Now for the TACTOR VEST

Science looks for ways to keep pilots from getting disoriented.

Beth Dickey & Adam Rogers

ANYONE WHO'S flown in an aeroplane has felt the odd, disconnected sensation of looking out the window to see the plane banking into a turn, and yet knowing that the floor of the cabin is still solidly "down". It's called spatial disorientation, and for air passengers it's less annoying than, say, crummy food. Pilots take it more seriously.

When they lose visual cues, in darkness or cloud, their instruments are supposed to help prevent them from flying off the straight-and-level. Yet spatial disorientation accounted for 1,022 general-aviation accidents in the US from 1976 to 1992, according to the Federal Aviation Administration (FAA). Some crash experts think it caused the fatal crash of John F Kennedy Jr's plane in July.

Experimental: Science may offer help. The way human beings perceive their own movement is fairly well understood. Now researchers from diverse fields are using that knowledge to help pilots handle spatial disorientation. The new technologies are still experimental, years away from common use. But as the military asks for an increased edge for its combat flyers and aviation becomes a more popular civilian pastime, researchers are leveraging the senses of touch and vision to help the brain tell up from down.

Human beings figure out their position in and movement through space in three ways. Vision is the most obvious; second is a set of fluid-filled channels in the inner ear that register motion. When these channels go out of whack, we get motion sickness. But when visual information isn't available, the brain misreads both inner-ear data and sensations coming from the somatosensory system – nerves in the skin, joints and muscles – and it gets confused about direction. In the air, "those two systems give you false information in any other condition than straight and level flight" says Angus Rupert, a NASA flight surgeon at the Naval Aerospace Medical Research Laboratory in Florida.

Pilots face a flurry of instruments in the cockpit; Rupert aims to cut through that data smog. He's invented a vest lined with "tactors" or tactile stimulators. They're an array of pneumatic buzzers (off-the-shelf vibrating-pager technology wasn't powerful enough), connected to the aircraft's avionics. "When you bank to the right, the tactor at the bottom right goes off first," says Rupert. "If you pitch the nose forward, it goes off in your lower abdominal area."

The US Air Force plans to install tactor vests in two H-53 Pave Low helicopters early next year. It's a pricey experiment, running $270,000 to outfit the choppers. But it's worth it, according to Jim Baker, a test pilot who flew a T-34 C turboprop wearing a tactor vest. Even with a hooded cockpit, without instruments, "I had an immediate knowledge of deviation from straight and level," Baker says. "I was maintaining the aircraft where it needed to be within one degree." In other tests, blindfolded helicopter pilots could not be disoriented while they were wearing the vest.

Virtual reality: Other techniques are in the works. The FAA operates a virtual-reality simulator – VR goggles and a rotating platform – to induce spatial disorientation in pilots, teaching them the situations to avoid. Some business jets and turboprops now use head-up displays that project flight data into pilots' lines of sight, so they can keep their eyes on the road. An even more advanced system, currently in the experimental stages, combines diverse information about the plane, weather and location in one easy-to-read display.

It's not certain that high-tech solutions will trickle down to general aviators. Rupert estimates it could be years before tactor vests go into operational use on military aircraft, and even then they could cost from $5,000 to $10,000. "It sounds technically interesting. It also sounds expensive," says Drew Steketee of the Aircraft Owners and Pilots Association. For pilots of small planes, training may still be the best way to stick a landing they can walk away from.

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