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Forefathers of Modern Rocketry: Part 2

By Bart Hennin

This is part two of the article of the "Forefathers of Modern Rocketry." In the first installment (www.ApogeeRockets.com/Education/Downloads/Newsletter307.pdf), we took a look at the first three men that had such a great influence on rocketry: Konstantin Tsiolkovsky, Robbert Goddard, and Hermann Oberth.

Next we'll meet the man who took rocketry from farm fields to interplanetary spaceflight in a single generation! He would be forced to work for the devil himself but ultimately escape the devil's grasp and bring men to the Moon! This man was at once an idealistic dreamer, a realistic thinker, a gifted genius, and a persuasive charmer. As a highly skilled, disciplined and self taught rocket engineer, he would live to see both evil men at their worst and good men at their best.

Wernher von Braun

This man was undoubtedly controversial but undisputedly brilliant. We're talking of course about Wernher von Braun.

Wernher von Braun

March 23, 1912 - June 16, 1977

We will pick up the story with Fred Schneikert.

.....Pfc Fred Schneikert of Sheboygan Wisconsin was a long ways from home. On this day, Private Schneikert was laying in a ditch. The ditch lay somewhere near Reutte. As a soldier of the U.S. 324th Regiment Anti-Tank Company (44th Division), Fred's duty today was to lie in this ditch flanked by his fellow infantrymen. This is what the army called sentry duty.

Presently Schneikert and company were witnessing a curious sight. A lone civilian on bicycle was coming towards their position. The group saw a white handkerchief tied to the bike's handlebars. Still, with Hitler dead, and the remnants of the Third Reich collapsing all around (and with all the chaos that implied), one couldn't be too careful.

Officially, Scheikert was by no means an interpreter. However, Sheboygan, Wisconsin had a high proportion of German ethnicity and as such, he had picked up a bit of the native language.

As the mysterious cyclist peddled closer, Pfc Fred Schneikert reacted. Leveling his M-1 rifle directly at the cyclist's chest, he barked "Halt! Komme vorwarts mit die Hände hoch! The man on the bicycle obeyed coming towards Pfc Schneikert as commanded. What this lone civilian said next sounded insane. In broken English the man blurted out, "My name is Magnus von Braun. My brother invented the V-2. We want to surrender!" The men of 44th division were understandably skeptical. Surely this was a desperate ruse by a hungry civilian refugee looking to get some special treatment.

After some further conversation in which this strange man continued to insist that he was brother to the legendary rocket scientist, Wernher von Braun, Fred Schneikert replied, "I think you're nuts, but we'll investigate." And investigate they did.

Schneikert dutifully turned the matter over to his commanding officer, First Lieutenant Charles L. Stewart. At first, Stewart mistakenly thought that Magnus was trying to sell his brother and fellow German rocket scientists to the Americans. However, after extensive interrogation that lasted throughout the night, it became clear that this man was claiming that the cream of German rocket scientists was nearby and ready to unconditionally surrender to the USA!

A plan was negotiated. Magnus would return to his brother with 6 car passes to fetch the von Braun team and bring them directly to the Americans. The cars loaded with scientists arrived at early dawn the next day (hidden technical papers and rocket parts were also later also recovered).

Having led his team for many days and weeks away from the Russians (who were showing no mercy to the Germans) and towards the Americans, Von Braun had finally succeeded in his latest quest. He brought his team of top German rocket scientists into American hands. He still had

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dreams of going to the Moon!

The Rocket Dreamer

Wernher von Braun was born in Wirsitz Germany to an aristocratic family. As a youngster, Wernher became interested in astronomy when his mother gave him a telescope as a gift.

At the precocious age of 12 (inspired by speed records of the new rocket propelled cars of the day) young von Braun attached some fireworks to a toy wagon and set them off. The mobile detonating pyrotechnics caused a major disruption along a crowded Berlin street. von Braun was consequently taken into custody by the local police and his father had to come fetch him.

At an early age, von Braun became an accomplished amateur musician playing both the cello and the piano. Able to play Beethoven and Bach from memory, Wernher's original goal in life was to become a composer. He even wrote several youthful compositions that are said to be reminiscent of Hindemithís style.

Ironically, when Wernher started boarding school in 1925, he did not do well in physics and math! A few years later, some events would dramatically change Wernher's direction in life.

First in 1929, he acquired a copy of Hermann Oberth's book *By Rocket into Interplanetary Space.* Space travel had always fascinated Von Braun and this book seemed to say that it was actually possible! Von Braun then re-applied himself to physics and math such that he could pursue a new field that barely existed at the time...'rocket engineering'!

He also at this time joined the Vfr, the German based "Spaceflight Society" (while attending the Technical University Of Berlin). As mentioned in our last installment, Von Braun got to assist his idol Oberth in 1929 with the successful test firing of a liquid fuel rocket engine.

When the Nazi regime came to power in 1933, rockets became a priority and the Vfr received a considerable boost in research support. Von Braun received his doctorate in rocketry in 1934. Only part of his thesis was made public, and was titled *"About Combustion Tests".* His FULL thesis, titled *"Construction, Theoretical, and Experimental Solution to the Problem of the Liquid Propellant Rocket"* was classified.

At about this time, Germany (and specifically von Braun) became highly interested in the work of Robert

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Goddard. In fact, von Braun (having acquired several of Goddard's technical journals) incorporated some of the US rocket scientist's ideas and plans into the *Aggregate*, the name given to the initial series of liquid fueled rockets being developed under a German army research program. These series of rockets were produced and tested in 3 variants from 1933 -1939: the A-1, the A-2, and the A-3 (the final variant, the A-4, would come some years later and be renamed the Vengeance weapon 2 or V-2).

In 1944, V-2 rockets started hitting England. Von Braun was reported to have commented, "The rocket worked perfectly, we just hit the wrong planet". This was an inference that von Braun's primary goal had always been to go to the Moon.

There has been much controversial historical debate about whether Wernher Von Braun was an 'innocent' idealist caught up in events he could not control, or a shrewd opportunist who was willing to sell his soul to pursue his work. The truth likely lies somewhere in between the two extremes and may never be fully known. However, it seems plausible that although von Braun was patriotic to his home country Germany, he was apolitical and likely anti-Nazi, or at the very least, certainly NOT pro-Nazi.

Granted, he was a member of the Nazi party, but this was a requirement with which he apparently had little choice. Failure to join the party would mean he would be barred from working. Von Braun's own claim that his involvement with the 'party' was minimal and nonpolitical in nature seems to jive with historical facts.

Also by von Braun's own admission, when the first V-2's fell on Britain, people at the Peenemünde plant cheered. But this was the simple survival instinct of a people whose country was at war. They were fighting not for Nazism but for the preservation of their homeland, Germany. They hadn't been privy to how badly the war was going for the Reich at this point.

Once the futility of the war became apparent, their (and particularly von Braun's) priority became one of how to best save the important rocketry work done at Peenemünde for the benefit of the world.

As for the slave labor the German SS had employed at the Peenemünde factory, apparently von Braun had no choice. So extreme was the SS that any significant protest from von Braun would have likely resulted in his being immediately shot on the spot. The one time he did strike a conversation with an SS guard to politely protest the treatment of camp workers, he was told with unmistakable harshness that he should mind his own business, or find himself in the same striped fatigues!

Wernher von Braun's arrest by the Gestapo seems to bear out that such threats were not at all idle in the least (the Gestapo arrest resulted when someone overheard von Braun talking of going to the Moon). He was subsequently released only after much persuasion and pleading

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by General Major Dr. Walter Robert Dornberger (the army officer in charge of the German rocket program and von Braun's boss) that von Braun was indispensable to the V-2 program.

Surrendering to the Americans

By the spring of 1945 it was becoming obvious to the rocket team that the war was lost. The Russians were only about 100 miles away and closing. Wernher and his team had been ordered to Berlin (on the pretense of regrouping for a rocket based counterstrike, but in reality the team was to be executed to deny the enemy any benefit of German rocket research). Von Braun was sure he and his team faced death if they went to Berlin and their prospects with the Russians weren't much better. Surrendering to the French or British was also likely to land them (justly or unjustly) in a war crimes court. After all, those countries had taken the brunt of Germany's V-2 rocket attacks (and in fact von Braun's boss General Major Dornberger would face war crime charges in Britain but would ultimately be acquitted). With Russia, France and Britain out, that left the Americans.

In Von Braun's own words...

> *"We knew that we had created a new means of warfare, and the question as to what nation, to what victorious nation we were willing to entrust this brainchild of ours was a moral decision more than anything else. We wanted to see the world spared another conflict such as Germany had just been through, and we felt that only by surrendering such a weapon to people who are guided by the Bible could such an assurance to the world be best secured."*

Von Braun discussed the options with his team and they concurred that surrender to the Americans was the best option. Wernher had his team gather up all the technical papers they could and arranged to have them stashed in an abandoned mine shaft (for later retrieval). The team then spent weeks traveling and evading both falling allied bombs and German authorities as they moved west towards the American lines. Along the way, they acquired needed food using phony supply requisitions at army supply posts.

Von Braun himself was traveling with a broken arm in a cast (the previous March von Braun's driver fell asleep at the wheel leaving the car to careen down an embankment resulting in von Braun's arm fracture). At von Braun's insistence, the cast was applied hastily and later his arm had to be re-broken and casted to heal properly.

Upon their eventual successful surrender to the Americans, the team found themselves in a temporary limbo as intelligence agencies decided how best to handle this situation. It is said that at one point during the team's initial interrogation where the group of German rocket scientists found themselves peppered with questions about rocketry, one of the team members replied in bewilderment, *"We were only expanding on the work of the American scientist Robert Goddard, why haven't you asked him about rocketry?"*

Interestingly, after further interrogation, von Braun's boss General Major Dr. Dornberger was deemed of no practical use by the American intelligence officers and he was unceremoniously turned over to the British to face trial for war crimes. Ironically, as mentioned, he was acquitted. It became apparent during the trial that he had no input on the positioning or launching of the V-2's.

Prior to the von Braun team's surrender, operation "Paperclip" had been created by the OSS (Office Of Strategic Services - the precursor to the CIA) to recruit German rocket (and other) scientists for employment in the USA

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(and deny them to the USSR). Under this operation, false employment histories and false political biographies were created for the scientists to circumvent President Truman's anti-Nazi order (which would have barred the scientists entry into the U.S.) and also keep any public outcry from occurring.

In June of 1945 von Braun and his team began the move to the United States and went to work for the U.S. Army. At just 26 years old Von Braun had thousands of engineers answering to him. A number of V-2's were tested and the German team instructed US technicians on the intricacies of operating rockets. However it was a frustrating time for von Braun as every 'new' rocket he proposed was turned down.

Working In America

With the outbreak of the Korean War in 1950, things changed. Von Braun was assigned to lead the U.S. Army's rocket development team at the Redstone arsenal in Huntsville, Alabama. From 1950-1956, under von Braun's direction, the Redstone rocket was developed and used for the first U.S. 'live' nuclear ballistic missile tests, which in turn led to the development of a high-precision inertial guidance system for the Redstone. Von Braun's team then developed the Jupiter-C, a modified, more powerful version of the Redstone rocket.

Still, the U.S. rocket program was in a low priority status (unlike the USSR where as we shall see shortly, rocketry was set as a high priority). The U.S.'s relative complacency would change abruptly in October 1957 with the Russian launch of 'Sputnik', the world's 1st artificial satellite.

Anyone on the globe with a HAM radio set could listen in on the "beep-beep-beep" of the silver ball as it flew overhead. The American public and much of the world's public interpreted this event as a signal that U.S. technology had become second rate to that of the USSR. In fact the opposite was true... Russian rockets of the time were bigger out of the necessity to launch larger warheads (to compensate for the much lower accuracy of their less advanced guidance systems technology).

U.S. rockets, with their technologically superior high-precision inertial guidance systems had much greater aiming accuracy than their less technologically advanced Russian counterparts. Thus American nuclear warheads could be much smaller than their Russian counterparts and do the same damage. Consequently, U.S. boosters being developed at this time were smaller than Russian boosters.

In fact, von Braun's Jupiter-C had the power to launch a satellite into orbit. Ironically, a little more than a year BEFORE the launch of Sputnik, the Jupiter-C had been tested (on Sept. 20th, 1956) but it's fourth stage was purposely disabled (filled with sand) on the order of the U.S. president for fear of 'provoking' the U.S.S.R. Had the fourth stage been active, the US would have been credited with having the world's first ICBM and artificial satellite.

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However, in the 1950's, all of this technology was classified and so the public perception became the reality. The U.S. needed to get its own artificial satellite up fast! Von Braun and his team wanted to now go ahead and use a Jupiter-C booster to get a US satellite to orbit ASAP. However, the U.S. Navy already had a satellite-launching project underway and planned on using their Vanguard rocket as the booster instead. Vanguard was given the go ahead.

When the Navy launch was attempted on December 6, 1957, their Vanguard rocket lost thrust about 2 seconds after launch and collapsed upon itself in a great exploding fireball. The spectacular and embarrassing failure was exacerbated when the press referred to the failed US satellite as 'Caputnik', and 'Stay-put-nik'.

Von Braun and team were quietly given the go ahead and on January 31st, 1958 Explorer 1, the first U.S. satellite, was successfully placed into Earth orbit atop a rocket called Juno-I (a Jupiter-C with a now functioning 4th stage). Incidentally, some years later, it would be a modified Redstone rocket that would carry Alan Shepard on the first U.S. manned sub-orbital rocket flight in 1961.

NASA was formed on July 29th, 1958 and was to be the civilian agency charged with carrying out the U.S. space program. Von Braun and his team were transferred to NASA's Marshall Spaceflight Center in 1960 and their first task was to develop a series of rockets designated "Saturn" which would carry heavy payloads to Earth orbit and beyond. This development would take place while project Mercury (and later project Gemini) proceeded.

von Braun explains the Saturn Launch System to President John F. Kennedy.

With President Kennedy's infamous call to land a man on the Moon before decade's end, the development of the Saturn rockets were fully committed to.

The Saturn development project resulted in the creation of the large Saturn 1b (essentially a bundle of Redstone rocket tanks surrounding a larger Jupiter C tank forming the 1st stage) to carry heavy loads to orbit Earth, and the gargantuan Saturn V (which would carry much larger loads beyond Earth's orbit and ultimately carry men to the Moon and fulfill von Braun's life long dream!).

In 1972, Braun left NASA and went to work for Fairchild Industries, an aerospace company in Maryland. Despite deteriorating health, von Braun continued to work as much as possible and also accepted speaking engagements. In 1975, he helped establish and promote the National Space Institute (now the National Space Society) and became its first chairman. Failing health forced him to retire from

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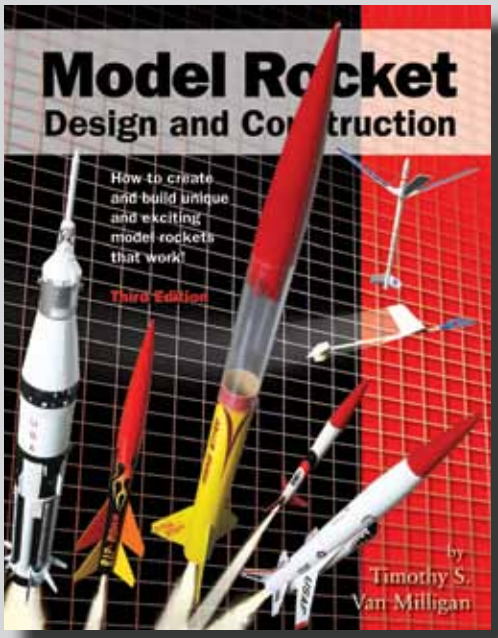

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Fairchild in 1976.

Like the other men of vision we've met, Wernher von Braun viewed mankind's future with great optimism, stating, "I have learned to use the word 'impossible' with great caution."

Finally we meet a great man who could be considered Von Braun's nemesis...

This man would be the one who would give the U.S. Space Program plenty of competition. And he would be so mysterious, that for years the West would not even know his name! He would only be known as "the chief designer" or "Chief". This man, brilliant in his own right, is Sergei Pavlovich Korolev.

Sergei Pavlovich Korolev

Born in Zhytomyr in the Volhynian Governate of the Russian Empire (presently Ukraine), Sergei Korolev grew up a lonely child with few friends. He did however prove to be a good student with an exceptional talent in mathematics.

Sergei's parents separated when he was only 3 years old, and he was raised by his maternal grandparents (his mother was away attending school). At age 6, Sergei's mother remarried an electrical engineer who turned out to have a good influence on the boy.

In 1913, young Sergei got to see an air show and was fascinated. Out of this grew Sergei's strong early interest in aeronautical engineering. He made an independent study of "flight theory" and also worked at the local glider club.

As a pre-teen child, Sergei saw his country go through some tumultuous times with the end of WW1 being followed by the Russian Revolution and Civil War. Although the Bolsheviks officially took power in October 1917 (so called "Red October"), there were continued power struggles and disputes through 1918-1920.

Sergei Pavlovich Korolev: January 12, 1907 - January 14, 1966

During this period, schools were closed and so young Sergei had to continue his studies at home. Food shortages were common for the family as well as for much of the nation. To top off these misfortunes, Sergei suffered a battle with typhus in 1919.

Continuing to follow his interest in aviation, Sergei joined the Society of Aviation and Aerial Navigation of Ukraine and the Crimea (OAVUK) in 1923 where he received one flying lesson and was able to fly as passenger many times. While at the OAVUK, Sergei designed a glider called the K-5, which the society accepted for construction! About this time Sergei also pursued gymnastics and became an accomplished gymnast.

In 1924 he entered the Kiev Polytechnic Institute, which had an aviation branch. He took many technical courses, which he paid for by working odd jobs. In 1925 he was accepted into a limited class on glider construction, which included working on an actual training glider. To Sergei's delight he was allowed to fly the trainer, but unfortunately this left him with two broken ribs.

From 1926-1929 Sergei attended Bauman Moscow State University (MVTU) where in addition to his aviation studies, a delighted young Korolev was permitted to fly gliders and powered airplanes!

In 1929, the Communist government, desperate for engineers to meet unfilled demand, offered a shortcut to graduation. If Korolev could complete the design of a practical aircraft and have it approved by year's end, he would

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be awarded his diploma. His adviser happened to be the legendary Andrei Tupolev!

Thus graduated, Sergei went to work for the nondescript OP-4 design bureau. He didn't initially stand out but in addition to this work he also pursued a pair of personal design projects of which one was the design of a glider capable of doing aerobatics. By 1930, Korolev was the lead engineer working on the Tupolev TB-3 heavy bomber. It was also in this year that Korolev was able to obtain his own pilot's license.

1930 was a landmark year for another reason. This marked the point where Sergei Korolev became interested in liquid fueled rockets. Where others saw the potential usefulness of these reactive devices as a means to make space travel a reality, Sergei saw them as potential power sources for airplanes.

In 1931, Korolev, working in partnership with Friedrich Zander (a space enthusiast), helped found the Group for the Study of Reactive Motion (GIRD). This was one of the earliest state sponsored rocket development centers in the USSR and Korolev became its appointed chief in 1932. This coincided with a rising military interest in the new rocket technology and correspondingly, funding was raised. Thus in March of 1933, the group accomplished the first launch (in the USSR) of a liquid-fueled rocket, called GIRD-X.

This same year, GIRD was merged with the Gas Dynamics Laboratory (GDL) in Leningrad to become the Jet Propulsion Research Institute (GNII) and Korolev was appointed Deputy Chief. He led the development of cruise missiles and rocket-powered gliders. Within two years Sergei was promoted to Chief of the GDL. The center developed gyroscopic systems that could guide a rocket along a programmed trajectory.

Although Korolev was a competent engineer, his true strength lay in his ability to manage people and projects. He was a hard driving yet charismatic man who used a disciplinary style of management. He was also meticulous about detail and closely monitored all key stages of every program personally.

Stalin's Great Purge from 1936-1938 resulted in Korolev being arrested on June 22, 1938 (he was falsely denounced by colleagues). Following a torture extracted confession, he was sentenced to 10 years in prison. Appeals were sent to no avail. Sergei ended up in a Gulag camp working in a gold mine under brutal conditions.

In 1939 he was recalled to Moscow for an appeals

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trial (Sergei had now lost most of his teeth and sustained multiple injuries from the Gulag's horrendous treatment). His sentence was reduced by 2 years and he was assigned to an 'intellectual prison' (essentially a slave labor camp for scientists and engineers who were assigned "projects" by Communist leaders). Here he remained in complete isolation from his family and in constant fear of execution for military secrets he possessed, until June 27th 1944 when he (and others) were released under a special government decree.

Stalin's Purge set his country back in numerous ways. For example, the military no longer had many competent experienced officers left (contributing in no small measure to Nazi Germany's initial rapid success when they invaded in June of 1941). Further, the USSR rocketry program was completely stalled and set back for years while Germany was now making rapid progress with Von Braun and his V-2.

Upon his release, Korolev went back to work at the design bureau. In 1945 he was awarded the Badge of Honor for his previous work on rocket motors for military aircraft, and was also inducted into the Red Army. He was part of a team of Soviet experts sent to Germany towards the end of WWII to recover lost V-2 technology.

With Stalin now seeing missile development as an urgent priority, a new research bureau NII- 88 (located in the suburbs of Moscow) was created. This bureau in turn created other bureaus one of which was called Design Bureau 1 (OKB-1) and Korolev was appointed the Chief Designer. Their first task was to build replica V-2's using captured blueprints. The rocket, now dubbed the "R-1" was successfully launched in 1947 at which time more advanced versions (R-2, and R-3) with longer ranges were developed. The R-3 in fact had enough range (3,000 mi) to strike England. Yet another Russian derivative of the V-2, the R-5 flew successfully in 1953.

Next came the 2-stage R-7 which (after some initial failures) flew from 1957-1961 some 28 times. The R-7 "Semyorka" in fact was the world's first true ICBM. The R-7 itself never became "operational" but a derivative, the R-7A, (known in the West as the SS-6 Sapwood) was operationally deployed from 1960 to 1968.

Though pleased with the progress of Soviet ICBM technology, Korolev's true motivations now lay primarily with the prospect of space travel. As early as 1953 he proposed using modified versions of the R-7 (still on the drawing boards at that time) to launch an artificial satellite into Earth orbit. He also proposed sending a live dog into orbit too.

The Russian Built R-7 two stage rocket - the world's first "true" ICBM, its derivative the R7-A became operational from 1960-1968

At first there was resistance from the military and government party members but Korolev eventually succeeded in getting widespread support for his space proposals by couching them in terms of beating the United States.

In particular, the new Soviet leader Nikita Khrushchev was open to the idea of "showing up" the West technologically, and would eventually become so pre-occupied with producing "space firsts" that the long term viability of the Soviet space pro-

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gram would suffer and become unsustainable.

However, on October 4th, 1957 (October for the "revolution" and 1957 to celebrate the international geophysical year) Sputnik (meaning "companion") was launched into Earth orbit atop a modified Soviet 2-stage R-7A rocket.

Korolev also had his eye firmly on the Moon. The goal was to send an unmanned probe to the surface of the Moon using a modified R-7 with an added upper stage. This upper stage featured the first rocket engine designed to be fired in outer space. 1958 saw three failed attempts to launch lunar probes. 1959, saw a successful launch of a probe, but it missed the Moon by some 6,000 miles. The next launch attempt failed yet again.

Then on Sept 12th 1959 Luna 2 was successfully launched and on Sept 13th it successfully impacted the surface of the Moon (www.ApogeeRockets.com/ Rocket_Kits/ Skill_Level_4_Kits/R-7_Luna). Next Luna 3, launched successfully on October 4th 1959, was the first probe to photograph the (up to then never seen) far side of the Moon. Korolev's planning for manned spaceflights began as early as 1958 and the one-man Vostok spacecraft was developed. Again modified versions of the R-7 would be used to boost the spacecraft to orbit. The 1st Vostok prototype was launched unmanned in May of 1960. It did 64 successful Earth orbits but then failed to return to Earth. Four more Vostoks were launched with dogs aboard. The last two were successful.

Then on April 12th 1961, the West once again watched in shock as the USSR successfully launched the first man,Yuri Alexeevich Gagarin, into Earth orbit and returned him safely. More manned Vostok flights ensued culminating with the launch of the first woman in space, Valentina Tereshkova on Vostok 6.

Korolev wanted to next proceed to completing the development of the next generation Russian manned spacecraft, Soyuz. But Khrushchev, now drunk with the idea of trumping the west with "space firsts", overrode Korolev insisting that he launch a three man spacecraft into orbit ASAP (to "out do" Gemini's 2 man capsule).

Korolev had reservations but was given no choice. The task was accomplished by creating the Voskhod spacecraft. Voskhod wasn't much more than a 'smoke and mirrors' type craft. It was simply a stripped down version of the Vostok. By removing all but the most essential equipment, it became possible to (just barely) cram 3 men into a capsule that was made for one. Voskhod also had larger more heavy duty parachutes added to compensate for the added weight of two extra men (actually the one man Vostok was not even designed to 'soft land'. Instead the crewman aboard would eject just prior to the spacecraft's impacting the Earth and come down with his own personal parachute - with THREE men, ejection was no longer an option and thus the larger, more heavy chutes). On October 12th 1964 three cosmonauts climbed aboard the Voskhod (with NO pressure suits - there wasn't room!). They completed 16 Earth orbits, and (fortunately!) landed safely.

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With the Americans now into their Gemini program and about to do a "spacewalk", Khrushchev ordered his wizard designer Korolev to do it first. Hasty modifications to the Voskhod craft were made. An "inflatable" airlock was quickly designed and added to the capsule. Although the Russian spacewalk was successfully completed by Alexey Leonov on March 18th 1965 (once again beating the Americans to the punch), the Soviet mission was plagued with serious problems and nearly ended in disaster.

Leonov had trouble re-entering his spacecraft because of the expansion of his space suit upon entering the vacuum of space (2-1/2 months later Leonov's U.S. counterpart Edward White would have similar problems re-entering his Gemini spacecraft after his space walk). During re-entry, the Voskhod landing module was set to spinning. The spinning was finally corrected at 62 miles altitude but the spacecraft landed some 241 miles off course! The crew ended up marooned in high mountains. The capsule hatch was blown open by automated pyrotechnics leaving the three men to face hungry and aggressive bears and wolves. They had to use guns and ammo included in their "survival gear" to fend them off. Nighttime temperatures plummeted to MINUS 22 degrees F and it was 2 days before rescue personnel could retrieve them.

With the Russian space walk completed before the U.S. spacewalk, Korolev was now allowed to turn his attention back to the development of the Soyuz spacecraft and also the monstrous N-1 (the "intended" Russian Moon rocket). The Soyuz would go on to become the workhorse of the Russian manned space program and be the first craft to carry paying civilian "tourists" into space decades later. The N-1 was destined to a series of spectacular failures which would lead to its ultimate cancellation. Unfortunately less than 10 months later (January 12, 1966) Korolev would pass away under unclear medical circumstances aggravated by a weak heart.

Though the Russian space program never recovered from the political meddling of Khrushchev, nor the loss of Korolev himself, the program did go on to accomplish some great things such as robotically retrieving lunar rocks and dirt samples from the Moon, landing probes on Venus and Mars, and developing a long term presence of manned space stations in Earth orbit. All of these feats (as well as giving the USA some stiff "space race" competition) would not have been possible without Korolov's massive positive influences on the Russian space program.

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About the Author

Bart Hennin graduated in 1984 with a BaSc in Mechanical Engineering from the University of Windsor, Ontario. His senior year thesis was *"Optimization Of A Model Rocket For Highest Altitude"* which earned a top of the class mark of A+. Following graduation, Bart worked for several years in auto manufacturing engineering, then migrated to technical sales, and eventually ended up in general sales and marketing.

Bart is currently married and is living in New York state. Bart says that his family consists of one obnoxious cat named Thor.

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