
BOB SIHLER

LOST *in* AMERICA

AIRPLANES THAT GO MISSING ARE OFTEN UNTRACEABLE. WHY IS EFFECTIVE TRACKING TECHNOLOGY BEING IGNORED?

In dense wilderness, downed airplanes can be virtually impossible to find, so the government requires almost all aircraft to carry emergency locator transmitters. But their failure rate is dismaying. A different approach, breadcrumb tracking, shows promise, but the government has been reluctant to endorse it.

BY MICHAEL BEHAR

THE MORNING OF December 9, 2009, began cool and clear. In Dorrigo, an Australian town about 300 miles north of Sydney, the pilot of a Bell 206L-1 LongRanger helicopter took off on his second flight of the day. The 29-year-old (officials did not release his name) was under contract with the New South Wales National Parks and Wildlife Service to aid crews fighting bushfires. Also aboard was Aaron Harber, a 41-year-old park ranger being ferried to Cathedral Rock National Park, where he would help battle a blaze.

At 11:20 a.m., a few minutes after takeoff, the pilot flew into a thick fog. He immediately lost all visual reference points. For a split second he glimpsed a ridgeline and a cluster of trees, then nothing. He knew he was perilously close to the ground—perhaps just 20 feet above it—but had no idea what direction he was traveling in. "This is not good," he told Harber. "I'm going to try to land." When the pilot yanked the cyclic to flare the chopper and slow its speed, there was a loud bang, and the LongRanger went into a flat spin. The main rotor snapped and sliced through the cockpit canopy just as the aircraft slammed into the ground. In the impact, Harber's seatbelt shoulder harness was severed.

Harber died in the accident, but the pilot survived. With severe injuries to his head, chest, and back, he used his cell phone to call for help, but couldn't tell rescuers where he was. It didn't matter. Search teams were already en route, having been summoned by a tiny device called a Spider S2. Not much larger than a bagel, the $1,800 Spider, affixed to the Bell's cockpit dash, had powered up automatically on takeoff and transmitted its whereabouts throughout the flight, in two-minute intervals, to a constellation of Iridium satellites, leaving a digital trail—"breadcrumbs"—that showed its latitude, longitude, altitude, airspeed, and bearing. Its flight data was stored on computer servers operated by New Zealand-based Spidertracks, the company that invented the Spider.

When the device was destroyed in the Dorrigo crash, it stopped leaving breadcrumbs. The silence told the software on the Spidertracks servers to begin dispatching a series of e-mails and text messages to a list of emergency contacts compiled earlier. On the list was Mark Rogers, whose firm, Commercial Helicopters, owned the Bell 206. Rogers notified authorities, using the breadcrumb data to direct searchers to the exact location of the impact. Rescuers found the pilot in critical condition. He was airlifted to a hospital, and he eventually recovered.

The helicopter was also carrying an emergency locator transmitter, or ELT, which contains a G-switch ("G" for gravity). When it senses a hard impact, the G-switch transmits a distress signal. But ELTs rely on a sparse network of satellites that get crummy reception, and it took more than 90 minutes for the ELT to be heard and its position conveyed to monitoring stations on the ground. By that time, "the whole recovery operation was well under way," Spidertracks co-founder and helicopter pilot Bruce Bartley says. The Spider's early alert had likely saved the pilot's life.

Adventurer-aviator Steve Fossett wasn't so lucky when his Bellanca Super Decathlon plowed into a mountain near Mammoth Lakes, California, in September 2007 (see "Anatomy of a Search," Feb./Mar. 2008). He carried an older-generation ELT, and if it sent distress signals, no one received them. More than a year later, searchers found his remains a half-mile from the crash site. The seat belts in the Bellanca had been unbuckled. Fossett appears to have survived the impact and staggered away from his airplane before he died. If he'd had a breadcrumb tracker, the distress calls, set in motion at almost the moment of the crash, might have alerted authorities in time to save him.

Under legislation passed by Congress 35 years ago and enforced by the Federal Aviation Administration, virtually every aircraft in the United States must have an ELT. But when an airplane with an ELT crashes, its location is transmitted only if the device calls for assistance. And there are any number of ways the device can be stopped from sending those alerts.

There are two types of ELT: the older models, which were introduced in 1973, transmit over 121.5 megahertz, an analog frequency, while newer beacons, which debuted in 1999, use 406 megahertz and broadcast digitally. The 406 ELTs are an improvement over the 121.5s because the digital signal can carry GPS coordinates, along with beacon registration data, such as the airplane's owner and contact information.

Most organizations that are involved in aviation safety believe that 121.5 ELTs should be replaced with 406s. Searchers can get a fix on a 406 unit's position in as little as five minutes (though gaps in global satellite reception can extend that to 15 minutes, and if the unit doesn't have an optional GPS accessory, the delay can be as long as three hours or more).

The older ELTs are so unreliable that as of February 1, 2009, Cospas-Sarsat, the multi-national entity charged with monitoring ELT transmissions, stopped listening to 121.5 megahertz. If an airplane outfitted with a 121.5 unit gets in trouble, its cries will now almost always go unheard. The FAA had hoped pilots would swap their 121.5 units for 406s. But no federal law requires them to, and installation of a new unit costs of up to $2,000. Says agency spokeswoman Alison Duquette: "The FAA's position is that 406 ELTs are superior, but their cost [to the pilots] would not justify mandating them." To date, only about 25,000 general aviation aircraft have upgraded units. Translation: Of the 224,172 active general aviation aircraft in the United States, about 90 percent operate with an emergency beacon that transmits its distress signal over a frequency that is not listened to. If one of these aircraft should crash, hearing its ELT is a matter of pure luck. A passing pilot might pick up the signal—but only if he or she happens to be tuned to the frequency.

EMERGENCY BEACONS ARE USED in many environments: aviation, marine, and terrestrial. Cospas-Sarsat relays distress alerts to the Air Force Rescue Coordination Center at Tyndall Air Force Base in Florida, which coordinates searches in the United States among various federal, state, and local agencies. In theory, ELTs should enable authorities to rapidly locate downed aircraft. In practice, they fail miserably. In the last five years, the AFRCC has been directly involved in 416 crashes in the United States that required some manner of search and rescue (often hundreds more occur, but are usually handled at the state and local levels). Each of these airplanes carried (or by law should have carried) an ELT. Yet in these accidents, just 124 ELTs activated. A five-year NASA study that analyzed the performance of 121.5 ELTs (comparable data from the 406 transmitters isn't yet available) in 3,270 crashes shows that in 75 percent of accidents, the beacons are disabled on impact or destroyed in a fire, and never activate.

The units are installed inside the cabin near the tail, where they're most likely to survive a crash. Their exterior antennas—mounted to the top of the fuselage, usually behind the wing, or forward of the tail rotor on helicopters—can easily snap. In 2005, 49-year-old New Zealand billionaire liquor baron Michael Erceg crashed his Eurocopter EC120B in a remote forest south of Auckland; he and a passenger were killed. The ELT antenna broke, so the distress pings went unheard. The ensuing hunt for Erceg would become one of the largest and most expensive search-and-rescue operations ever conducted in New Zealand.

Four years after Erceg died, Spidertracks enlisted the support of his widow, Lynne, in a marketing effort to help subsidize the price of Spiders for New Zealand pilots. The pitch to aviators: Breadcrumb trackers like the Spider don't use an external antenna. Instead, they affix to the dash and transmit through the windscreen.

Even if the crash leaves an ELT and its antenna intact, the unit can't transmit if the aircraft is upside down, under water, or concealed in dense foliage. And if the pilot, trying to lessen the crash's impact, lands too gently, the G-switch can fail to arm.

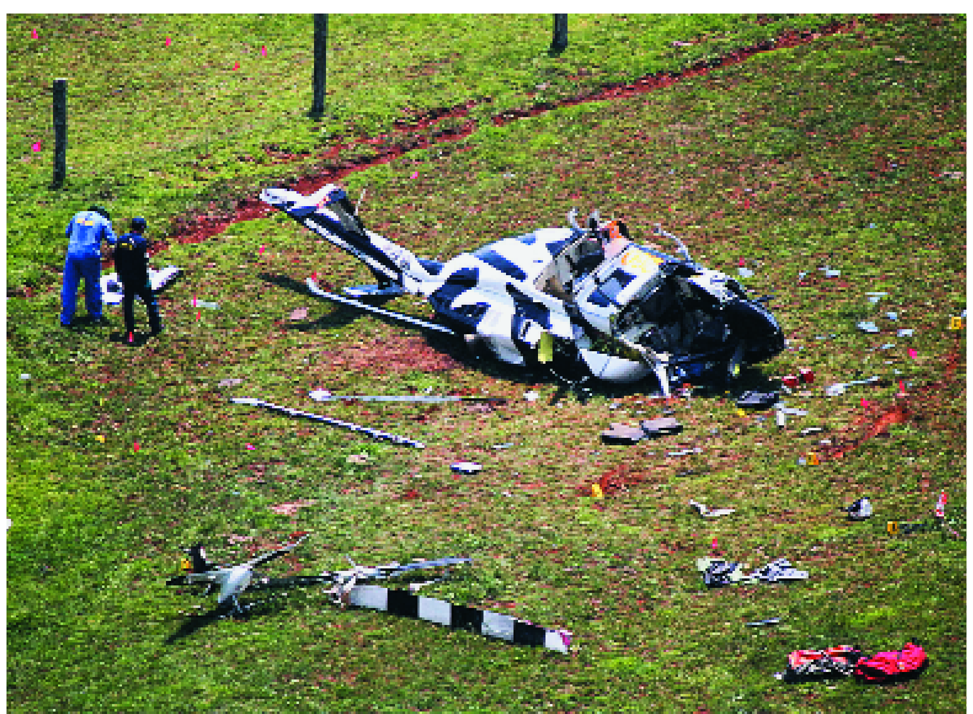
When ELTs do work properly, rescue is virtually guaranteed. "There are no open [accident] cases in the U.S. that I'm aware of where an ELT activated but for whatever reason we haven't found the wreck site," says Shawn Maddock, a Cospas-Sarsat operations support officer.

But when ELTs transmit improperly—and that's the majority of the time—the result is a lot of wasted labor.

I'm standing next to Dan Conley, the Air Force Rescue Coordination Center's chief of operations, inside Tyndall's Air Operations Center. At the front of the room is a $3.5 million data wall—a 90-foot-long assembly of 16 screens that displays a real-time map of U.S. airspace, extending several hundred miles into Canada and Mexico and over international waters. I'm here to learn how the AFRCC handles an incoming ELT distress alert.

Since aviation accidents are rare, I'm not expecting much activity. But the two AFRCC controllers on duty are frenetically making phone calls, sending e-mails, scribbling notes, and tapping on keyboards. It's 11 a.m. and already there are seven ELT distress signals. A Learjet is sending a 406 alert. A call to the phone number associated with the ELT's registration reveals that the airplane was sold after the unit was installed and the new owners never bothered to update the contact information. Another 406 ping arrives, lacking any registration data whatsoever. A commercial jetliner cruising at 33,000 feet over Washington state reports hearing a 121.5 signal but cannot get a fix on its location. The controller in charge of the case employs a computer program to plot a potential search area, which encompasses Washington, Oregon, Idaho, and parts of British Columbia.

AFRCC controllers field endless ELT distress calls. They meticulously log the details of each incident, then begin investigating to determine whether they're dealing with an actual emergency. Since its inception in 1975, the AFRCC has saved more than 15,000 lives. But it has also had to spend a hefty part of its budget chasing phantoms: 97 percent of ELT activations are false alarms, usually caused by a hard landing or a careless mechanic. The units can also be triggered while they are still on the delivery truck, on the way to the purchaser. So to avoid wasting resources, the AFRCC has taken drastic measures. When the organization receives 121.5 distress reports, it ignores them for at least 18 hours after they are first reported. Air traffic control monitors the frequency, but disregards 121.5 alerts for the same reason the AFRCC does: The signal-to-noise ratio is untenable. "I can't tell you how many times I've called an air traffic control center and told them to turn the volume up on 121.5," says Conley. "I've had a guy tell me it had been going off for two hours and it was driving him crazy, so he ignored it and turned down the sound."



Breadcrumb tracking brought rescuers to the site of a 2009 LongRanger helicopter crash in Dorrigo, Australia. The pilot was flown to a hospital and, though badly injured, survived.

AAP/FRANK REDWARD

Investigators do succeed in tracing 406 devices to their owners (who sometimes have no idea their ELT is chirping). But 60 percent of pilots who have purchased the newer beacons have never bothered to register them, and of the units that have been, the information in the registration database is sometimes out of date, and investigators then have to track down the new owner. "It's garbage in and garbage out," says Conley.

SPIDERTRACKS' breadcrumb tracking unit is fixed to the dash (top) and transmits location data through the windscreen. Above: A flight path overlaid on a Google map shows the transmissions of a SPOT-brand tracker. SPOT users can activate various options: "Track" plots points every 10 minutes so friends can follow a flight; "Help" sends location data to a contact list when non-emergency problems arise; and "911," a critical message, summons authorities.

TOP: COURTESY SPIDERTRACKS; BOTTOM: COURTESY SPOT LLC

COLONEL EDWARD PHELKA is the wing commander for the Civil Air Patrol in Colorado. He has been with CAP for 24 years, participating in dozens of searches for airplanes in seven states. But he hasn't had much experience with breadcrumb devices. When I meet him at the Boulder Municipal Airport, it's the first time he has seen a Spider. I've brought along the S3, a newer, smaller model that runs about $1,000. Our goal is to test the tracker's performance.

It's early March, and the winter sun is strong—"perfect flying weather," declares Phelka. He completes his preflight of our Cessna 182 Turbo Skylane and we get airborne. There's barely a jostle as we climb and then bank north along the Rocky Mountain foothills, flanking snowbound summits that pierce 12,000 feet. Stacks of saucer-shaped plumes hover above the Continental Divide. "Lenticular clouds," notes Phelka. "A sign of turbulent air. We'll keep our distance."

Before departing, I had logged onto the Spidertracks Web site and entered my brother and wife as emergency contacts. (Users can add local first responders, who then get notified along with your loved ones that your aircraft has had an emergency.) My brother and wife are in on the experiment, but they have no clue when and where I will manually set off the Spider's SOS. They have been told that if they receive an alert, they should phone my mobile number.

A few miles north of Horsetooth Lake, I activate the SOS. Within a minute, my phone rings. It's my brother, in Seattle. He received my SOS, along with a URL that linked him to a Google Map showing our exact location. "You're near Fort Collins," he informs me. Another incoming call: my wife. She dittos the data.

Time elapsed from sending the signal to receiving both calls: 57 seconds.

"Amazing, absolutely amazing," Phelka says, then asks where he can buy one.

When a Super Cub ran out of fuel and had to land on uninhabited Kayak Island in Alaska last May, the pilot and passenger tried both low- and high-tech alerts. In addition to the "SOS," they activated a SPOT beacon, and were rescued by the Coast Guard.

CURRENT FAA RULES STATE that pilots must carry an ELT or "other equipment approved by the secretary [of transportation]." To gain that approval, the equipment must have undergone testing that meets an established standard. The standard applied to breadcrumb trackers is the one used to certify ELTs; it requires stress tests that simulate what can occur during an impact. But a breadcrumb tracker's performance is predicated on the device not surviving an impact. Unlike ELTs, breadcrumb trackers don't have to weather a crash. In fact, that's their strength. It's when they stop tracking your location that your emergency is revealed.

The senior FAA official I interviewed, who asked not to be quoted, said that for the agency to consider breadcrumb trackers acceptable emergency transmitters, the manufacturers would have to devise appropriate standards, then persuade Congress to modify the existing legislation.

Presently, the FAA touts a technology called ADS-B (Automatic Dependent Surveillance-Broadcast), currently under development, as "bringing the precision and reliability of satellite-based surveillance to the nation's skies." ADS-B satellites capture positional data from aircraft, then relay it to other flights in the vicinity, or to ground receivers, which forward it to air traffic control. ADS-B gives pilots a three-dimensional awareness of their airspace, a view once available only to air traffic controllers. But ADS-B is designed primarily as a tool for managing scheduled commercial-flight traffic, and requires an onboard avionics suite that can total more than $12,000, a cost many general aviation pilots would find prohibitive. More importantly, it is not meant to hunt for missing aircraft. Says AFRCC program manager David Fuhrmann, the principal intermediary between his agency and Cospas-Sarsat: "The problem with ADS-B is it still uses a radio signal.... You can still have terrain masking. There are not going to be towers all over the U.S. So in remote areas, it won't work. It will work at altitude, but if you descend, you could go many miles before crashing, and may not ever be visible by ADS-B."

TOP LEFT: USCG/LT. JON BARTEL; BOTTOM LEFT: NOAA; BOTTOM RIGHT: COURTESY SPIDERTRACKS

TOP RIGHT: COURTESY HURON COUNTY SHERIFF'S OFFICE; BOTTOM RIGHT: COURTESY SPOT LLC

In an e-mail, FAA public affairs spokeswoman Alison Duquette, who agreed to speak on the record, says: "The FAA is investing in the infrastructure for ADS-B, which serves the entire U.S. aviation community. The FAA requires ELTs for general aviation airplanes. While breadcrumb tracking may have some applications for aviation, it is not a substitute for ELTs or ADS-B."

Duquette's assertion that ADS-B "serves the entire U.S. aviation community" is true only if the nation's general aviation pilots pay for the pricey avionics needed to get the ADS-B's full benefits. Without a breadcrumb tracker on board, the average private pilot whose airplane goes down in a remote area will remain at significant risk of going undiscovered.

I ask Duquette: "Can you tell me what specifically can ADS-B and ELTs do that breadcrumb tracking cannot?"

She answers: "We've already provided you an interview on the subject. I think we're done."

FROM A PRELIMINARY NTSB REPORT:

"On August 13, 2011, about 1940 [7:40 p.m.]...a Cessna 207 airplane, N91099, impacted mountainous, brush-covered terrain, about 37 miles west of McGrath, Alaska. Of the six people aboard, the pilot and one passenger died at the scene, and four passengers received serious injuries.... During a hospital room interview with the National Transportation Safety Board investigator-in-charge, on August 16, a passenger related that the purpose of the flight was to transport a group of school teachers to Anvik.... His wife and two children were also aboard the accident airplane.

"The passenger stated that he was seated in the front, right seat, next to the pilot. He said that about 20 minutes after leaving McGrath...low clouds, rain and fog restricted visibility. At one point the pilot told the passenger, in part: 'This is getting pretty bad.' The passenger said that the pilot then descended and flew the airplane very close to the ground, then climbed the airplane, and then it descended again. Moments later the passenger said that the airplane entered "whiteout conditions." The next thing the passenger recalled was looking out the front windscreen, and just before impact, seeing the mountainside suddenly appear out of the fog. He said that all of the survivors lost consciousness during the impact, and he was the first to regain consciousness.

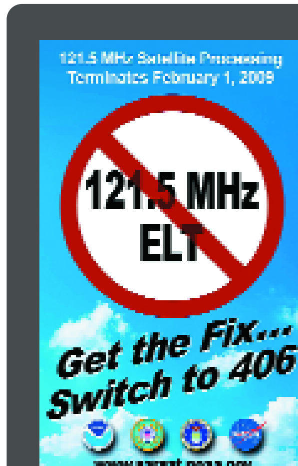
Michael Trapp ended up in Lake Huron in Michigan last July when his Cessna 150 suffered an engine failure; his emergency beacon sank with the airplane, and he had to tread water for 18 hours before being rescued. ELTs are useless once they're under water – their transmissions can't be heard. With a breadcrumb tracker, a cessation of transmissions actually helps, triggering alerts to be sent to the pilot's contacts.

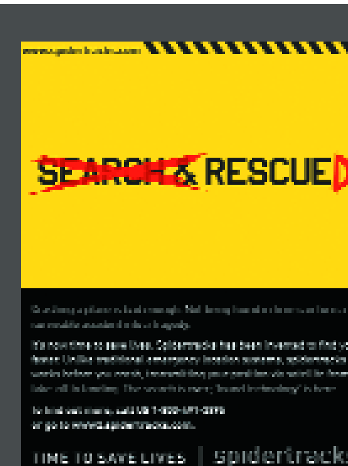
"The passenger noted that while boarding the airplane in McGrath, he happened to notice a SPOT satellite personal tracker clipped to the pilot's sun visor. He said that after the accident, he was able to find the SPOT device in the wreckage, and began pushing the emergency SOS button....About 2030, family members in Wasilla, Alaska, the pilot's hometown, received an emergency SOS message from the pilot's SPOT device. A family member then immediately called the operator in Aniak to alert them of the distress message."

The author of this report, NTSB senior air safety investigator Clint Johnson, says that the Cessna was carrying a functioning 121.5 ELT. However, it could only lead Alaska Air National Guard pilots to within five miles of the aircraft, and cloud cover prevented the rescuers from finding the site that day. The next morning, an HH-60G helicopter from the Air National Guard's 210th Air Rescue Squadron located the crash site, landed, and evacuated everyone. The breadcrumb tracker's GPS data took rescuers "right to the doorstep of the accident," says Johnson.

The same week, Johnson was assigned to five other aviation accidents. "Out of those," he says, "more than half involved SPOTs—that's how they found them."

"We have a situation," says NTSB survival factors investigator Jason Fedok, "where you have the most technologically advanced country in the world that is basically allowing a large segment of the pilot population to fly unprotected by any sort of real technology. It's patently ridiculous."





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LIVE TO TELL ABOUT IT™

Currently, general aviation aircraft must carry electronic locator transmitters (opposite, far left: an announcement of the switch to 406-MHz ELTs). Pilots can also carry a breadcrumb tracking product. Two popular options for aviation: Spidertracks (opposite, left) and SPOT. The principles behind the two are the same, but they use different satellite constellations – Spidertracks relies on Iridium, while SPOT employs Globalstar – so coverage is not identical. Users buy a unit (from $320 to $1,800, depending on features), then pick a service plan.