Safety

Emergency Locators: Saving Lives with Greater Frequency

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The date was October 16, 1972, the place, Alaska. U.S. House Majority Leader Hale Boggs (D-La.) and Representative Nick Begich (D-Alaska) took off in a Cessna 310 along with two others and were never seen or heard from again. To this day, they have never been found.

Their disappearance sparked a renewed cry for an emergency locator transmitter (ELT) beacon system. In 1970, President Richard Nixon had signed a bill mandating locators by the end of 1973. But nothing much was done until the two congressmen were lost.

The ELT concept

The 1970s-era concept behind the ELT is simple. If an airplane crashes, the severe G-forces trigger a G-switch that activates a battery-powered transmitter. The transmitter's siren-like tone, operating on the aircraft emergency frequencies of 121.5 megahertz (MHz) and 243.0 MHz, is heard by aircraft passing overhead, who "guard" these frequencies when the radio isn't needed for something else. The pilots report an ELT signal and a search ensues.

But concepts are one thing, implementation another. While there are about 170,000 ELTs installed in general aviation aircraft, ELTs have plagued owners and rescuers from the beginning. They have a 97 percent false-alarm rate and can be triggered by non-emergencies such as hard landings, aerobatics or maintenance issues. Units built to original standards activate in less than 25 percent of crashes while newer ones activate 73 percent of the time. The disappearance of Steve Fossett without a trace in Nevada on Sept. 3, 2007 shows that ELTs are nowhere near infallible.

And it's impossible to know whose airplane is apparently in trouble. Worst of all, it could take 10 to 15 hours to find a downed aircraft — far exceeding the "golden hour" so well known to emergency rooms.

Search and rescue the satellite way

ELT technology took a leap skyward with the activation of the international COSPAS-SARSAT search-and-rescue satellite (SARSAT) network in 1985. COSPAS-SARSAT employs low-earth-orbit satellites to detect 121.5 MHz beacons. Placed in low, fast orbits that pass nearly over the poles, four satellites cover about two-thirds of the earth with waiting times of 45 to 90 minutes to detect an ELT.

Since 121.5 MHz ELTs send no coded information, a phenomenon called Doppler shift is used by earth stations to analyze a received signal and locate the beacon. You have heard Doppler shift if you have ever stood next to a train as it whistled through a station. As the train approached, the whistle's pitch increased, and then sharply decreased as it passed. The satellite does the same thing using its movement relative to the beacon.

Ultimately, this system can locate an ELT within 12 nautical miles — that is, the ELT could be anywhere within a circle with a radius of 12 nautical miles, which is an area of 452 square nautical miles. That is still a lot of territory to search. Since only one in 50 such alerts indicate real distress, the specter of an unnecessary, expensive and even dangerous search is quite real.

ELTs come of age

Now snap ahead to 1992. The ELT system uses basic satellite technology but no ELT-based computer technology. Search times take too long and the false alarm rate is, well, alarming. But the technology is about to take two giant steps forward.

The first is the introduction of a new ELT that uses 406.025 MHz, a frequency that can "punch through" overhead cover such as leaves. The new frequency offers better Doppler accuracy to within 2 nautical miles (an area of about 13 square nautical miles), a far better signal-to-noise ratio and the ability to locate signals much more accurately.

Overhead, geosynchronous satellites that stay in the same position over the Earth can be used, and three can effectively cover the earth except near the poles. Detection can now be instantaneous.

Location-protocol beacons

The second step is a low-speed data link. Every 50 seconds a powerful five-watt signal is sent in a .05-second coded location-protocol message containing the aircraft's registration and manufacturer's serial number (MSN, which is the equivalent of a car's vehicle identification number, or VIN) along with the beacon identification code and country of beacon registration. The message format eliminates false alarms from the like of microwave ovens and electronic scoreboards.

Further, the information is correlated to as many as eight points of contact in a database. Rapid verification allows an immediate stand-down if the alert is false.

About 30 percent of these beacons offer a connection to the aircraft's GPS or flight management system. After a crash, the ELT transmits the latest latitude and longitude data to the satellite, yielding an incredible accuracy of less than 100 yards — the length of a football field. Some ELTs even contain their own GPS units; a GPS-equipped ELT will pinpoint the unit's location to an area of just 0.008 square nautical miles upon activation.

ELTs and the airlines

Even if you fly only on the airlines, ELTs mean something to you. Long-range overwater flights are now equipped with not just one but at least two ELTs, one of which must be automatically activated. Both must be capable of transmitting on 121.5 MHz and 406 MHz simultaneously. Further, aircraft flying over land masses designated as "difficult" search and rescue areas must be equipped with at least one automatic ELT.

It's the Results that Count

406 MHz ELTs survive much better than older units. They are so reliable that search-and-rescue (SAR) resources can be deployed the moment a beacon is detected because the likelihood is that one in 12 is a real distress call. Most importantly, the time to reach accident victims inland is reduced by an average of six hours.

Ironically, one day after Steve Fossett disappeared, the National Transportation Safety Board made a Safety Recommendation to the FAA, contrasting the case of a downed aircraft that took 16 hours to find — it was 11.25 miles from the ELT-derived location — after its 121.5 MHz ELT activated. Had the occupants been found sooner, the pilot's life might have been saved.

Almost two years later, a 406 MHz ELT-equipped private jet crash in Colorado delivered the coordinates of the jet only 1.68 miles from the actual site to rescuers just 42 minutes after the crash. Unfortunately all the occupants had died on impact.

The End Nears For 121.5 MHz ELTs

One government study concluded that 134 extra lives and millions in SAR expense could be saved each year if all U.S. general-aviation aircraft switched to 406 MHz ELTs. The FAA has left it to individual owners to decide if they wish to do so.

However, on Feb. 1, 2009, COSPAS-SARSAT will stop actively monitoring 121.5 MHz ELTs. On that day they will become all but useless. Perhaps then owners will find the money to implement this live-saving gadget that has finally come into its own.

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