Taking the "Search" Out of "Search-and-Rescue"

The new generation of 406 MHz Personal Locator Beacons

After years of bureaucratic delay, the FCC has finally approved the use of 406 MHz PLBs in the United States starting July 1, 2003. For less than $800, you can now carry technology in your flight bag or survival kit that will alert Search-and-Rescue agencies of your identity and exact location within five minutes. These new PLBs provide protection not just for flying, but also all sorts of other outdoor activities.

by Brent Blue, MD (brent.blue@aeromedix.com)

I was ferrying my antique open-cockpit biplane -- a rare Flaglor High Tow -- from my home base in Driggs, Idaho (just west of Jackson Hole) to the maintenance shop at Idaho Falls. That's about 45 nautical miles, which doesn't sound like much unless you're flying an open-cockpit airplane for a half-hour in sub-freezing 6 a.m. temperatures.

I started to think about what I'd do if the engine quit.

The terrain below was rugged and sparse. There's not much civilization between Driggs and Idaho Falls, and the cellular coverage is spotty at best. If I had to make a forced landing, how long would it take before someone found me?

I silently chastised myself for being in too much of a hurry to file a VFR flight plan. It sure would be reassuring, I thought, if I had one of the new 406-MHz Personal Locator Beacons (PLBs) with me.

Now I'm not a pessimist by nature, but I have had five engine failures over past 14 years with one leading to a short-of-the-runway landing in Green Bay, Wisconsin. Even though

The GyPSI 406 MHz PLB from ACR Electronics is priced under $700 and includes a GPS interface. A similar model without the GPS interface is priced under $600.

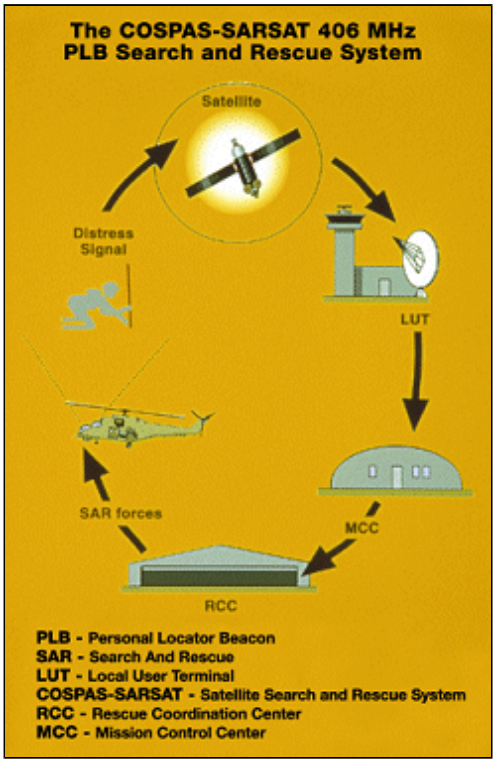
Green Bay is a large airport, the tower was closed and nobody realized I'd gone down. It was a good thing that the crash site was in an area of good cellular telephone coverage, because I had to notify local authorities via cell phone that our current location was 30 feet short of the runway threshold. By the time all the telephone calls were made by the local "authorities," it was a half hour before the first rescue vehicle arrived.

That's why I will be first in line to carry one of the new GPS-augmented PLBs as soon as they are approved or land-based use in the United States on July 1, 2003. In fact, I've already got one on order. Once it arrives, I don't plan to leave home without it. The new 406-MHz PLBs are small, economical, and amazing. One prominent expert on search and rescue remarked recently that they "take the search out of search and rescue."

The FastFind Plus 406 MHz PLB from McMurdo Pains-Wessex is priced under $1,000 and includes an integral GPS. The company also offers a similar model without the built-in GPS for under $600.

Not your father's ELT

For decades, our aircraft have been required by government mandate to carry an Emergency Locator Transmitter (ELT) that transmits on the civilian 121.5 MHz and military 243.0 MHz emergency frequencies. Pilots and rescuers have both become pretty soured on these ELTs because they have been the source of thousands of false alarms and precious few actual "saves" to their credit, not to mention being a source of mounds of paperwork and maintenance cost. Most aircraft owners would pitch them in a flash -- and will be permitted do just that in 2006 when the satellite system that monitors those two frequencies is scheduled to be phased out.



The digital distress signal from a 406 MHz PLB is received by one of ten COSPAS-SARSAT satellites, and then relayed via a local ground station (LUT) to the Mission Control Center (MCC) and then to the nearest Rescue Coordination Center (RCC).

While ELTs are known for their

uselessness, 406 MHz PLBs offer a huge technological advance. I predict their small size, economical prices and advanced functionality will make them a must-have item for most pilots to carry in their flight bag or survival kit, as well as when camping, snowmobiling, cross-country skiing, and the like.

One of the primary differences between ELTs and these new PLBs is that the 406 MHz units are digital. They don't just send out the familiar anonymous "whoop whoop whoop" signal, but transmit a digital data stream that includes the unique unit identifier of your particular PLB. If your PLB is equipped with optional GPS capability, your precise GPS position is also transmitted digitally. This information is received by an orbiting satellite and digitally downlinked to a ground receiving station called a Local User Terminal (LUT). If the LUT is not in range of the satellite when it receives the PLB transmission, it can store the information and forward it to the LUT as soon as it does come into range.

You can carry a PLB in your flight case or survival kit while flying, then take it with you for protection during all sorts of other outdoor activities.

This is significantly different than the analog 121.5/243.0 MHz ELTs. For those, the receiving satellite must simultaneously have the ELT beacon and ground relaying station in range, because the satellite cannot store any analog information.

GPS-enabled PLBs (like this GyPSI from ACR Electronics) can broadcast your precise GPS position from a handheld GPS (here, a Garmin eTrex) to provide rescuers with your exact location, accurate to within a few hundred feet . Without GPS data, the PLB can be located via satellite triangulation to within about 2 nm.

When the digital information from a 406 MHz PLB reaches the Mission Control Center (MCC), the unique identifier is looked up in a master database and the name, address and contact information for the PLB's owner pops up on a computer screen in the MCC. The MCC will then call the registered emergency contact to find out where the owner is, what he/she is doing, and whether the signal is due to a genuine emergency or a false alarm. The instant ability to identify the PLB owner provides a

dramatic improvement to the staggering false-alarm problem that exists with analog ELTs. It is estimated that there are 1,000 false ELTs alarms for each genuine emergency activation. So far, experience with the new 406 MHz beacons averages just eight false alarms for each true emergency.

Another dramatic difference is the accuracy of location. Satellite location of 121.5/243.0 ELTs is accurate only within a radius of approximately 12 nautical miles, identifying a search area of 452 square miles, and on average it takes six hours for search-and-rescue centers to be notified of the beacon coordinates. Compare this to the new 406 MHz PLBs that can be located to within a radius of two nautical miles, identifying a search area of just 12.5 square miles, and an S&R notification time of one hour. Add the optional GPS capability to the PLB and the location radius becomes 0.05 nautical miles, a search area of 0.008 square miles, and five-minute notification time!

Think about the significance of those numbers if you are the one being rescued and the outside temperature is below freezing!

In addition to the 406 MHz digital signal, all PLB units also transmit on 121.5 MHz so that rescuers can use their current equipment to home in on a beacon on the ground.

Eyes in the sky

All locating beacons utilize the National Oceanic and Atmospheric Administration (NOAA) satellites that carry payloads supplied by Canada and France called Search and Rescue Satellite Aided Tracking (SARSAT) systems. Russia operates similar satellites known as COSPAS. A few years ago, all the countries involved established a cooperative rescue effort known as COSPAS-SARSAT. The low-earth-orbit COSPAS-SARSAT satellites have recently been joined in the rescue monitoring by high-orbit geosynchronous GEOSAR satellites and its global network of ground receiving stations.

The SARSAT satellites circle the earth every 102 minutes while the Russian COSPAS satellites circle every 105 minutes. They view a circular area of the earth of about 2,500 miles at any one time each. Because they pass the poles on every orbit, coverage is most frequent at the poles and least frequent at the equator but coverage is global. Average time for a 406 MHz transmission location in the mid latitudes is 30-45 minutes (without GPS input). Now that's technology.

The GEOSAR satellites are geostationary and can receive the 406 beacon and recognize its identity, but cannot help with actual location because they have no relative motion to earth which is required for the Doppler shift technology used for position location. The ground station can try and locate the registered owner of the PLB and activate S&R groups while the orbiting satellites establish a position fix. If the PLB has GPS capability, however, the GEOSAR can relay the GPS supplied position immediately.

You can bet I'll be carrying a GPS-enhanced PLB just as soon as the July 1 release date arrives!

What's the delay?

This 406 MHz digital technology has been in use for quite some time in marine applications,

but terrestrial use of this technology has been forbidden until now. Why? Bureaucratic bungling.

To quote survival guru Doug Ritter of Equipped to Survive® (www.equipped.org), "it's been an uphill battle against bureaucracies that haven't given a damn about the lives lost by their inaction…the U.S. Air Force and the FCC deserve credit for the dubious distinction of holding up PLB approval…" Apparently, the U.S. Air Force had fears of too many false alarms (apparently not understanding that the new technology offers a dramatic reduction in false activations) and didn't feel saving civilian lives was part of the USAF mission. Who knows what splinter the FCC had up their butt.

Although there are several manufacturers of 406 MHz marine Emergency Position Indication Radio Beacons (called EPIRBs just to confuse you), only two of them are going to have 406 MHz PLBs ready for the July 1 release date: ACR Electronics and Pains-Wessex. Other manufacturers expected to enter the PLB market later on include NAT, Kannad, and Microwave Monolithics.

(The primary difference between a marine EPIRB and a terrestrial PLB is battery size: The larger marine unit is required to operate at -40º C for 48 hours while the pocket-sized PLB only has to function for 24 hours at -40º C. These times are extended considerably at warmer temperatures.)

PLBs from ACR and Pains Wessex

At this writing, I have evaluated four PLB models, two from ACR Electronics and two from McMurdo Pains Wessex. My hands-down favorite is the "Fastfind Plus" from Pains Wessex (pictured at right), because it's the only one on the market (so far, anyway) that has an internal GPS built right into the unit ... so it's the one I now carry.

With the Fastfind Plus, there are no cables or external GPS to worry about, and I think that's a huge advantage. Most pilots I've spoken with do not want to mess with hooking cables up to their aviation GPS, nor do they want to buy a dedicated GPS just to stick in a bag with the PLB. The Fastfind Plus is easy to operate with a simple on/off switch which is turned on after breaking the seal on the antenna. It also has a self-test feature which tests both the 406 MHz and GPS portions of the unit. Suggested retail price for this unit is $1,199, but you should be able to find it at discount for under $1,000.

Pains Wessex also offers a low-end model (the "Fastfind") that lacks the built-in GPS but is otherwise identical. At $400 less than the "Fastfind Plus," it's one of the lowest-cost 406 PLBs on the market.

ACR Electronics also offers a basic 406 MHz PLB (without GPS input capability) priced about $600, and a GPS-enabled "GyPSI" model with a GPS interface for about $100 more. The ACR GyPSI does not have a built-in GPS, but can interface with any GPS that supports an industry standard NMEA 0183 serial output (and almost all of them do). Expect to pay an additional $115 "street price" for a dedicated GPS like Garmin's eTrex, plus $20 interface cable to hook the GPS to the GyPSI's NMEA 0183 interface.

Although these prices are more than 121.5 MHz ELTs, keep in mind that a 406 MHz PLB is very likely to get you rescued in time to do some good, whereas the same can't be said for a 121.5 MHz ELT. A 406 MHz PLB is also portable and self-contained, so you can carry on your person -- not only when flying, but also during any remote area activity such as snowmobiling, backcountry skiing and hiking, canoeing, and climbing.

Some outdoors enthusiasts now carry satellite phones, but they are quite expensive, comparatively fragile, and do not have a shock-resistant or waterproof case like a PLB. Unlike a satellite phone, carrying a PLB involves no cost for registration or monthly subscription fees.