side propeller on a vertical axle but they failed to solve the issue of directional stability, which, in the experimental stage, was left to the pilot's manual control. The project was known as the Balaban-Bloudek helicopter.
In his Budapest period, Bloudek is also attributed with the invention and development of a mechanism for the synchronised firing of a pair of machine guns by the rotation of a special worm gear. In addition, he is also credited as the designer of a concept for a fighter/interceptor plane - the Ufag D1. It was to be a monoplane with a wingspan of 8.5m, and 15.6 m2 of wing area, a net weight of 380kg, and with pilot and fully laden, 630kg. In order to enhance the level speed and climbing, Bloudek radically reduced the angle of attack and created a radical 'V' shape to the wing. The plans for the manufacture of a prototype, dated 5th June 1918 and marked 60.02, were fully prepared but the imminent break-up of the Austria-Hungarian Empire prevented their realisation.

Attempts to establish a Slovene aircraft industry
His vast experience and reputation gave Bloudek the opportunity for creative work in almost any developed European country after the war, but he decided to come back home. His decision was based on the expectation that the newly-formed State would develop its own aircraft industry - and one in which he could play a pioneering role.
It was natural to anticipate that the location of such an aviation industry would be determined by the concentration of expert staff. At the end of the war all of this expertise was concentrated in Ljubljana. In 1919, a squadron from Šiška airfield, together with air forces from Maribor, also participated in fighting with Austria along the northern Slovene border. In addition, near to the airport, there were workshops for aircraft servicing and repair, which far exceeded the requirements of the eight planes based there. The engine, machinery and joiner's departments could provide for the assembly, rebuilding, servicing and repair of many other planes of the SHS air force, and between 1918-24 they serviced more than a hundred planes.
Bloudek and his colleagues (Gulič, Rape and others) saw these workshops as the potential cradle of a Slovene aircraft industry. In the transition period it operated to meet the requirements of the Ljubljana Aero Club, established in late 1923. The plans failed however in 1924, when the military headquarters dissolved the Ljubljana squadron and moved the equipment and personnel to inland Serbia. Thus the opportunity for the transition from military to a civil aircraft industry, failed.

Bloudek XI, Sraka(magpie)

Bloudek employed his skills at the Ljubljana-based Aero Club, Naša Krila, and he designed a new aeroplane in 1924. With a simple construction that was easy to manufacture and easy to fly, it would be suitable for club use, and he tried to combine the characteristics

of both gliders and powered aircraft. This was the thinking amongst other sport aircraft manufacturers in England, France and Germany, a perfect example being the German BAG EI fitted with an English Blackburne engine. Following the huge acclaim of this aeroplane in early 1925, Bloudek decided on a similar single-seat monoplane design with a wing shape that at first resembled the Wels-Etrich plant-seed design, though later replaced by a more classically-shaped wing. Its specific feature was a box-like frame of mainly wood and linen, distinguished by a low weight of 120kg and consequently a low loading of the wing area (19 kg per m2), which was even more favourable than the German design. The dimensions varied slightly with various versions; the wingspan was about 11m, fuselage was 4.10m, and together with the forward reaching ski, its total length amounted to 5.50m. The tail, which was originally designed without stabilisers and fitted only with an elevator and rudder, was later replaced with a more classical design.

There were great expectations for Bloudek's third civil aircraft, mainly due to a number of construction innovations and improvements. Unfortunately, it featured an underpowered Blackburne 'Tomtit' engine which should have produced 3,600 revolutions per minute but delivered only a little over 2,000. Its rated power was between only 9 to 10.5 kW (12 to 14hp). The expected velocity was 120km/h, but the plane actually reached only 90 km/h. Both the plane and the engine proved capricious on the occasion of the maiden flight on 3rd November 1925, performed by the pilot Gabrijel Vodišek, who was to fly the plane most often, alongside other pilots at the Ljubljana Aero Club.
Although Bloudek worked on versions XII and XIII, he lost interest in the aeroplane and he didn't even mind when it was – uncharitably - named Sraka (magpie). The club however, did undertake some improvements and sent the engine for repair in Sarajevo. During the last flight of version XIV on 22nd September 1932, the engine failed again and this was a definite farewell to Sraka.

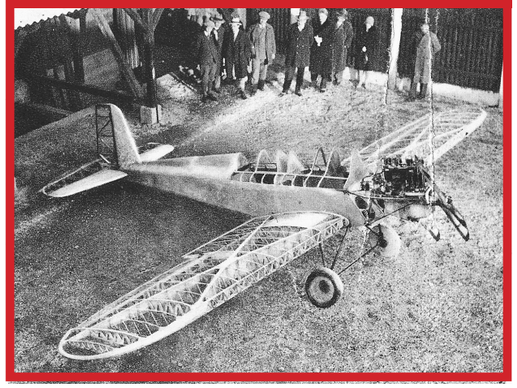
The Red bird - Lojze

Alongside the aeroplanes actually under construction, Stanko Bloudek also designed many more planes than were actually made, thus his fourth aeroplane was officially known as the Bloudek XV, and nicknamed Lojze.
In 1928, Bloudek and his colleagues at the Ljubljana Aero Club embarked on an ambitious project for a light sports airplane able to compete with machines made by the more famous manufacturers, such as the Raab Katzenstein RK 25 or the de Havilland DH 71, fitted with an ADC Cirrus 59 kW (80hp) engine.
Bloudek finished the basic plans by mid May 1929. This aerodynamic and aesthetic masterpiece was a two seater (at competitions a single-seat) monoplane with a 9.40m wingspan and 6.80m in length. It was mainly constructed of wood, covered in linen and painted red. All its components were locally manufactured, with the exception of engine, fuel tank and some metal parts which were imported. Both seats (the plane was piloted from the rear seat) were placed so deep in the fuselage that they prevented a view forward, which was – in addition to an unreliable engine – a major failing of the aeroplane. Nevertheless, it proved the constructor's estimations in being able to fly at 200km/h, be very agile and to be able to rise more than 4,000m.

The Bloudek XV was made at the Technical School and in Bloudek's own workshops in Ljubljana between July 1929 and early June 1930. When the work was in full swing, they decided to calculate the strength characteristics of the plane that had been designed by Bloudek solely on the basis of his good instinct and vast experience. These calculations were required for its registration and the issuing of a flying permit. A young engineer, and a future expert in aerodynamics and mechanics, Anton Kuhelj, undertook these calculations. He proved that where Bloudek had used X-shaped struts in the wings, they needed additional reinforcement. The cooperation between an experienced empiricist and a young, but consistently scientifically and mathematically oriented professional was a symbolic turning point in the history of Slovene aeroplane design and manufacture: the experimental phase was over and replaced by a more modern approach.

The first flights took place on 9th June 1930, and the plane was christened Lojze at Polje airfield on 3rd August. On 6th August, Colnar flew from Ljubljana to Zemun where the flying permit was issued. Then Colnar, together with Ksenija Hribar who was plane's godmother, set an intercity record between Ljubljana-Zagreb-Ljubljana (an hour and 40 minutes).
In the spring of 1931, Lojze successfully competed in Zagreb, where it once again proved its flying capabilities. In addition, it was exhibited at fairs on several occasions, where it always met with huge interest and acclaim by visitors. In September 1933,

#17
A double-seat sports plane Lojze, which started to fly in 1930, could compete perfectly well with similar aircraft-industry products. Author's archive.



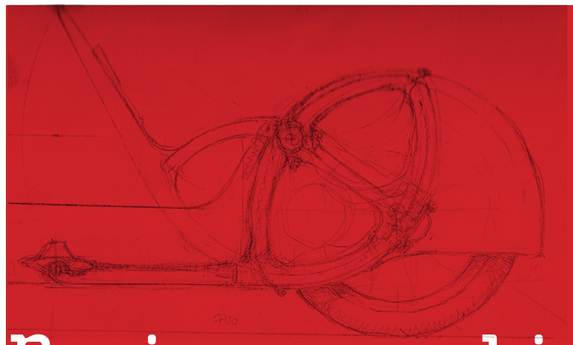
Colnar had to make a forced landing near Sarajevo, because he ran out of fuel and couldn't reach the Rajlovac airport.
In May 1934, Lojze won the air show in Borovo, but the split votes of the jury cost it a well-deserved award. Then came the fatal day of the 24th June 1934, when Colnar attended an air show in Zagreb. Whilst performing a corkscrew turn, he fell into a spin and due to a lack of height he couldn't recover from this in time. The Red Bird crashed and its pilot was killed on the spot.
The accident hurt Bloudek badly and he ceased constructing planes after this point, although he continued to make sketches of various ideas and conducted experiments with models. He was striving for the unattainable: an absolutely safe flying machine. He later employed his aircraft experience in the construction of ski jumping hills which would - in the first place – be safe and yet allowed man to fly – although merely on skis and without the assistance of an engine.

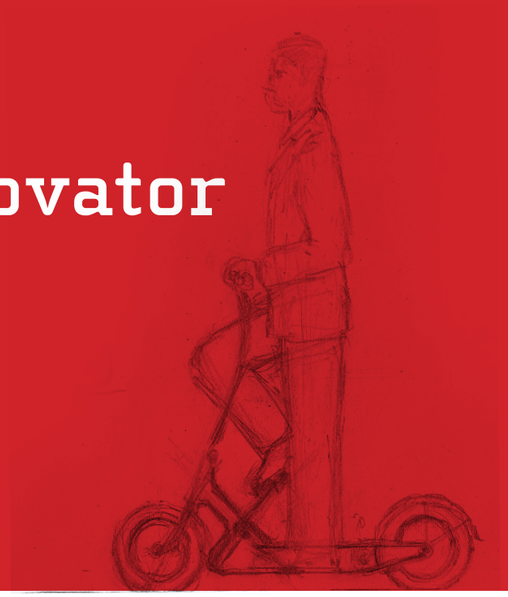
Last 25 years of Bloudek's life

Between 1934-59, following Colnar's plane crash and tragic death, Bloudek continued to work on aircraft ideas and designs. His first priority was safe flying. His records are somewhat similar to those made by Leonardo da Vinci, filled with ideas from other people and his own. Thus, he designed aeroplanes that employed interesting technical achievements from abroad, as well as helicopters whose propeller would – in the events of engine failure – spin using the air stream alone, thus allowing a safe landing. He also designed a jet-propelled helicopter using compressed air, an idea that was finally realised much later. He made models that – to the great enthusiasm of those watching – he tested at the Tivoli Park toboggan run or in the Evropa coffeehouse, in the building where he lived. He spent most of his time working on ideas for aeroplanes aimed at one or more people that would be of simple construction and consequently be affordable, and yet due to imaginative technical solutions would still be competitive with more expensive aeroplanes. This is an issue that still remains as topical as in Bloudek's time.

Bloudek's aircraft design endeavours were interrupted by WWII, during which period, the airplane constructor considered how he could offer technical and innovative support to the partisan fight.
He imagined special partisan combat units flying into action using aircraft similar to modern day hang gliders. The important railway viaduct at Borovnica, near Ljubljana, was heavily protected by the occupying forces and he suggested using pilot-free aircraft (drones) as air torpedoes to destroy the bridge.

Bloudek was fascinated by the achievements of Slovene aviators and the efforts made to establish an aircraft industry (Construction Bureau, Letov-Libis plant), continuing his own efforts from the inter-war period. In Letov-Libis, preparations were well advanced for resuming manufacture of his Libela design, but a fire broke out which destroyed not only the factory but all his schemes.
Recently, there have been efforts made in creating replicas of Bloudek's aircraft and a revival of interest in studying the data dispersed through his surviving documentation.



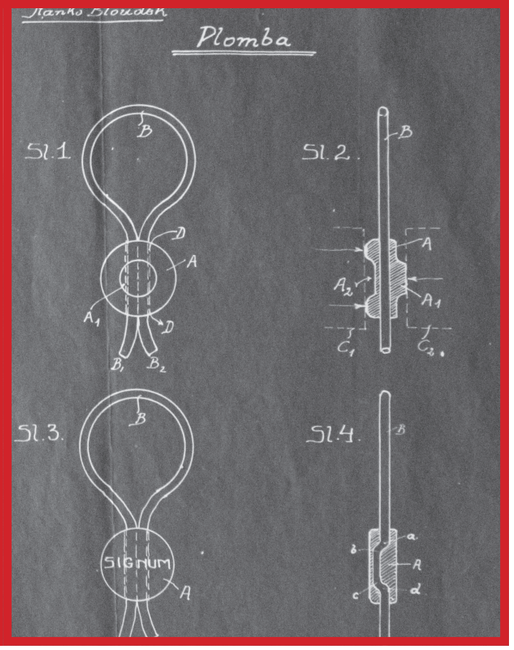


3 _Designer and innovator

Boris Brovinsky, Sandi Sitar

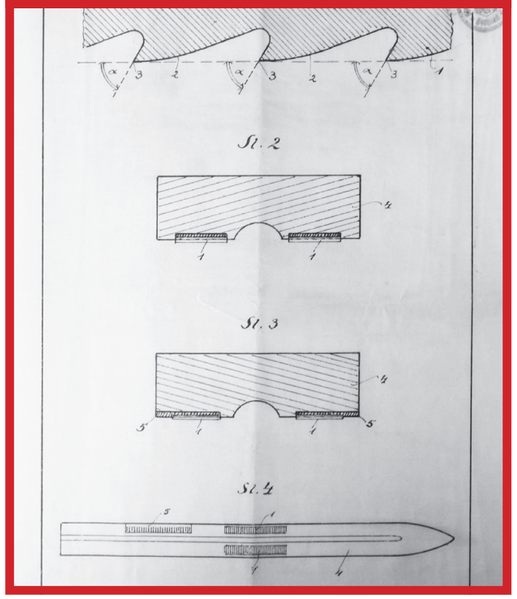
#18

Bloudek's most successful inventions include several solutions for locking wagons against thieves. Technical Museum of Slovenia.



#19

Bloudek's idea for a device to prevent skis from sliding backwards whilst ascending a snowy hill, was complex and never adopted. It was a design similar to the so-called »dogs« - animal-skin straps with the hair pointing backwards, used by skiers for this purpose. Ljubljana Historical Archive, Idrija unit.



Stanko Bloudek became familiar with technical developments and innovations during his childhood years in Idrija; a town dominated by the mercury mine that saw considerable energy, skill and knowledge directed towards its development. Across the centuries, the Idrija mine had acquired many local and foreign experts, in particular from the technically advanced country of Bohemia. The Idrija mine enjoyed well-deserved fame as having the most advanced technology of the metal ore mines in the Austrian-Hungarian Empire, and in a great many aspects it could also stand alongside the best in Europe. As a result, Idrija was a centre for technical and mining engineering expertise and this knowledge - together with the mercury being extracted - was used both locally and well beyond the borders.

As a mining engineer, Stanko's father was particularly responsible for solving technical issues, and as a result, the spirit of innovation was literally within the home of the Bloudek family. This home life led Bloudek to the University in Prague where he enrolled – perhaps surprisingly - for the study of painting, although he soon realised that he wanted to find a different expression for his more inventive ideas and transferred to the Faculty of Technology. Nevertheless, he carried across some of the influence of the art world into his technical studies: so rather than just relying upon established technical practise, he would also listen to intuitive innovation and he often chose experience and common sense over mathematics and physics. 'Do it, try it, do it better' was his life's motto, and one that enabled him to do some very successful work in the first half of the 20th century.

Aviation was his first passion

The aspect of technology that especially attracted Bloudek during his studies of mechanical engineering at the Faculty of Technology in Prague, was aviation, so much so, that this fascination continued all his life. At the time of his studies, aviation was a huge – and particularly for young people – challenging novelty. Development was fast, commencing with the gliding of heavier-than-air craft by Lilienthal in 1891, followed by the first engine-powered flight by the Wright Brothers in 1903.
Bloudek's first models originate from 1906, though his first attempts quite probably started earlier. Due to the fact that he was not familiar enough with the topic or aware of solutions already being discovered, he initially drew his inspiration from nature. Once he acquired information to inspire the design of his first flying-machines, he started to explore suitable technical solutions, and started to fly his aircraft models.

In 1910 he made an exact scale model of Santos-Dumont's small monoplane, the Demoiselle. This was also the way many other future pioneers entered the world of aviation, including the first Slovenian aviator to fly a powered aircraft, Edvard Rusjan, whose Eda V was a full-size copy of the very same French design. Bloudek's version, made about six months later, proved to have a better performance than Rusjan's. After their first replicas, the creative path of both pioneers took their separate ways. Rusjan followed the examples of successful contemporaries, and constructed – in the Gorizia district, with the help of a number of partners and colleagues – seven aircraft in nine months, whereas Bloudek integrated a great many original ideas in his second aircraft and in 1911 designed one of the best small biplanes of the time, and released its manufacture to the industry.

Between 1911 and 1918, Bloudek was a professional aircraft designer, working first with the pioneering Austrian aviation family of Etrich and son, and later in aviation factories that rapidly started to supply military aircraft once war commenced. From 1916 to 1918, Bloudek was chief designer in the large aircraft plant of Ufag in Budapest, where he gained valuable experience – from the gradual improvement of standard products through to the design of ever-more prestigious aircraft – whilst his own development of a helicopter design saw him create a whole new concept for flying machines.
At this time his engagement in the world of aviation – both in terms of quantity as well as intensity of work – far outreached anything he accomplished either before, or after, WWI.

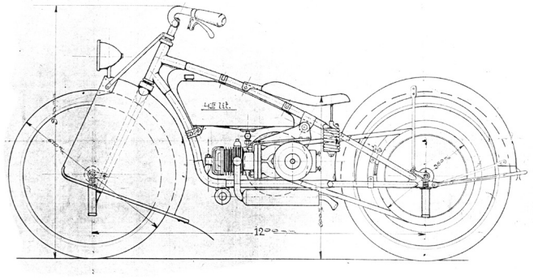
At the end of WWI, Bloudek returned to Ljubljana with the intention of establishing a Slovenian aircraft industry at an improvised military airfield, complete with workshops. While waiting for the realisation of these plans, he was employed between 1919-20 in a car repair workshop, and between 1920-24 he worked in a company that supplied the Zagorje mine with timber. During this period he designed aerial

railways and other devices for the preparation and transportation of timber.
At the same time, he also developed his own workshop facilities, forming a company called Bloudek & Co. in 1923, which gradually grew into a small factory. This specialised in the manufacture of metal objects and Bloudek showed his inventive flair in this business. For example, he produced combs by sawing teeth in metal plates. A small patented invention from early 1920 not only brought him success, but also considerable financial gain. He contributed several solutions for locking wagons against thieves, and his major success was a clip-on-lock which could only be opened with a special key. At the same time he investigated the issue of rail track connections that would prevent vibrations at the joints.

When the idea of the establishment of aircraft industry in Ljubljana failed in 1924 due to the relocation of all the former military workshops inland by the SHS, Bloudek continued his aviation work at the aero club Naša Krila.
However, he only managed to design two aircrafts in the decade following WWI: the first called Sraka (Magpie) was a modern design but weak in its technical execution. It was designed to combine the advantages of a glider with that of a light powered aircraft. The other craft was a double-seat sport plane called Lojze, of a less original design which successfully flew until its tragic crash resulting in the pilot's death in 1934.
Throughout this time and for a while afterwards, Bloudek designed a number of sports grounds and facilities including the Ilirija Sports Baths in Ljubljana which included an Olympic-sized swimming pool and a smaller indoor pool. International regulations didn't leave much room for innovative work in the construction of sport facilities, but he nevertheless made very original designs for a series of auxiliary water heating and cleaning devices for the Ilirija Sports Baths, as well as highly original flood-lighting equipment for the stadium of the same name, which won him a patent.

Skating was one of Bloudek's favourite sports. In order to offer skaters the possibility to practise throughout the year, he was heavily engaged in the design of four-wheel roller skates and in-line roller skates. In his designs he came very close to the solutions which characterise the modern products we all know. Mention should also be made of a very interesting hybrid between a scooter and a bicycle. The vehicle, which resembles scooter, is driven by the driver's feet with the help of alternately oscillating pedals and a

#20
Bloudek's sketch for a motorbike, 1923. Author's archive.



transmission to the rear wheel. The vehicle propulsion method resembles the stepping machines ('Steppers') popularly used today for strengthening leg muscles.

He also tested himself in the world of automobiles

In 1926 the road to the Ljubelj pass – which hosted the largest Austrian rally, the Alpenfahrt, Austrian Alpine Rally, prior to WWI – was again opened to car competitions. On Sunday, 8th August 1926, the Ljubljana Automobile Club organised a rally to Ljubelj. In addition to the time trials, the quality and endurance of the cars and motorcycles were to be awarded points. 25 cars and 9 motorcycles participated, and one of the cars was driven by Bloudek. The rally drew extraordinary attention. Indeed, despite bad weather, including rain and snow at the top, it was also attended by the Yugoslav royal couple with their entourage.
The cars were divided into five categories according to their price, rather than engine capacity. The first category (the cheapest cars) was won by Stanko Bloudek driving a modified Ford car. It is presumed to be one of the very popular Model T's which – thanks to its low price – had "put America on wheels" and which was also one of the most affordable cars in Europe.
The Ford Model T featured a two speed planetary gear, but according to the newspaper Slovenec, Bloudek's Ford had four gears and a water pump. He might have improved it himself and replaced Ford's planetary gear with a classical four speed gear and improved the air-cooled engine by fitting a water pump. The Ljubelj slopes were undoubtedly easier to deal with by driving a car modified in this way.

The following year, Bloudek participated once again in the rally to Ljubelj, this time with a Buick. He was placed third in the fourth category (the most expensive cars, costing up to 175,000 dinars). In addition to competing, Bloudek also participated as part of the technical commission for the event. In this event, in addition to the car competition, a true mountain race was organised that was won by an Austrian, Hansal, who completed a 10-kilometre track in 10 minutes. It is interesting that it took Bloudek and his Buick 35 minutes to cover the same distance, twelve minutes more than in the previous year with his modified Ford from the lowest category. Following 1927, when the races to Ljubelj were discontinued for four years, there is no evidence of Bloudek participating in any other relevant car race, though he still participated in the organisation of competitions. His name can be traced between the sport commissioners and members of a sport committee at the Ljubelj motorcycle race in 1932.

Bloudek certainly didn't cosset his car; he used it to haul a heavy roller in smoothing of tennis courts. A Bloudek design for a motorcycle dating from 1923 features two very interesting characteristics; a leg support at the axis of the front wheel and a leg shield which anticipates the design of roller blades in later years. All this activity with road vehicles inevitably led him into car production ten years later, where he accomplished what he didn't manage in the aircraft industry.

Following WWI, the car was a well-established means of transport. Its mass production didn't pose any major technical or technological obstacles, and thus the car industry paid more attention to improvements, the optimisation of production organisation and the implementation of new technologies.
By the late 1920s, passenger cars were losing the open bodied design with a linen roof above, being replaced by closed cabins of angular shapes. Considerable progress was also being made in the development of car engines which at one litre capacity generated about 20 hp, but which had increased to 30 hp a decade later. New cars with lighter and aerodynamically-designed bodyworks generated higher speeds without having to augment the engine capacity, which in turn contributed to fuel efficiency.

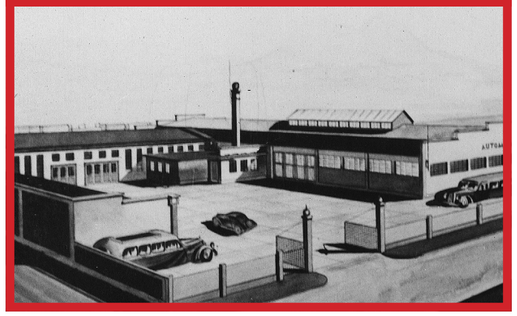
In the manufacture of car bodies the wooden elements were gradually being replaced by metal, whilst the development of new cellulose paints and varnishes and new application techniques of spray painting shortened the drying and finishing times. Screwing and riveting together of the main car components was replaced by electrical welding, which soon became irreplaceable within the car industry. In the period between the two world wars, the classical chassis design of two longitudinal profiles was complemented by other versions which finally led to the self-supporting body where the engine as well as chassis and steering elements are attached directly to the body. Further to this, the mass produced passenger vehicles of the time featured many other solutions that today we can't imagine the modern car without: for example front-wheel drive, hydraulic dampers, hydraulic and power-assisted braking systems, the diesel engine, synchromeshing and automatic gears, individual suspension system

The mass production of complete commercial vehicles is often not cost-effective, and for this reason the larger truck and bus manufacturers usually mass produce only the chassis and engines and some basic models of trucks. The end-users then commission bodywork to suit their own particular requirements from specialised 'coachwork' suppliers.
The manufacture of car bodies has a long tradition within the Slovenian territory dating back to before WWI. At that time, one of the most renowned in the country was the Keršič works in Ljubljana, that manufactured the bodies for passenger cars and buses fitted to pre-supplied chassis with engines.
A number of other coachwork manufacturers were established during the inter-war period, including those of Matija Trlep, Jožef Peterca, Franc Rojina, Matej Fajfar, Albin Kunstler (all from Ljubljana) and Franc Pergler from Maribor, etc. They often remodelled the bodyworks of old passenger cars into delivery vehicles because many entrepreneurs or craftsmen preferred a modified passenger car.
Special mention should also be made of the Ljubljana-based workshop of Jožef Peterca that enjoyed the cooperation of Bloudek.

Bloudek at Automontaža

In 1933, Bloudek joined the Automontaža joint-stock company, and he became part-owner and chief designer. The company also managed the bus service between Ljubljana-Ribnica-Kočevje-Delnice-Sušak and the urban transport system in Sušak.
In addition to trucks and light motor vehicles, the company specialised in the manufacture of buses. Chassis and engines were usually purchased from Henschel, Magirus, Mercedes, Saurer and other distinguished foreign manufacturers who often

#21
The view of the Automontaža plant in Ljubljana, 1936. Ljubljana Historical Archive.



supplied them pre-fitted with the original factory-designed coachwork. Bloudek and his colleagues adapted these schemes to their own domestic circumstances and to the specific requirements of their clients, resulting in more or less original designs.
Bloudek kept abreast of new developments and introduced modern technical production solutions and methods. One of the more significant was the welding of steel bodywork, a technique that found favour in the car industry during the 1930s. Construction of coachwork from pre-fabricated steel profiles was far more cost efficient than building up wooden frames – a technology that had developed from the techniques used in making horse-drawn vehicles. But cost was not the only benefit, because as engines improved and vehicles attained higher speeds, the greater mass and the inherent weakness of wooden frames, particular at the pinned joints, significantly affected their safety and efficiency.

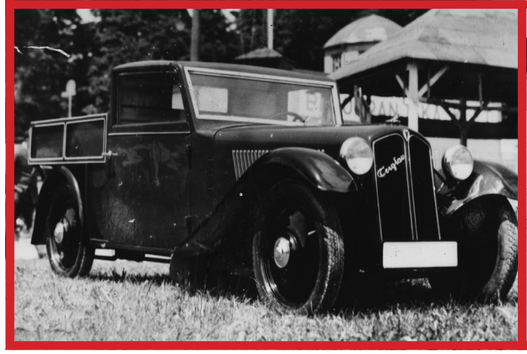
Automontaža products were also distinguished by their design as well as their good construction – functionality was combined with the aesthetic of aerodynamic forms. Bloudek actively followed the transition from angular forms of the 1920s, to the more rounded and aerodynamic shapes which started to dominate air, rail and road design in the 1930s.
With speeds of 100 km/h being attained by cars of the time, wind drag could account for nearly 50 percent of the total resistance. Prior to WWI, some racing cars had been designed to look a bit like airships in an attempt to reduce wind drag. Following the war, a number of aircraft designers – whose prototypes anticipated the future designs for cars – rose to the challenge of developing aerodynamic car bodies. In 1921/22, the Austrian car and aircraft designer Edmund Rumpler, who worked in Germany, designed a teardrop-shaped car body that measured such a low drag coefficient, that it has not been matched by any mass produced car to this day. At the same time, the Austrian aircraft engineer Paul Jaray patented a car design with basic lines that can be recognised in many of the aerodynamic-designed mass-produced cars of the 1930s. Bloudek was familiar with the development and achievements in this field, as testified by the many professional magazines of the period retained in his personal archives.

Bloudek was primarily engaged in the design of bus coachwork. Nevertheless, some material has been preserved from the 1930s showing his ideas for the development and manufacture of simpler and more affordable passenger cars. This was the time when improving life styles enabled many European companies to start developing smaller cars that were affordable to middle-class families. The aspiration of designing a car available to many, followed the example of the American Ford company, which between 1913, when the assembly-line production was organised, and 1927 when the company engaged in production of more contemporary cars, manufactured over 17 million Model 'T' cars. Thanks to this design, several million Americans drove their own car by the late 1920s.
Small, fully enclosed, four-seat limousines with an engine capacity of little over one litre were launched on the European market in the decade prior to the outbreak of WWII. During this period, the number of cars in the Drava Banovina increased from fewer than 1,300 (in 1929) to only 2,300 (in 1938) which was way below the European average, explained by a standard of living that would prevent the acquisition of a car by the majority of the population. Nevertheless, further to his design of heavy vehicles, Bloudek wanted to develop and manufacture passenger cars, and this led in 1934 to his concept of the first Slovenian car – called Triglav – and based upon the design of the German DKW.
The prototype was first shown in April 1934 and was sold to a buyer in Zagreb the very next day. The initial tests were successful and the two-stroke DKW engine consumed only 6 to 6.5 litres of petrol which is a relatively satisfactory consumption rate even today.

Domestic DKW-Triglav

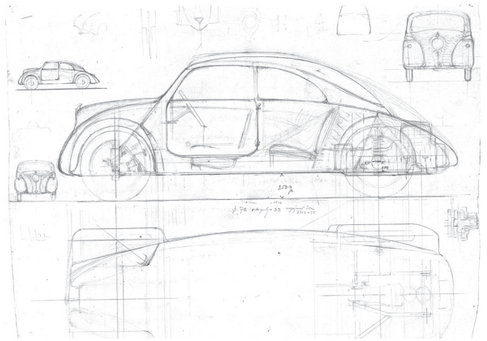
The fact that Bloudek based the development of the first Slovene domestic car on the technology of the German manufacturer DKW was not a coincidence.

#22
Several Triglav vehicles were manufactured at the Ljubljana-based Automontaža plant, including at least one example of a cargo model. In the picture, below left, the man sitting in the car is Automontaža's owner, Salamon Krenter.
During the testing of the Triglav in Jezersko (below right): S. Krenter is second on the right and S. Bloudek is last from the left. Ljubljana Historical Archive.



DKW were one of the world's leading manufacturers of motorcycles before WWII, and they correctly anticipated with the introduction in 1928 of their first car, the attraction of offering to the market an affordable and yet modern vehicle of a simpler, more basic specification. Their experience with two-stroke engines of lower volume and simple, but technologically advanced solutions were most valuable in the manufacture of their cars. Not many people know that DKW was one of the first companies to produce cars with front-wheel drive, which today is the predominant design. In the 1930s, DKW introduced a series of cars marketed with an 'F', as in 'Frontantrieb' (front-wheel drive). The first car, a small DKW F1, attracted considerable attention not only because of the front-wheel drive but also because of the uncomplicated two-stroke engine, the individual suspension system and the lowest price among all contemporary German cars. Of particular interest was its light, but nevertheless rigid body made of plywood coated on the outer side with artificial leather.
Automontaža chose to manufacture a larger, four-seat cabriolet limousine design by DKW with front-wheel drive; a design that in Germany was then selling at 2,500 marks, more than 50 percent more expensive than the smaller F1.
Due to lower production costs, the domestic DKW-Triglav cost over thirty percent less than the imported version. It would have cost even less if it had been mass produced and if some expensive components had been manufactured locally. For the prototype series, only those parts which required a lot of manual work without the employment of special machines or tools were manufactured locally. The car bodies were constructed in the workshop of Matej Fajfar, whilst the upholstery and lacquering was executed in the workshop of the Belantič company. The wooden coachwork was coated with special domestic leather, and the metal parts – including door hardware – were chromed. The cars were assembled at Automontaža.

#23
Bloudek's sketch of a small passenger car with aerodynamically designed coachwork. National Museum of Contemporary History.



Based on surviving photographs of Bloudek's Triglav, the exterior hardly differed from the original DKW model. The lettering 'Triglav' on the radiator grill below the DKW maker's mark in the centre is the only clear sign to differentiate the 'domestic' version of these popular DKWs.

About 50 percent of the first prototype was claimed to have been made from domestically sourced components and Automontaža strove to gradually master the manufacturing of the complete car, which would additionally reduce its retail price. To this end, they started to develop a new engine similar to that supplied by DKW, but with air, rather than water, cooling. Prior to these developments, the initial specification was for all metal parts, including the chassis, drive shafts and suspension to be manufactured locally.
Quite why these ambitious plans for a domestically constructed car were soon abandoned is still not fully understood, though one should not forget that at the time the Slovenian and Yugoslav car market were relatively small, and sales were perhaps not sufficiently strong. Despite this unsuccessful venture with the Triglav, Bloudek continued to develop the idea for a passenger car of Slovenian origin.

Even whilst he was working on the DKW-Triglav, Bloudek – as an aircraft designer – was following articles about the recent developments in aerodynamically-designed coachwork, published in the automotive magazines of the time. The report in Motor Kritik magazine on the car exhibition in Berlin during 1934, gave particular attention to the revolutionary prototype of the Tatra 77, which featured an aerodynamic body, and other revolutionary prototypes which anticipated the future developments. A significant portion of the article was also dedicated to light, small cars.
Bloudek based his sketches for a 'domestic' car on contemporary trends in the design of aerodynamic bodies and the concept of the increasingly popular small cars. His sketches include a smaller passenger car with a concept (engine at the back) and aerodynamic design that emulates the example of the Tatra prototype, and which was very similar to the popular Volkswagen 'Beetle'.
The 'Beetle' is without doubt the most well known European-designed 'folk' or 'people's' car, and a design that was to eventually exceed the American Ford Model T in sales. However, this car was still under development at the time Bloudek was formulating his designs. In the years immediately before war, various designers worked towards developing the 'Beetle', which finally entered mass production almost as the war started, subsequently being modified for military purposes, and then returned to civil use after hostilities ended; by 1979, when production was discontinued, nearly 22 million units had been made.

Bloudek continued to develop his concept of a small car with an aerodynamic body; in part, based upon information he obtained from printed sources, as well as following his own original ideas. He further simplified the body which resulted in a three-wheel version that would make the differential redundant and thereby further reducing the production cost as well as retail price. By stripping away useful, but expensive components, he further improved the aerodynamic design, an approach that betrayed his previous experience as an aircraft designer.

In 1936, Automontaža became a joint-stock company, and Bloudek worked as a designer there until WWII. After nationalisation in 1948, it became a state-owned factory and one of the largest bus coachwork manufacturers in Yugoslavia. Under its new name, Karoserija, it established a partnership and cooperation with the Maribor-based company TAM; a car and motorcycle manufacturer. During this period, Karoserija buses once again featured components from the German Deutz company, who had been its most important supplier prior WWII. The company also reverted back its previous name from Bloudek's time – Automontaža. The company remained in production until 2002. Its bankruptcy saw the end of a motor vehicle company with the longest tradition in the Slovenian territory.

#24
Between 1937, when Automontaža became the Yugoslav representative of the German Magirus-Deutz Company and 1939, the company manufactured about 80 city buses on the chassis of the this supplier (seen in the photo), of which more than half were for Belgrade. Ljubljana Historical Archive.

From aircraft to ski flying

Despite his successful activities in various fields, Bloudek receives the most credit for his pioneering work in the aviation industry and his development of ski jumping into sky flying. In many ways this was a connected and natural process, in which the aircraft was reduced to the very smallest possible dimension – the skis and the ski-jumper's body.
The Swiss theoretician, Straumann and the practitioner, Bloudek have been credited with doing the most work in the development of ski-flying, internationally. As aircraft designers, they both based their work on working out the ballistic (trajectory) together with aerodynamic elements (drag, lift) to determine the length of a jump.
Whereas Straumann adopted the formal limitations of the FIS on the length and height of a jump, Bloudek continually demonstrated that such limitations are not necessary as long as the speed of the jumpers, the height of their jump and the angle of their landing remained within the abilities of these experienced jumpers. Indeed, he argued that their safety depended on the ski jump profile, rather than height or length of jump. In order to get as close as possible to the ideal of a parabolic curve, he added elements to the straight and curved elements of the jump – the so-called 'chlotoids' (parts of a parabola) – and compared and adjusted these additions according to his observations of the jump line, averaging out the results from both the best and the least successful jumpers. In this development stage, by exceeding 120m and even 150m, the jumps transformed into flights. Even in Bloudek's lifetime, it became obvious that these distances would not be the ultimate limit of ski-flying, and now the record ski-flights are approaching close to 250m.
Nevertheless, the theory, experiments and modern computer data processing have not yet agreed to allow the further development of ski jumps to the ultimate limit for top-level, and safe ski flying could far exceed anything seen to date.

Innovation was an integral part of Bloudek's activity throughout his life, and his ability to react to the challenges of the changing environment is perfectly illustrated by the period of WWII, when Bloudek firmly supported the national liberation movement.
He drew schemes for secret bunkers and invented a tricycle with a secret compartment designed for the distribution of illegal printed papers. His other inventions included a sound suppressor for firearms, and sharp-edged pyramids for perforating military vehicle tyres. Special units of the Partisan armed forces could fly to action using aircraft similar to modern hang-gliders and heavily protected enemy premises could be targeted with pilot-free aircraft (drones) that were, in effect, air torpedoes. Due to the need at the time for absolute secrecy, not even Bloudek knew which of these ideas were realised and there are no records whatsoever about any of them.

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C_Objects on the exhibition

Irena Maruši

Diploma of the Organisation Committee of the 7th Winter Olympic Games, Cortina, 1956. Awarded to Stanko Bloudek, member of the International Olympic Committee. Museum of Sport.

Diploma of the Automobile Club of the Kingdom of Serbs, Croats and Slovenes – Ljubljana Section for Stanko Bloudek, winner of the first mountain race to Ljubelj, 8.8.1926. Graphics by Božidar Jakac. Museum of Sport.

Membership card of Stanko Bloudek for the International Olympic Committee, 7th Winter Olympic Games, Cortina, 1956. Museum of Sport.

Membership card of Stanko Bloudek, Slovene Mountaineering Association, 1939. Museum of Sport.

The membership card of Stanko Bloudek for the Skiing Association of Yugoslavia and the Enotnost Skiing Club, Ljubljana, 1955. Museum of Sport.

Planica Commemorative Emblem, 1934-1954, awarded to Stanko Bloudek in 1954 for his work in Planica. Museum of Sport.

Commemorative plaque awarded to Stanko Bloudek for his »effort in the construction of a 60-metre jumping hill in Ljubljana 1954.« Museum of Sport.

Wooden jumping skis with Lato ski bindings used in the 1930s. Museum of Sport.

Discus used by Stanko Bloudek between 1918-1920. Museum of Sport.

Stanko Bloudek death mask by academic sculptor Stojan Babič, 1959. Museum of Sport.

Plaque awarded to Stanko Bloudek, the winner of Ljubelj mountain race, 1928. Ljubljana Historical Archive, Idrija unit.

Model of Bloudek's idea for an aerodynamically designed tourist bus from the late 1930s. Technical Museum of Slovenia.

Model of ski jumping hill in Planica made following Bloudek's design. Technical Museum of Slovenia.

Model of Ilirija Baths, Ljubljana made following Bloudek's designs. Technical Museum of Slovenia.

Empty page from his health card, issued 1956, testifies that Bloudek was anything but a regular visitor to a doctor. Museum of Sport.

Yugoslav passport from 1955 and Czechoslovak passport from 1936. Since 1929 Bloudek had dual citizenship. Museum of Sport.

Model of a four-axle bus designed and made by Stanko Bloudek, first half of 20th century. Technical Museum of Slovenia.

Patent for joining tracks and roller skates. Ljubljana Historical Archive, Idrija unit.

Plaque awarded to Bloudek for his participation at the 1st Sports Week in Ljubljana, 1920. Ljubljana Historical Archive, Idrija unit.

Champion of Yugoslavia in Figure Skating, the plaque Bloudek received as winner, 1927. Ljubljana Historical Archive, Idrija unit.

Commemorative plaque awarded to Bloudek at the Olympic Games in St. Moritz, 1928. Ljubljana Historical Archive, Idrija unit.

Commemorative flag given to Bloudek by the swimmers of Ilirija Club, 1935. Ljubljana Historical Archive, Idrija unit.

Wings of a model aircraft constructed by Bloudek, first half of 20th century. Ljubljana Historical Archive, Idrija unit.

Glasses which are, according to the available information, the only preserved personal item of Stanko Bloudek. Ljubljana Historical Archive, Idrija unit.

Badge of the 5th Olympic Games in St. Moritz, 1948. Ljubljana Historical Archive, Idrija unit.

Model of Bloudek's monoplane Lojze. Technical Museum of Slovenia.

Model of Bloudek's biplane Libela, property of Frenk Svetina.

In preparing the exhibition and catalogue 'The Flying Man, Stanko Bloudek (1890 - 1959)' we discovered that Bloudek's material heritage is dispersed across a number of institutions and private collections.

The material used for project:

Museum of Sport; National Museum of Contemporary History; Archive of Slovenia; Ljubljana Historical Archive; Ljubljana Historical Archive, Idrija unit; Idrija Municipal Museum; Olympic Committee of Slovenia; Sandi Sitar; Technical Museum of Slovenia; City Museum of Ljubljana; Architecture Museum of Ljubljana; Radiotelevizija Slovenije; Slovene Ethnographic Museum

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