

GPS Feature of Some EPIRBs Fail

In March 2003, the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Coast Guard organized a test to determine the answer to a very troubling question: why, in 66% of real-world activations of GPS-enabled emergency beacons, were the GPS coordinates not transmitted to search and rescue authorities as they should have been?

This test — referred to as the Key West Test — was requested by representatives of COSPAS-SARSAT, the international, satellite-based distress alerting system that monitors emergency transmissions around the world. Originally, the test was to see if there was a weakness in their system of receiving distress alerts from mariners, pilots, and inland wilderness travelers in trouble, however, once the test was completed, another issue surfaced.

While the core function of the EPIRB — the 406 MHz distress signal — was reliable and could provide an approximate location of the distressed vessel via Doppler, not all the beacons performed the additional function of transmitting their exact GPS coordinates. In other words, some of the beacons were not performing as advertised.

This discovery disturbed those involved with the test and those privy to the results. Essentially, consumers were paying a premium for EPIRBs they believed had capabilities that could increase their chance for survival in an emergency — and some models clearly weren't meeting those claims. The problem was that beacon manufacturers had allowed their units to be tested in the Key West Test with the understanding of anonymity.

To confirm the Key West Test and ensure that the results were made public, a second set of tests was conducted by the nonprofit Equipped To Survive Foundation and sponsored in part by West Marine and the BoatU.S. Foundation for Boating Safety and Clean Water.

The Latest Tests

The second series of tests were conducted in January 2004, on and off the coast of Santa Cruz, CA. The Equipped To Survive Foundation performed the testing and representatives from the BoatU.S. Foundation, West Marine, the U.S. Coast Guard and NOAA attended, as well as representatives from some beacon manufacturers and other companies and agencies.

All beacons legal and available in the U.S. at the time of testing were included. Five were off-the-shelf models from ACR Electronics and McMurdo Ltd. The sixth was a Techtest GPS PLB, a prototype not readily available to consumers.



Tests included activating an EPIRB inside a life raft.

Baseline testing began with the beacons stationary on a jetty, with open, uninterrupted access to the sky and the GPS satellites. All beacons were activated using a test code so authorities would know it was not an actual emergency. On the jetty, all six activated beacons were able to lock on satellites (in other words, “acquire satellites”) and successfully transmit GPS coordinates with their distress alert.

Next, to test the beacon's ability to “refresh” its position every 20 minutes, useful if you were in a drifting life raft or disabled boat, the beacons were then hand-carried 400 yards and their GPS readings checked at the 20-minute update. Here was the first sign of trouble. The McMurdo Fastfind Plus PLB failed to update its position, even after it was allowed to remain on through a second 20-minute cycle. In the remainder of the baseline testing, all units except the McMurdo PLB performed as expected.

Next, during maritime testing, the six beacons were put through simulated boating emergencies in the Pacific Ocean. When activated out on the water, all the beacons reliably transmitted an emergency alert, however the McMurdo beacons — both the EPIRB and PLB — failed to transmit GPS coordinates when activated, even when the tester's control GPS was showing ample satellites in view. In test after test, the McMurdo beacons could not lock on satellites within the first 30 minutes of operation — the COSPAS-SARSAT certification requirement.

The first failure occurred on a sailing vessel in eight-foot swells, with clear and dry conditions and few obstructions to the horizon save for the mast overhead and the people sitting around the beacon. Neither McMurdo beacon could acquire satellites, though all other beacons had no trouble. During the remainder of maritime tests, the McMurdo beacons continued to have difficulty acquiring satellites and failed to transmit GPS coordinates in every subsequent planned maritime testing scenario.

Concerned by the findings, the testers put the McMurdo Precision GPS EPIRB to an additional test not part of the planned

How They Work

In a severe emergency, you would activate your **Emergency Position Indicating Radio Beacon (EPIRB)** or **Personal Locator Beacon (PLB)** by flipping a switch. The beacon then transmits on the 406 MHz frequency. It is detected by the **COSPAS-SARSAT Satellite Distress Alerting System** and the appropriate search and rescue authorities are notified. Provided you have registered your EPIRB with NOAA as required, authorities will also be able to access information about your vessel, emergency contacts, and how many are aboard.

There are two main advantages to using a GPS-enabled beacon over a “standard” 406 MHz beacon. First, authorities will not only receive your distress signal, but they should receive your exact GPS coordinates. Without GPS coordinates, authorities can narrow your position down to a radius of about two nautical miles via Doppler. Combined with a GPS, the unit's location can be pinpointed to within a half nautical mile.

Second, your position is transmitted much quicker when the GPS coordinates are available.

Standard 406 MHz EPIRBs are highly-trusted as a safety tool, and are rented through the BoatU.S. Foundation by the week. However, GPS-enabled EPIRBs are seen as an upgrade and can cost up to 50% more. With this comes the expectation that one's rescue will be more likely and time spent in the water will decrease.

To rent an EPIRB please visit us at www.BoatUS.com/foundations.

test protocol. In one- to two-foot, mirror-smooth seas and in clear weather, it was allowed to float free, as opposed to being tethered, which causes additional jerky movement. Here, in near perfect conditions, the McMurdo EPIRB was able to transmit its GPS coordinates when activated.

There were two other instances of failure in the maritime testing. The ACR GlobalFix EPIRB failed to transmit coordinates when in the water tethered to the RIB and being sprayed with water. The Techtest PLB failed to transmit from the life raft with the canopy open.

Cause for Concern

Again, it's important to note that all beacons reliably transmitted emergency signals; signals identical to those of a standard (non GPS-enabled) 406 MHz EPIRB. It was the repeated failure of the GPS feature in the McMurdo beacons in all but ideal conditions that concerned the testers.

Ideal situations, however, are really the only type of certification testing asked of GPS-enabled EPIRBs. COSPAS-SARSAT certification is made up of lab tests which do not reflect the unpredictable nature of the marine environment. A GPS signal is difficult to find and maintain in the presence of rain, saltwater, and obstructions like metal, rock — and even people. Movement only compounds the difficulty. So while McMurdo may have sold a product that did not perform as promised in all situations, they did meet what was required of them by COSPAS-



Coast Guard rescue swimmers help test EPIRBs.

SARSAT when the beacons performed flawlessly in minimally challenging situations. Could it be that COSPAS-SARSAT standards are simply not stringent enough?

What Now?

Above all, consumers should keep faith in the COSPAS-SARSAT System and 406 MHz beacons in general. It is specifically the failure of some to transmit additional GPS coordinates as promised that has brought attention industry wide. Before the Key West Test, as long as emergency beacons met COSPAS-SARSAT standards, they were approved by the Federal Communications Commission (FCC) before being sold to the public. With the new results, the question is: are the testing standards — lab tests under ideal circumstances — rigorous enough?

In response to the results of the testing, the Radio Technical Commission for Maritime Services (RTCM), an international nonprofit that monitors maritime radio navigation and radio communication issues,

established a special sub-committee to develop new “operationally-oriented” testing standards for PLBs. The FCC relies heavily on RTCM when developing new standards, and while it may take some time for the FCC to officially put new standards into place, RTCM’s recommendations could allow manufacturers to voluntarily begin more thorough testing by the end of the year.

West Marine was quick to respond by removing the units in question from all West Marine and BoatU.S. stores and offering refunds to customers who wanted to return the product. Some other retailers are doing the same.

Representatives from McMurdo, Ltd. say they are puzzled by the results and plan to conduct their own series of tests. Additionally, they plan to offer owners of their GPS-enabled beacons a software and firmware upgrade. As this issue of *BoatU.S. Magazine* goes to print, details of the planned tests and how to upgrade the beacons were not yet available. Equipped To Survive Foundation has announced plans to conduct independent tests of these upgraded McMurdo beacons.

For the latest on this developing story, or for the Equipped To Survive Foundation summary report, please visit www.equipped.org.

The BoatU.S. Foundation is a national nonprofit 501(c)(3) organization. Visit us at www.BoatUS.com/foundation.

Selected Maritime Testing Results of GPS-Enabled Emergency Beacons	Maritime Scenario Description	Conditions, Seas and Skies	ACR RapidFix 406 EPIRB with external GPS ¹	ACR GlobalFix 406 EPIRB	McMurdo Precision 406 GPS EPIRB	ACR GyPSI 406 PLB with external GPS ¹	McMurdo Fastfind Plus PLB	Techtest 500-27 PLB
	On aft deck of vessel, under mizzen boom	8 ft. swells with waves, partly overcast	▲ Success ⌚ 1 min. 18 sec. ➤ 4 satellites	▲ Success ⌚ 6 min. 28 sec. ➤ 6 satellites	▲ Fail ⌚ NA ➤ 5 satellites	▲ Success ⌚ 59 sec. ➤ 4 satellites	▲ Fail ⌚ NA ➤ 7 satellites	▲ Success ⌚ 16 min. 24 sec. ➤ 6 satellites
	In water tethered to Rigid Inflatable Boat	8 ft. swells with waves, partly overcast	▲ Success ⌚ 1 min. 16 sec. ➤ 6+ satellites	▲ Success ⌚ 4 min. 25 sec. ➤ 6+ satellites	▲ Fail ⌚ NA ➤ 6+ satellites	Not tested ¹	Not tested ¹	Not tested ¹
	In water tethered to Rigid Inflatable Boat with simulated rain/spray	8 ft. swells with waves, partly overcast	Invalid Activation ¹	▲ Fail ⌚ NA ➤ 6+ satellites	▲ Fail ⌚ NA ➤ 6+ satellites	Not tested ¹	Not tested ¹	Not tested ¹
	Held by swimmer tethered to Rigid Inflatable Boat	2-3 ft. swells with waves, clear	Not tested ¹	Not tested ¹	Not tested ¹	▲ Success ⌚ 57 sec. ➤ 8 satellites	▲ Fail ⌚ NA ➤ 6-8 satellites	▲ Success ⌚ 1 min. 51 sec. ➤ 7 satellites
	Secured on simulated swimmer (inflated swimmer's vest) in water tethered to Rigid Inflatable Boat with simulated rain/spray	2-3 ft. swells with 0.5 ft. wind chop, clear	Not tested ¹	Not tested ¹	Not tested ¹	▲ Success ⌚ 44 sec. ➤ 6 satellites	▲ Fail ⌚ NA ➤ 7-8 satellites	▲ Success ⌚ 7 min. ➤ 5-8 satellites
	In 6-person life raft with canopy open	2-3 ft. swells with 0.5 ft. wind chop, clear	▲ Success ⌚ 1 min. ➤ 8 satellites	▲ Success ⌚ 1 min. 58 sec. ➤ 7 satellites	▲ Fail ⌚ NA ➤ 7 satellites	▲ Success ⌚ 1 min. ➤ 8 satellites	▲ Fail ⌚ NA ➤ 7 satellites	▲ Fail ⌚ NA ➤ 9 satellites
	In water floating free <i>Originally not part of test protocol; given to McMurdo EPIRB as additional chance for success</i>	1-2 ft. swells with glassy surface, clear	Not tested	Not tested	▲ Success ⌚ 4 min. 23 sec. ➤ 11 satellites	Not tested	Not tested	Not tested
Footnotes 1. Garmin eTrex Legend GPS was used as the external GPS. Add up to 5 minutes to acquisition for a GPS cold start. 2. Results were excluded because external GPS was not held under spray. 3. Would not simulate a typical use of beacon.		LEGEND ▲ Success or failure to acquire a GPS location within 35 minutes ⌚ Time to acquisition, if location was acquired ➤ Number of satellites acquired by a control GPS, a Garmin eTrex GPS, monitored by testers						