German protective clothing manufacturer Ballonfabrik has found a new use for Gore-Tex, in a suit that can help helicopter crews stay alive in freezing water for more than two hours.



In at the deep end

Inspired by its success in the outdoor apparel arena—in keeping walkers, golfers and climbers dry for decades—a manufacturer from Augsburg, southern Germany, has decided to put Gore-Tex to an unusual use.

Ballonfabrik, as the company's name suggests, has a history of making hot-air balloons, the high-point of which, literally, was the use of one of its products for first manned flight into the earth's stratosphere in 1931. Its new idea also has an aviation connection: it's a safety suit for helicopter crews.

Specifically, the suit is designed to save the lives of helicopter passengers, airmen and women, who have to abandon aircraft that—for whatever reason—land on water. Pilots have had their own protective clothing for some time, but craft such as the Super Puma, in use in around 40 defence forces around the world, also carry as many as 18 passengers at a time. This suit is for them. It is breathable, fire- and flame-proof (fire is a significant risk when a helicopter has suffered damage) and, of course, completely waterproof.

Even if the water is freezing cold, someone wearing this suit would be able to survive for as much as two-and-a-half hours. This seems an incredible length of time for the core body-temperature to stay close enough to 37 °C for a person to survive, but Ballonfabrik's sales director, Markus Bolay, is adamant. He says: "We've already carried out tests on these suits with the German airforce and the people involved were very happy. Even after 120 minutes, the average core temperature only dropped to 36.9 °C, by one tenth of a degree, and nowhere near the critical limit of 35 degrees. Some physicians even put that limit at 34 degrees."

Mr Bolay's company has made the suits from a form of Gore-Tex that the partner company describes as "the most stringently tested Gore fabric on the market". To it, Ballonfabrik has added super-stretch neoprene to make wrist- and neck-seals, and reinforcement pads at the knee and elbow.

There is a single central zip, which is soft and light, but chunky enough to be easy to find—with a gloved hand—and to pull across the torso in a diagonal line. It feels completely secure. This component comes from a specialist supplier, TIZIP, which also happens to come from Augsburg. "We looked at every zip available on the market," Markus Bolay explains, "but there was nothing like this. And I'm not just saying that because TIZIP is from the same part of Germany as we are. Everything else on the market was 40-year-old technology."

It feels impossible to sink wearing this suit. It is hard enough to turn over in the water and start swimming; using the arms to scull is easier.

W.L. Gore

Technical question

The experience of feeling the Ballonfabrik helicopter suit balloon up immediately on contact with the water, only for the air to start escaping through the built-in vents right away makes you wonder how the suit manages to insulate the body so well. Air, as we know, is normally the key to good insulation, but if all the air escapes, how does the body stay insulated?

Markus Bolay confirms the assumption that air is the key to insulation. He goes on to explain that the inner lining of the suit "always contains and keeps some air trapped inside the system", which is why the suit insulates so well.

The lining is the key, then. In fact, this part of the suit, for which Ballonfabrik has used the Nomex material that DuPont first developed in the 1960s for parachutes (which seems appropriate), is detachable. This makes it possible to use the suit in warm-water areas without this component.

With the lining in place, however, the suit provides enough protection in even the coldest water environments to give helicopter crews a much greater chance of rescue and survival.

Tests with the German airforce have resulted in some modifications since the prototype Ballonfabrik helicopter passenger suits appeared. Its breathability owes much to valves under the arms. We have come to accept that waterproof garments and footwear can also be breathable, but the specialist helicopter crews seemed to harbour doubts that the product could incorporate these vents without compromising its capacity for keeping out life-threatening, freezing water.

The key to their change of heart was that an important part of their overall requirement was to have protective clothing that would inhibit only to the smallest extent possible their ability to move and escape from a submerged or partially submerged aircraft. So the suit now has the valves at the underarm, allowing it, Mr Bolay says, to function "like a second skin", with air flowing in and out.

Two-minute warning

Another stipulation from the professionals was that they should be able to put the suit on in two minutes. The strict truth is that, when Ballonfabrik and Gore set up a demonstration of the product for journalists towards the end of last year, it probably took most participants closer to ten minutes to pull the garment on, even with help. However, it's a safe bet that in a more challenging environment than a placid Bavarian lake, the Chiemsee, on a quiet afternoon—say, for instance, that of an out-of-control helicopter hurtling towards the ocean—people would have speeded up.

It was easy enough to walk to the water's edge wearing the suit and to jump from the boardwalk into the lake. In the water, though, there were two strange sensations. The first was that the suit expanded immediately on impact until it felt for a few seconds like the one the Michelin man wears. The air rushed out quickly enough though and the suit then clung to the body. The second strange sensation was one of incredible buoyancy; it would have been impossible to sink, even for people who had never swum in their lives (which would not apply to helicopter crew anyway).

It was hard enough even to turn over and start swimming back to the lakeshore, with most participants preferring to stay on their backs and move by virtue of a sculling motion with the arms. Hardest of all was putting the feet onto the lake-bed when the water became shallow and the shore came within touching distance; it was like trying to force a football to the bottom of a swimming-pool. However, it's clear that the high-visibility suit's purpose is not to equip anyone to swim long distances, but to save air crew subjected to immersion in water by bringing them to the surface and helping them stay there safely until help arrives.

At no point did anyone who took part feel cold or wet. In fact, it was a lot of fun.

The German airforce will distribute the suits to its entire helicopter fleet in the course of 2008.



Volunteers prepare to test the Ballonfabrik helicopter passenger suit in the waters of the Chiemsee in Bavaria.

W.L. Gore