



Slovenian Innovators: *From the Workings of the Earth to Travels in Space*

Located in south central Europe and framed by neighbors Italy, Austria, Hungary, Croatia and the Adriatic Sea, Slovenia has a population of two million.



In land mass, compact Slovenia is roughly equivalent in size to the state of New Jersey.

While coming from a modest-sized country, Slovene scientists and transportation pioneers have added many key innovations to the global body of knowledge.

Many Slovenian scientists and other talented individuals have earned international acclaim; this presentation offers a sampling of ten Slovene innovators through the centuries.

Janez Vajkard Valvasor (1641-1693) *Early Slovene Polymath and Inventor*

Baron Janez Vajkard Valvasor was born in 1641 in Ljubljana.

Graduating from a Jesuit school in 1658 at the age of seventeen, he did not choose to continue his studies at a university but decided instead to broaden his horizons on a 14-year journey across Europe and northern Africa.



Valvasor is considered the founder of scientific literature on Slovenian territory.

His fundamental work is the 15-volume *The Glory of the Duchy of Carniola*, finished in 1689 – the work is a rich encyclopedia on the land and history of the Slovenian people.

In his work, Valvasor included numerous inventions, designs and descriptions which were far beyond their time, such as advances in

tunnel design, new methods of casting sculpture, and presentations of the first maps of Slovenia and neighboring territories.

Valvasor's hydrological research on Lake Cerknica (pictured here in a winter scene) won him the membership of the Royal Society in London and established Valvasor as a pioneer in the study of karst landforms phenomena.

Valvasor died in 1693 in Krško, Slovenia.



Jurij Vega (Veha in Slovene)(1754-1802) *Ballistics expert, and logarithm tables author*

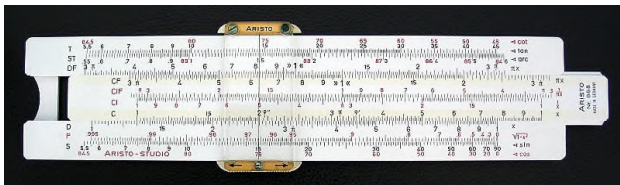
Jurij Vega was born in the village of Zagorica in Slovenia (then part of Austria)



After completing school in Ljubljana, he became a navigational engineer. Vega entered military service in 1780 as Professor at the Artillery School in Vienna. Vega served in the Austrian army against the Turks at Belgrade and his innovative command of mortar batteries contributed considerably to the fall of the Belgrade fortress.

In 1795, he designed new 30-pound mortars, with conically drilled bases and a greater charge, with a firing range up to 3,300 yards (the old mortars had a range of only 2,000 yards).

Vega's major contributions were in mathematics; he published books of logarithm tables in 1783 and 1797. Logarithms formed the basis of slide rule calculation devices (pictured here) which were used for more 200 years until the onset of handheld electronic calculators in the late 20th century.



Vega achieved a world record in 1797 when he calculated pi to 140 places; his record stood for 52 years and his method is still cited today.

Vega was a member of the Bohemian Scientific Society in Prague and the Prussian Academy of Sciences in Berlin and was awarded the Order of Maria Theresa in 1796. In 1802, Vega died near Vienna.

Jožek Stefan (1835-1893) *Physicist and light radiation pioneer*

Born near Celovec (now Klagenfurt, Austria), Jozek Stefan graduated in mathematics and physics at the University of Vienna.

He taught physics at the University of Vienna and was Director of the Physical Institute there.

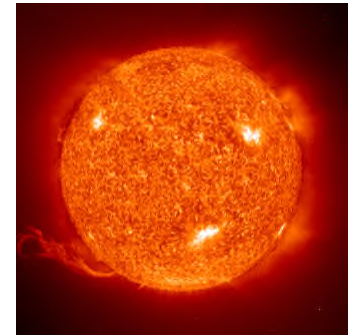


In 1879, Stefan discovered the law of light radiation, which is now called Stefan's Law, which relates the total radiation from a black body to the 4th power of its absolute temperature. This law is the only physical law of nature named after a Slovene physicist.

With his law, Stefan determined the temperature of the Sun's surface and he calculated a value of 5430 °C. This was the first accurate of the temperature of the Sun.

Stefan also provided the first measurements of the thermal conductivity of gases. For a treatise on optics, he received the Richard Lieben Award from the University of Vienna.

Very important are also Stefan's work with electromagnetic equations, defined in vector notation, and works in the kinetic theory of heat.



Stefan also researched a phenomenon called the *skin effect*, where high-frequency electric current is greater on the surface of a conductor than in its interior. After suffering a stroke, Stefan died in Vienna in 1893.

Peter Kozler (1824-1879) *Cartographer and manufacturer*

Peter Kozler (or Kosler) was born in Koče, a village in what was then the Austrian and is now Slovenia. Kozler was lawyer, geographer, cartographer, and manufacturer. He made a fortune with beer manufacturing and was the founder of the Union Brewery in Ljubljana.





Kozler is most famous for creating the first map of Slovene Lands, called *Zemljevid Slovenske dežele in pokrajin* ("A map of the Slovene Land and Regions"), regarded as the first geography atlas using exclusively Slovenian toponyms (replica seen here).

Kozler died in Ljubljana in 1879. His former home that city's Tivoli Park is now a major ethnographic and history museum.

Edvard Rusjan (1886-1911) *Fearless Slovene Aviation Pioneer*

Edvard Rusjan was born in 1886 to a Slovene father and a Italian mother in Trieste, now a part of Italy but then a part of the Hapsburg Empire.

Rusjan, referred to as the *Slovenian Icarus*, is considered one of the twelve most famous aviators in the world.



In 1909, Rusjan became the first Slovene to achieve motor-powered flight in an aeroplane and was also the first to design, construct and fly an aeroplane in Central Europe. Working with his brother, the Rusjan brothers built and flew monoplanes, biplanes and triplanes (the EDA III in the photo here was an example of their bi-planes).



The machines were constructed by the Rusjan family – the brothers worked on designs and construction, their sister sewed the canvas, and their father provided financial support.

Edvard started flying at air shows. In 1911, the Rusjan brothers went on a promotional tour across the Balkans.

At an air show in Belgrade on a very windy day, Rusjan flew despite warnings and his plane crashed at the Kalemegdan fortress. He died en route to a hospital; he was 26. Fourteen thousand people attended Rusjan's funeral in Belgrade and he remains a legend of Slovenian aviation.

Herman Potočnik Noordung (1892 – 1929)

Rocket engineer and space travel visionary

Herman Potočnik was born in 1892 in Pula, then part of **Austria** (now in **Croatia**). His family originated from **Slovenj Gradec** and **Vitanje**, both in **Slovenia**.

Potočnik attended primary school in Maribor and afterward he went to the military secondary schools in Fischau and Hranice in Moravia.

He studied at the technical military academy in Mödling near Vienna and graduated as an engineer's second lieutenant in the Austrian army, specializing in railways and bridges.



Released from the military in 1917, he studied electrical engineering at the University of Technology in Vienna.

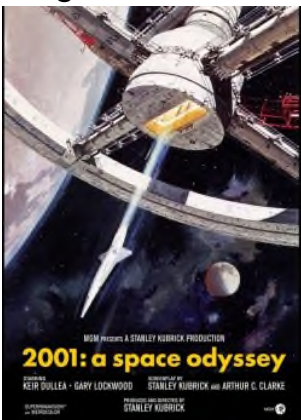
After being awarded a doctorate in engineering, he specialized in rocketry, devoting himself entirely to the problems of a rocket science and space technology.

In 1928, he published a remarkable book, *Das Problem der Befahrung des Weltraums - der Raketen-Motor* (*The Problem of Space Travel - The Rocket Motor*) in Berlin. In the book, Potočnik outlined detailed plans for space travel.

He conceived a space station design and was the first to calculate the geostationary orbit, on which the station would orbit the Earth.

Potočnik described the use of orbiting spacecraft for detailed observation of the ground and explained how the special conditions of space could be useful for scientific experiments.

A partial translation of the book into English was made in 1929 for the American magazine *Science Wonder Stories*. The full text was translated into Russian in early 1935 and into English, by NASA, in 1999.



Potočnik's wheel-shaped space station served as an inspiration for further development by Wernher von Braun in 1953. In 1968, Stanley Kubrick's ground-breaking film, *2001: A Space Odyssey*, depicted such a role for the wheel-shaped "Space Station V".

The geo-stationary satellite and the manned space station are two of the most well-known of Potočnik's ideas which have been

developed decades after his death. In his book, Potočnik also gave practical instructions for life in a weightless state: the space suit, specialized writing instruments, and adapted bottles for drinking among them.

Potočnik fought tuberculosis and died of pneumonia in 1929 at the age of 36.

Friderik “Fritz” Pregl (1869 –1930) *Nobel Prize Laureate and Micro-analytic Chemist*

Friderik Pregl was born in Ljubljana, in part of Austria, in 1869. Pregl started his career as a physician after he studied medicine at the University of Graz.



Pregl began working on the modernization of organic microanalysis in 1909, when he faced problems because the samples used in studying the composition of bile acids were too small.

Because his enthusiasm for research led him into learning certain skills (glassblowing, carpentry, locksmithing), he was able to resolve scale problems with new instruments.

As a result of his research, he lowered the minimum of substance necessary for analysis by a factor of 50 and his methods were soon widely adopted.



Pregl won the Nobel Prize in Chemistry in 1923 for his important contributions to quantitative organic microanalysis, the first Slovenian to earn that award. Pregl died in 1930 in Graz.

Johann Puch (1862–1914) *A Mechanical Wizard Who Became Central Europe’s Henry Ford*



Johann Puch (in Slovene – *Janez Puh*) was born in 1862 in Juršinci close to Ptuj, then part of Austria and now in Slovenia.

His only formal education was as a locksmith – but the Slovene inventor and mechanic went on to become a one of the most significant vehicle producers in Europe.

Johann Puch first produced bicycles in 1889 in a small workshop in Graz. Ten years later he founded his company, "*Erste Steiermärkische Fahrradfabrik AG*" (en: "First Styrian Bicycle AG"). Puch's company became successful through innovation and quality handicraft, rapidly expanding over time and it soon began producing motorcycles, mopeds, and larger vehicles. A new main production plant was constructed in the south of Graz and the production of engines was started in 1901, motorcycles in 1903, and cars in 1904.



Puch's motorcycles and cars were successful in races and rallies all over Europe. In 1909, a Puch car broke the world speed record, reaching 130.4 km/hr (79.5 mph).

By 1912, Puch's factory employed 1,100 workers and manufactured 300 cars, 300 motorcycles and 16,000 bicycles per year.

By 1914, the Puch company developed 21 different types of cars, as well as trucks, buses and specialized vehicles, including limousines for the Imperial Habsburg family and military vehicles.

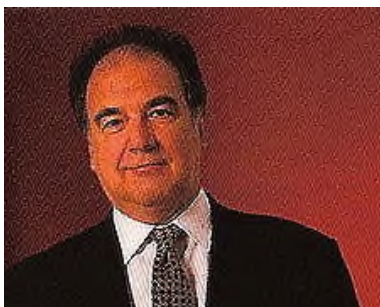


The Puch transportation tradition was continued by the Steyr-Daimler-Puch company in Graz and Vienna. A consummate inventor, Puch obtained more than 35 patents in his lifetime. He died in Zagreb, now in Croatia, in 1914.

Richard C. Fuisz, M.D. (1939-)

Pharmaceutical Innovator Born to American Immigrants

Richard Fuisz was born to Slovenian immigrants in Bethlehem, PA in 1939 and later graduated from Georgetown University Medical School. After serving as a Lt. Commander in the U.S. Navy, Fuisz founded a series of medical equipment and pharmaceutical firms, including Medcom and Fuisz Technologies.



Fuisz now holds more than 200 patents, including 90 U.S. technology patents. Among his achievements, he pioneered quick release drugs, created new encapsulation technologies for taste-masking and for timed release of medications, and designed remotely-adjustable stent technologies. Boasting widely-varied talents, Fuisz was also awarded e-commerce and electronic mail software patents, created a successful modeling agency, enjoyed a brief acting career, and worked in Midwest diplomacy.

Martin Strel (1954-) *Ultra Swim Marathoner, Bridging Nations*

Martin Strel was born in Slovenia in 1954. He taught himself to swim when he was 6 in a stream near his home and became a professional marathon swimmer in 1978. Breaking a series of his own distance records, including the Danube, Yankzhe, and Mississippi, Strel's career culminated with his Amazon River marathon in 2007, in which Strel swam more than 3,200 miles in just 66 days.



Strel continues his work today behind a microphone as much as in the water, focusing on building international cooperation to improve water quality and build a greater environmental consciousness amongst nations.



Sources and Credits:

Edward Gobetz, Slovenian Heritage Vol. 1, Willoughby Hills, OH, 1980

<http://www.martinstrel.com> – Martin Strel website

<http://www.johann-puch-museum-graz.com/> - Johann Puch Museum website

<http://www.edvard-rusjan.it> - Edvard Rusjan website

<http://kt.ijs.si/> - Josef Stefan Institute website

Republic of Slovenia Public Relations and Media Office, Facts about Slovenia, Ljubljana, Slovenia, 2000

www.Slovenia.si – Gateway to Information about Slovenia

Wikipedia – On-line Encyclopedia

<http://www.everyculture.com/multi/Pa-Sp/Slovenian-Americans.html> - Edward Gobetz online article
