



WHERE IS MY JETPACK?

The history of back mounted propulsion devices

The year is 1961. A waitress drives back home from an all-night dinner, when a noise makes her glance toward a field besides the road. What she saw glued her eyes to the field, making her car roll into a ditch. She had seen a goggled and helmeted man rise straight up into the air. The waitress was one of the first to witness a rocket propelled human. But if this already was possible in the 1960s, why aren't we flying jetpacks right now?

TEXT Jan Schneiders, Student Aerospace Engineering, Editor Leonardo Times

"We're working right now on a 'flying belt'. It will strap on a man's back. It will rocket him to an altitude of several hundred feet, and shoot him forward for several thousand yards. When he wants to land he'll simply reverse thrust and coast gently back to earth."

Back in 1958 scientist Harry Burdett, manager of "Project Grasshopper" at the Thiokol Chemical Corporation told this to an editor of the magazine Popular Science. In the same magazine engineers working on the Project Grasshopper predict the estimated delivery date of a workable unit within two years. With promising flight tests in the 1960s people thought their dreams would be reality in no time. Skimming along treetops traffic jams would not exist anymore. But now in 2010 we are still not flying to work with a jetpack. Why hasn't the rocket belt technology advanced after those first promising flight tests?

THE HISTORY OF JETPACKS

Although already in the late 1920's comic strip hero Buck Rogers uses a perfectly working rocket pack throughout his adventures, the first real life experiments with jet packs started in the Second World War. Not scared off by possible dangers, the Germans experimented with simply strapping two pulse jet tubes to the body of a soldier. One allowed forward flight and the other less powerful jet simple control with hand grips for steering. These pulse jets were similar to the ones that powered the V-1 flying bomb, but were shortened and force-fed oxygen by a separate oxygen tank.

The so called Himmelstürmer allowed a German flier to make jumps up to sixty meters far and was intended to be used to cross minefields and bridge-less waters. It was tested by the German army but was still very experimental once the war ended.

After the war the device was taken to the USA and handed over to Bell Aerosystems, where the Himmelstürmer was tested on a tether because no pilot was willing to risk his life on trying the strange German machine. After few tests the Himmelstürmer proved to be not safe enough to be of any use and Bell had to invent a new jetpack (note that 'jetpack' is used here to name a backpack that allows you to fly, powered by either a rocket or a jet).

Engineers at the Reaction Motors division of the Thiokol Corporation started working on Project Grasshopper in 1958. Under this code name they developed a 'jump belt' which used canisters of compressed nitrogen for propulsion. With the belt it was possible jump to a height of seven meters. It didn't allow a soldier to fly, but did give him seven-league boots. One of the first test pilots described the jump as being a strange sensation. Not everyone



Figure 1. Graham preparing for a flight in his rocket belt

enjoyed the experience though and test pilot Kurcewski was shot head-first back to earth on his first jump. Only a few more tests followed, after which Project Grasshopper was stopped due to lack of financing.

In the meantime Bell Aerosystems had abandoned the *Himmelstürmer* and was working on the Bell Rocket Belt. The main problem was to achieve a stable and steady flight, for which a reliable control system had to be developed. By trial and error the best positioning for the nozzles of the rocket pack was found. The device was still not safe enough though: after twenty successful tethered flights with the Rocket Belt test pilot and engineer Wendell Moore scattered his kneecap after falling down with the sixty kilograms heavy belt from a height of almost three meters. This disabled him from doing any further tests. Moore, who was also leading the project, needed a replacement; someone with no flying experience to prove that any grunt could master flying with the rocket belt. That man became Hal Graham (see figure 1), who had no experience in piloting anything but his car.

The first free flight in history of a rocket pack was performed on 20 April 1961. To put this date in perspective, that is one week after Yuri Gagarin became the first human in outer space. Instead of going into orbit, Graham reached an altitude of approximately 1.5 meters, flew smoothly forward for 35 meters with a speed of ten meters per second and landed safely afterwards. In subsequent flights Graham mastered the flight techniques and learned how to perform more complex maneuvers: rocket packs had ceased to be fantasy. Moore continued to work on the belt to attain absolute reliability. In the end a maximum flight duration of 21 seconds was achieved, which required twenty liters

of hydrogen peroxide (which cost about \$100 in 1961).

The construction was very simple and reliable as the rocket engine of the belt had no moving parts. The basic idea was to bring liquid hydrogen peroxide in contact with a catalyst (which are in this case thin silver plates covered with a layer of samarium nitrate). Normally the hydrogen peroxide is relatively stable, but when it comes in contact with a catalyst it decomposes into a mixture of superheated steam and oxygen, increasing the volume 5000 times in less than one tenth of a millisecond.

Simple and reliable does not mean without complications. It is worth noting how dangerous the rocket pack actually was. The reaction comes with a piercing, whistling hiss at 130 decibels; that is at the threshold of pain. A sound level able to cause severe discomfort and serious hearing damage. And sound is not the only problem. The steam comes out of the nozzles at 750 degrees Celsius requiring pilots to wear heavy thermal protection. Graham's heart rate was unsurprisingly registered at 140bpm during his first flights. Graham however could overcome his fears and together with Moore he prepared the rocket belt for the first public demonstration. Already after a few months Graham gripped the handles of his rocket belt at the Fort Eustis military base and floated over a two-and-a-half ton army truck and over an H-12 helicopter in front of several hundred officers. More demonstrations followed quickly and when the rocket belt was demonstrated in front of John F. Kennedy the look on the president's face was described by an unnamed army officer as "wide eyed and open mouthed—just like a kid."

The career of the rocket-man and his grandiose performances ended violently only



Figure 2. The jetbelt here in a successful test flight

two years after they had begun. During a demonstration at Cape Canaveral the Rocket Belt malfunctioned and stopped working 6.5m above the ground. Graham fell head-first to Earth and crashed into the ground fast enough for his helmet to crack. He remained unconscious for thirty minutes, after which Graham walked away from the Rocket Belt, forever. Together with Graham also the army turned his back to the Rocket Belt and the project was cancelled.

Bell did not give up completely though and developed a jet pack with a turbofan engine in the late 1960s. It allowed longer flights, but nevertheless a few months after the first demonstrations the project was abandoned. Jetpacks ultimately turned out to be too dangerous and too heavy. The demonstrations proved that it was more a spectacular toy than an effective transportation method: no rocket belt flight has ever lasted long enough to be of practical use and current jetpacks are only used for amusement and not for transportation. However, that is on Earth. While you won't see practical jet packs above the streets, in space where less thrust is required, rocket packs can be very useful and have been used frequently... ✈

References

- Christof Friedrich, *German Secret Weapons and Wonder Weapons of World War II*, Samisdat Publications, 1976
- E. Tozer, *Man's first leap toward free flight*, *Popular Science*, Dec. 1958
- R. Gannon, *This man can Broad-Jump*, *Popular Science*, Dec. 1961
- W.P. Sutor, *Rocketbelt Pilot's Manual: A Guide by the Bell Test Pilot*, Apogee Books, 2009