ELTs, PLBs & "SEND" Devices

From the Preventive Search and Rescue (PSAR) team at Alpine Rescue Team

Distress signals on land can be made from two primary types of emergency devices (top). Aircraft and watercraft use others (bottom) that work on the same satellite system as the "PLB" for land.

Traditional PLB (Personal Locator Beacon)

Used by hikers or other people in distress.

Satellite Emergency Notification Device (SEND)

Also used by hikers and other travelers of remote terrain.

Emergency Locator Transmitter (ELT)

Used by an aircraft in distress (typically a crash).

Emergency Position Indicating Radio Beacon (EPIRB)

Used on watercraft.

PERSONAL DISTRESS TRANSMITTERS FOR LAND USE

There are basically two categories of personal destress devices:

1) the Personal Locator Beacon (PLB) (top left(and
2) the "SEND" transmitter: Satellite Emergency Notification Device (top right).

PERSONAL LOCATOR BEACON (PLB):

The true PLB operates on the SARSAT system on the 406 MHz frequency, the same as the various ELTs mentioned above. Use of the term "PLB" has often been misconstrued with SEND or other similar devices, so transmission on the 406 MHz is key in distinguishing one unit from the other.

The true PLB just sends a one-way signal saying "I Need Help" or in other words, an "SOS". There is no two- way communications. Traditional PLB alerts are received by SARSAT satellites, re-transmitted to the AFRCC, and then channeled through the State SAR Coordinators then on to the local County or Sheriff's Dispatch Center and finally to the on-call Mission Coordinator. Time from triggering the PLB alert in the field to reaching the appropriate state's SAR Coordinator is generally less than 10 minutes.

How the PLB (and ELT, EPIRB) notification system works

The Air Force Rescue Coordination Center (AFRCC) is responsible for coordinating search and rescue activities in the 48 contiguous United States and will support search and rescue operations for American citizens in Mexico and Canada. The Civil Air patrol (CAP), along with the U.S. Coast Guard- when needed, law enforcement, and other first responders will be engaged in the actual search for downed aircraft. Today, ELTs have evolved from just a transmitter of a signal that is used to locate a downed craft, to emergency position-indicating radio floating beacons for watercraft (EPIRBs) and now GPIRBs (GPS transmitting emergency position-indicating radio beacons).

All ELTs and EPIRBS transmit on the 406 MHz frequency. This signal is received by the Search and Rescue Satellite Aided Tracking system (SARSAT), which is in inter-governmental co-op of 45 nations dedicated to detecting such emergency signals. Today's EPIRBS and GPIRBS also transmit a homing beacon on the 121.5 MHz that can be picked up by ground radio detection devices, but the area of reception is very limited to about ½ mile.

Once a signal is detected on SARSAT, in less than one minute, it is transferred to one of 30 Mission Control Centers (MCC) around the world. The US based MCC is located in Suitland, Maryland, and is managed by NOAA (National Oceanic and Atmospheric Administration).

The location of the signal is then transferred to the AFRCC at Langley Air Force Base in Virginia. Then, AFRCC notifies the appropriate state's SAR entity — in Colorado, the Colorado SAR Association — and then the local Sheriff's Office, who in turn, activates the local SAR team(s). There is a high incidence of false alarms with aircraft ELT type transmitters. According to NOAA's

SARSAT tracking team, in 2017, 98% of the nearly 8,900 alerts were false activations, with only 112 being real emergencies. ELTs typically transmit for a minimum of 48 hours.

In 2019, a popular PLB is made by ACR Electronics and sells for about $300. It has no subscription fees, and there are a variety of models to choose from. When new, battery life is guaranteed for 5 years, after which the battery should be replaced by an authorized repair center for about $100. Monthly tests of satellite connectivity are recommended. If the PLB is used in an emergency, ACR will replace the battery at no charge.

PLBs MUST be registered with NOAA. This can be done on-line via https://www.sarsat.noaa.gov/beacon.html.

The PLB transmits an emergency signal on the 406 MHz to the satellites and includes a GPS coordinate in the transmission, making the determination of the subject's location more accurate, even to within about 100 meters, provided the PLB can obtain an accurate "fix" on the satellites. True PLBs typically also transmit a homing beacon signal on the 121.5 MHz frequency for a minimum of 24 hours, SEND units do not.

PLBs on the 406 MHz frequency enjoy better satellite communications due to having a 5 watt transmitter (e.g., able to push through dense overhead foliage) vs a 1.6 watt transmitter on a SEND device, as discussed below. PLBs are not dependent on cellular networks and generally work around the world. However, if traveling to a foreign country, contact that country or NOAA to learn about any usage restrictions in foreign countries.

PLBs do not allow the user to describe the nature of the emergency, it is just an "SOS" type broadcast. Location accuracy relies on the US government's GPS satellite system and requires a clear view of the sky. Having said that, GPS signals may still be affected due to shielding by terrain, atmospheric conditions or other factors occurring between the earthbound transmitter and the SARSAT satellites travelling 22,000 miles above earth.

Older PLB's, if still in operation, without the GPS coordinate capability, provide a large footprint of a potential search area that can be several square miles in size.

SATELLITE EMERGENCY NOTIFICATION DEVICE (SEND)

As of 2019, SEND devices can be either one-way transmission devices, such as the basic SPOT, or two-way satellite transmission units such as the Spot X or Garmin in-Reach units.

Today, there are a variety of manufactures and many models to choose from. The key difference between SEND and PLB devices is the frequency the units operate on. SEND units transmit on the ~1610 to ~1626 MHz frequency range, versus the true PLB on the 406 MHz frequency. The other big difference is in signal strength. The SEND units are 1.6 watts of transmit power and the PLBs are 5 watts.

SEND devices utilize a network of commercial satellites versus governmental satellites and provide for two-way communications. These units communicate directly to the commercial satellite and are not dependent on cellular networks. SEND transmitters generally work around the world, if traveling to a foreign country, contact that country or NOAA to learn about any usage restrictions.

There are many commercial satellite constellations for backcountry emergency communication and the most popular are the Iridium and the Globalstar satellite constellations, as opposed to the governmentally operated SARSAT satellite system.

- **Garmin in-Reach** uses the Iridium satellite constellation is owned by Iridium Communications, Inc. and consists of 66 active satellites. The Iridium system operates in the frequency range of 1616 to 1626.5 MHz.
- **SPOT** uses the Globalstar satellite system is owned by Globalstar Inc. which consists of 24 active satellites. The Globalstar system operates in the frequency range of 1610.73 to 1621.35 MHz. Globalstar is used by the OnStar System in some vehicles. This system, and uses one frequency for US units and a different frequency for the rest of the world.

Both satellite systems operate in a low earth orbit of 485 miles versus the SARSAT's 22,000 mile orbit.

GEOS International Emergency Response Coordination Center (GEOS-IERCC), located in Houston TX, monitors both the Iridium and Globalstar satellites for emergency traffic. If an emergency signal is detected, GEOS determines the location and alerts the appropriate county's Sheriff who then activates local SAR teams for that area.

Some folks carry both a true PLB (406 MHz) and a two-way satellite transceiver such as a Spot X or Garmin in-Reach (~1610 – ~1626 MHz range). Each has their unique advantages.

For example:

- PLBs (406 MHz with 5 watts output power) will push an SOS signal through dense foliage better than a SEND. Getting the signal out under adverse conditions may lead to a faster reporting time to local SAR teams than the two-way satellite communication units. And, it is only a one-way communication.
- Whereas the SEND devices (~1610 – ~1626 MHz range and only 1.6 watts of power) may struggle to reach the satellite in similar conditions; but, it does allow for 2-way conversations when connected.

TWO-WAY SATELLITE COMMUNICATIONS

As of 2019, there are several companies who now offer global satellite two-way communications. SPOT X and Garmin in-Reach are probably the most widely used in the back country here in the US. Many features are similar, and each has its unique features. This is not an endorsement of either type. If interested in purchasing a SEND unit, you must research each unit's features, costs, ongoing subscriptions, etc. and determine which unit best meets your specific needs, and price range.

In 2019, the purchase price of a SEND unit varies, most in the $250 to $450 range depending on available features. Too, there are a variety of available service plans, which must be purchased for operation of the unit. Some service plans are annual, others are monthly. In comparison, a true PLB does NOT require the purchase of any service plan.

Because SEND units operate on private networks, registration with NOAA is not required. But, registration with the company is required for activation. Each company may request varying amounts of info, some is optional. Registration includes general information that might be needed in a rescue, e.g., name, age, address, medical info if desired, secondary emergency contact info, etc. It is from such registration that this important emergency information is provided to GEOS for use in an actual emergency.

GENERAL FEATURES FOUND ON SEND UNITS

The Garmin in-Reach and SPOT X are examples of modern global – two-way communication devices. Today, there is a wide selection of vendors. Features found in these units vary, but now most allow the user to:

1. Send an SOS – along with the GPS coordinates, and elevation of the individual requesting help. This message is without detail- just "I Need Help";
2. Send pre-written text messages to a selected recipient or recipients, and most importantly,
3. Send and receive customized SMS text messages (like on a smart phone) to any selected recipient or recipients. This feature allows the user to explain the nature of the emergency, and provide details of the emergency versus just "I Need Help".

Messages can often be directed to any cell phone number and/or to an email address. Too, units may allow direct posting to social media accounts like Facebook and Twitter.

A smart cell phone may be linked via Bluetooth to make "texting" easier. This feature may vary based on the unit. Some units on the market, such as Bivystick, require the linking of a cell phone for full operation. So, if the cell phone is broke or the battery is dead, you cannot communicate.

The SEND units function independent of a cell phone network; thus "no signal, no problem".

Basic mapping (scales vary) and other limited features found on a standard handheld GPS unit may also be provided. Again, features vary based on model, etc.

Furthermore, the Garmin in-Reach and Spot X user may allow for his/her location to be "shared". Sharing allows a person or persons at home to track that individual real time in the field on a mapping system. These programs vary from proprietary mapping programs to the use of Google maps, and can be used on an individual's computer, smart phone, or similar device; cellular or internet connection is required for the "in town" person to view such activity on-line. Periodic track points show current coordinates of each point, a visual tracking of the route a person is taking, the direction headed, elevation, and calculates speed of travel. Interval of transmission is a user selected option and there is a wide range of time intervals available; the most frequently selected interval is every 10 minutes.

There are too many companies, with varying features and subscriptions, who now provide these valuable services to discuss here. If looking to purchase such a device, you should do your own research and determine which service meets your unique needs and financial limits.

Alpine Rescue Team *of Evergreen, Colorado is a mountain search and rescue unit dedicated to saving lives through search, rescue, and mountain safety education. The Team is composed totally of volunteers and is available upon request to help in mountain search and rescue problems anywhere, under the authority of local jurisdiction agencies.*

Alpine Rescue Team has been a nationally-accredited member unit of the Mountain Rescue Association (MRA) since 1962. The function of the national association is to provide coordination, education and standardization to member units to promote maximum safety and effectiveness in mountain search and rescue. The association provides member units with information on testing and research of rescue equipment and techniques. It also provides extensive compilation, study and statistical analyses of lost persons and mountain search operations from units throughout the country.

The team is also an active member of two general rescue organizations. The Colorado Search and Rescue Board (CSRB), is an organization composed of many rescue units of differing disciplines throughout the state. The National Association for Search and Rescue (NASAR) is an organization which serves as a forum within which search and rescue teams exchange ideas on a national level. Any team or group involved with search and rescue, emergency situations, medical disasters, etc. can be a member of NASAR.

We have extensive backcountry safety information for hikers, climbers, mountaineers and visitors to the mountains on our PSAR page.