National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: September 4, 2007

In reply refer to: A-07-51

Honorable Marion C. Blakey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

In 1970, in response to numerous airplane accidents in which the airplanes were difficult or impossible to locate, the U.S. Congress enacted Public Law 91-596,[1] mandating the installation of emergency locator transmitters (ELTs) in most general aviation airplanes[2] by December 30, 1973. Two years later, on October 16, 1972, House majority leader Hale Boggs, Congressman Nick Begich, and two others went missing on a Cessna 310 flight from Anchorage to Juneau, Alaska. Despite one of the longest searches in U.S. history, the airplane was never found.[3]

Since that time, numerous technical improvements to ELTs have been made, and an international, satellite-based search-and-rescue (SAR) system has been developed and implemented. The following letter explains those improvements and discusses accidents that demonstrate the need for additional action on this issue.

On March 2, 2003, about 2009 eastern standard time, a Piper PA-32-300, N4072R, was destroyed when it collided with terrain in Monterey, Massachusetts.[4] The certified private pilot and three passengers were fatally injured, and three passengers sustained serious injuries. Instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan was filed for the flight from Siler City Municipal Airport, Siler City, North Carolina, to the Dillant-Hopkins Airport (EEN), Keene, New Hampshire. The personal flight was conducted under 14 *Code of Federal Regulations* (CFR) Part 91. Although the airplane's Technical Standard Order (TSO)-C91 121.5-megahertz (Mhz) ELT functioned after impact, the airplane

[1] President Richard Nixon signed the Occupational Safety and Health Act into law on December 29, 1970.

[2] Title 14 *Code of Federal Regulations* 91.207 lists those general aviation aircraft that are exempt from the requirement to carry an ELT.

[3] The airplane was not equipped with an ELT.

[4] For more information about this accident, see NYC03FA061 at the Safety Board's Web site at <http://www.ntsb.gov/ntsb/query.asp>.

wreckage and survivors were not located until about 1226 on March 3, 2003, more than 16 hours after the accident.

National Transportation Safety Board investigators reviewed global positioning system (GPS) data from a handheld GPS receiver onboard the accident aircraft (see figure 1) and found that, about 1843, N4072R was approaching the New York–Connecticut border on a northeasterly heading toward Keene. ATC recordings revealed that the pilot contacted New York Terminal Radar Approach Control (TRACON) and stated that he did not like the weather at EEN, thus, he was canceling his IFR flight plan to EEN and was proceeding to Barnes Municipal Airport (BAF), Westfield/Springfield, Massachusetts, under visual flight rules (VFR). About 1849, a controller at the New York TRACON told the accident pilot that he was leaving the TRACON's area of radar coverage and advised the pilot to squawk VFR (transmit a 1200 transponder code) and contact Bradley TRACON, Windsor Locks, Connecticut, in approximately 10 miles. The pilot of N4072R acknowledged this transmission and changed his transponder code to 1200. This was the last communication between air traffic control and the airplane. At that time, the airplane was in the vicinity of Falls Village, Connecticut.

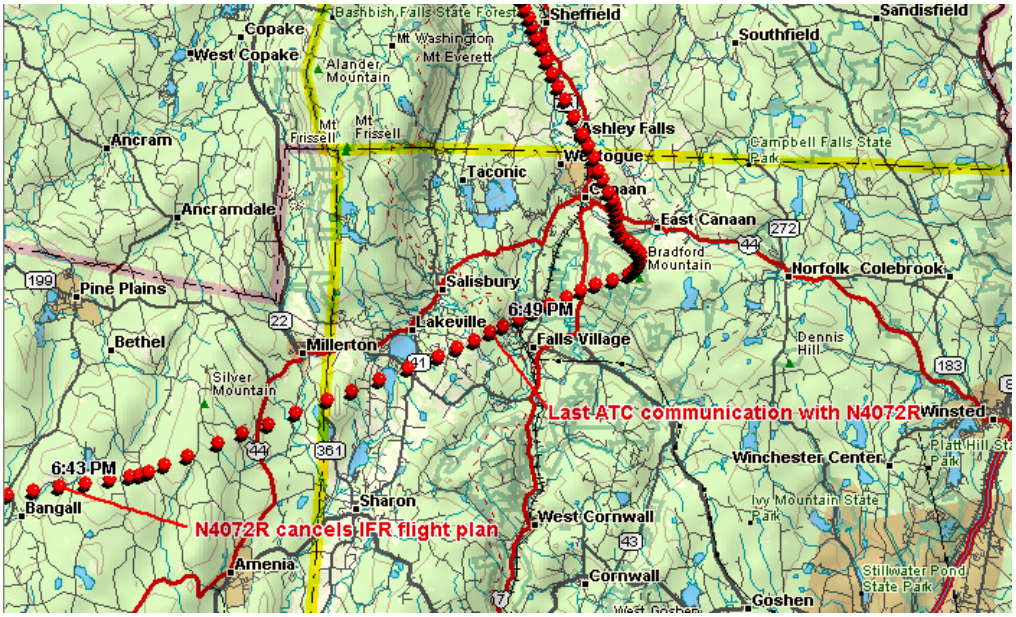

Figure 1. Plotted data recovered from handheld GPS receiver on board N4072R

Further review of GPS data indicates that, about 1900, N4072R landed at Great Barrington Airport (GBR), Great Barrington, Massachusetts. After being on the ground for about an hour, the airplane took off under VFR about 2003. N4072R turned to the north and established a northeasterly heading flying directly over Great Barrington about 2006 (see figure 2). The airplane impacted terrain just south of Mount Wilcox about 2009; however, the Federal Aviation Administration (FAA) was not aware that the airplane was missing until about 2200, when the FAA's Burlington (BTV) Automated Flight Service Station, Burlington, Vermont, received a phone call from a relative of those on board N4072R. The relative reported that he spoke to his sister, the pilot's wife, via cell phone about 1738 and that she told him that the

family was heading home to Keene. He could not reach his sister again, despite repeated calls to her cell and home phones.

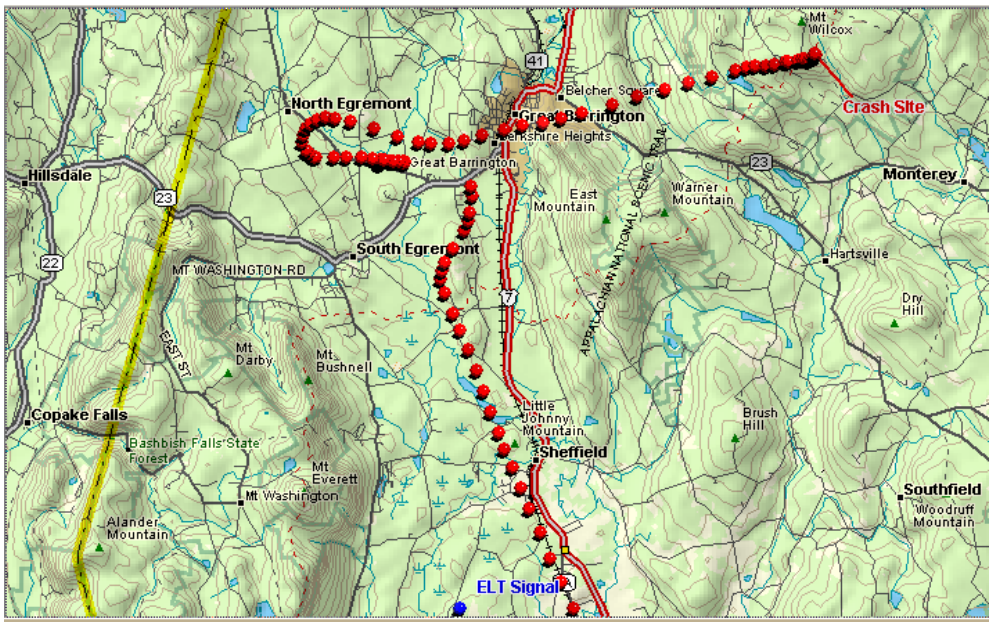

Figure 2. Plotted GPS data showing N4072R's landing and takeoff from GBR

After receiving the phone call from the relative, BTV began contacting other FAA facilities (including Boston Center, or ZBW) to request information about the airplane and to request ramp checks at airports along the airplane's intended route of flight. About 2139 (1 hour 31 minutes after the accident), the Air Force Rescue Coordination Center (AFRCC) in Langley, Virginia, received an ELT signal[5] near Sheffield, Massachusetts, from the COSPAS-SARSAT[6] system. Several minutes later, AFRCC opened an incident report for the ELT signal with ZBW.

About 2304, ZBW learned from the New York TRACON that the pilot canceled his IFR flight plan to EEN and changed his destination to BAF. While ZBW controllers were attempting to locate N4072R on the ground at BAF, they notified AFRCC that N4072R was overdue but that it may have landed at BAF and that its last known position was in the vicinity of Falls Village, Connecticut, at 1850. A short time later, local police reported that they had searched the

[5] The location of the ELT signal was approximately 11.25 miles southwest of the accident site.

[6] SARSAT (Search and Rescue Satellite Aided Tracking) was a system jointly developed in the 1970s by the United States, Canada, and France. A similar system was developed by the then-Soviet Union, known as COSPAS (Cosmicheskaya Systyema Poiska Avariynich Sudov—translated "space systems for the detection of vessels in distress"). The four nations banded together in 1979 to form COSPAS-SARSAT. The COSPAS-SARSAT system consists of a constellation of satellites and a network of Earth stations, which provide distress alert and location information for maritime, aviation, and land users to appropriate rescue authorities anywhere in the world. Instruments on board satellites in geostationary and low-Earth polar orbit detect the signals and transmit them to ground receiving stations, known as local users terminals (LUTs). The LUTs, in turn, provide the distress alert and location information to appropriate rescue authorities. In the United States, AFRCC receives all inland ELT detections while the Coast Guard receives all overwater detections. Since 1982, the COSPAS-SARSAT system has provided assistance in rescuing more than 20,000 people worldwide.

public parking area at BAF and did not locate the airplane. ZBW notified AFRCC, which opened an ELT incident report with Massachusetts Civil Air Patrol about 2343.[7]

Between 0006 and approximately 0145 on March 3, Massachusetts Civil Air Patrol actively began SAR operations by launching at least one fixed-wing airplane. Massachusetts State Police reported that their helicopters were unable to fly because of the extreme weather conditions (reportedly 25 mph winds with gusts to 40 mph expected).[8] Between 0300 and approximately 0430, local police searched the ELT coordinates in Sheffield but did not find N4072R. Massachusetts Civil Air Patrol airplanes continued searching for the airplane in the Great Barrington, Westfield, and Sheffield areas. About 0800, the Massachusetts State Police notified the New York State Police air wing of the ongoing search and requested helicopters to provide additional assistance searching the areas of Sharon, Connecticut, and Sheffield, Massachusetts.

About 1215, one of the New York State Police helicopters arrived at a set of ELT coordinates provided by Massachusetts Civil Air Patrol, and, after a short search, N4072R was located about 1226. A Civil Air Patrol ground team reached the scene about 1300 and found four survivors—the pilot and three of his sons, ages 10, 5, and 2. An 11-year-old boy, an 8-year-old boy, and the boys' mother had died of multiple traumatic injuries on impact. In addition to their traumatic injuries, the three surviving boys were all severely hypothermic with body core temperatures ranging between 74.1° and 92.5° Fahrenheit (F). While the three children recovered, the 5-year-old's frostbite injuries developed gangrene, and surgical amputation of his left leg (below the knee) was required. Trapped in his seat because of the deformation of the engine and fuselage, the children's father was conscious and able to communicate with rescuers on their arrival. After being extricated from the wreckage, he became asystolic, and cardiopulmonary resuscitation was performed en route to the local hospital emergency room. He arrived at the hospital about 1700 and was noted to be cold to the touch with a core temperature of 80ºF. His temperature was raised to 90ºF; however, no meaningful heart rhythm was ever restored. He was pronounced dead about 2047 on March 3, 2003; his cause of death was "hypothermia and cardiac asystole." A 406-MHz ELT could have identified the location in a more timely manner and possibly saved the life of the father.

In another accident, the airplane was equipped with a 406.025-Mhz ELT, which enabled AFRCC to receive the airplane's position 42 minutes after the crash. On February 16, 2005, about 0913 mountain standard time, a Cessna Citation 560, N500AT, crashed while on an instrument landing system approach to runway 26R at Pueblo Memorial Airport, Pueblo, Colorado.[9] The two flight crewmembers and all six passengers were fatally injured, and the

[7] An alert notice was not issued by BTV until about 2344 when BTV learned that the pilot had canceled his IFR flight plan with the New York TRACON.

[8] An automated weather report from Pittsfield, Massachusetts, about 0754 on the morning of March 3, 2003, indicated that the temperature was –4ºFahrenheit (F) with 17-knot winds gusting to 25 knots. These factors produced wind chill temperatures of approximately –27ºF.

[9] National Transportation Safety Board, *Crash During Approach to Landing, Circuit City Stores, Inc., Cessna Citation 560, N500AT, Pueblo, Colorado, February 16, 2005*, Aircraft Accident Report NTSB/AAR-07/02 (Washington, DC: NTSB, 2007).

airplane was destroyed by impact and a post-crash fire. The accident site was located in an open field approximately 4 miles east of the runway. The airplane was owned and operated by Circuit City Stores, Inc. of Richmond, Virginia, utilizing the aircraft management services of Martinair, Inc., also of Richmond. The flight was being conducted in accordance with 14 CFR Part 91, and instrument meteorological conditions prevailed on the approach.

N500AT was equipped with a G406-1 (406 MHz) ELT. As required by the National Oceanic and Atmospheric Administration (NOAA), the ELT's 15-digit identification code had been registered in NOAA's 406-MHz ELT registration database system. The ELT activated during the accident, and COSPAS-SARSAT satellites received the 406-MHz signal. AFRCC logs indicate that the ELT was detected immediately[10] and that contact information for N500AT's operator was provided to the AFRCC controller on duty. The controller used the contact information and called the Martinair operations center to report that the AFRCC "was receiving a possible distress signal on a/c N500AT." Approximately 20 minutes later, a Martinair employee called the AFRCC and told the AFRCC that "they believe that the aircraft was down." Although no ELT location information was provided in the initial ELT report,[11] a position 1.68 miles from the accident was received from the COSPAS-SARSAT system approximately 42 minutes later.

Title 14 CFR 91.207 currently requires a majority of general aviation airplanes to be equipped with an ELT that operates on one of two frequencies: 121.5 MHz (manufactured under TSO-C91a) or 406.025 MHz (manufactured under TSO-C126). Both frequencies can be detected by the COSPAS-SARSAT system, but they have considerable differences.

For example, the 121.5-MHz signal is an analog signal that the COSPAS-SARSAT satellites can receive. In addition to ELTs, other objects (including automated teller machines, pizza ovens, compact disk players, and stadium scoreboards) can sometimes emit a 121.5-MHz signal that the satellites can detect. Therefore, each 121.5-MHz signal that is detected must first be verified, which uses up time, resources, and money that could go toward addressing actual distresses. COSPAS-SARSAT satellites detect hundreds of hits from this frequency each day; according to NOAA statistics, more than 99 percent are false or non-emergency alerts.[12]

Conversely, a 406-MHz ELT emits a digital signal that allows for a unique identification code to be transmitted along with its distress signal. Because each identification code is unique and required by law to be registered in a NOAA database, rescue authorities can immediately identify exactly which aircraft is in trouble and, more importantly, get in touch with the emergency point of contact registered to the aircraft's ELT. This allows the rescue coordination

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[10] AFRCC recorded the time of the alert as 0909, which, due to differences in clock settings, was 4 minutes before the recorded time of the accident.

[11] This occurs when the 406-MHz ELT is detected but no encoded or Doppler position information is immediately available. The average time for a 406 MHz (non-GPS encoded) ELT position is approximately 30-45 minutes.

[12] National Oceanic and Atmospheric Administration brochure, *ELTs and EPIRBs [emergency position indicating radio beacons]: Transitioning from 121.5 MHz to 406 MHz* (Washington, DC: NOAA, 2003) <http://www.sarsat.noaa.gov/Phaseout_Brochure.pdf>.

centers to quickly confirm whether the distress is real and, thus, begin to mobilize appropriate SAR authorities.

In addition to decreasing false alerts and providing registration information, the 406-MHz ELT has a significantly stronger,[13] more stable signal and transmits a much more accurate location. While a 121.5-MHz position is accurate to within approximately 12–15 nautical miles, a 406-MHz position is accurate to within only 1–3 nautical miles. This equates to search areas of approximately 707-square nautical miles compared with 28-square nautical miles. This smaller search area not only increases the overall likelihood of rescue and the survival of those injured in the crash but also saves the time, money,[14] and resources of emergency responders and mitigates the potential risk to rescuers themselves.

The February 16, 2005, accident demonstrates the efficacy of 406-MHz ELT technology. The Safety Board finds that, had the airplane involved in the March 2, 2003, accident been equipped with a 406-MHz ELT, AFRCC would have received an alert notification of the accident in a more timely manner and notified the emergency point of contact registered to the aircraft's ELT hours before the phone call from the concerned relative. Additionally, the position received from the ELT would have led searchers to the immediate vicinity of the accident. This would have resulted in a much more timely rescue and, quite possibly, saved the life of the pilot who succumbed to the effects of hypothermia.

Dating back to the 1970s, the Safety Board has a long history of supporting ELT carriage on aircraft and improvements to ELTs. On February 8, 2000, the Board made several recommendations about ELTs after a Cessna 208B accident in Montrose, Colorado, in 1997.[15] Specifically, Safety Recommendation A-99-63 asked the FAA to "require that all Federal Aviation Regulation-mandated automatic ELTs meet the requirements of Technical Standard Order C126 or equivalent technology within 3 years."

The FAA responded that the 2000 FAA reauthorization bill permitted the carriage of an ELT that transmits on 121.5/243 MHz or 406 MHz or the carriage of other equipment approved by the Secretary of Transportation that meet the requirements of the ELT law.[16] Therefore, the FAA could not require the use of only TSO-C126 ELTs to meet the regulatory requirement. The

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[13] Approximately 5 Watts compared to 0.1 Watts for a 121.5-MHz ELT.

[14] According to the AFRCC's annual report, there were approximately 2,528 aircraft/121.5-MHz ELT missions in 2004. In these missions, 1,761 search aircraft flew for approximately 5,458 flight hours. AFRCC estimated that the total expenditure for these searches was approximately $1.3 million. This estimate does NOT include costs incurred by organizations other than the Air Force and Civil Air Patrol, such as state police, emergency management officials, and local emergency responders. Note that, since 1994, only four actual distress signals have been received from registered ELTs in the United States. None of those signals required any flight hours and were each resolved by AFRCC controllers in less than 1 hour.

[15] For more information about this accident, see DCA98MA002 at the Safety Board's Web site at <http://www.ntsb.gov>.

[16] Public Law 106–181 (dated April 5, 2000) specifically inserted "section (d) Compliance," which stated, in part, "an aircraft meets the requirement … if it is equipped with an emergency locator transmitter that transmits on the 121.5/243 megahertz frequency or the 406 megahertz frequency …" Before Public Law 106–181, 49 *United States Code* 44712 did not specify what frequencies could be used to meet the requirement.

Safety Board classified the recommendation "Closed—Reconsidered" because the FAA could no longer take the recommended action.

Additionally, in its final response to the FAA regarding Safety Recommendation A-99-63, the Safety Board urged the FAA to inform Congress that COSPAS-SARSAT will no longer process alerts for 121.5-MHz signals beginning February 1, 2009. COSPAS-SARSAT made a final decision in 2000 to cease satellite processing of these signals in response to guidance from the International Civil Aviation Organization (ICAO) and the International Maritime Organization.[17] Both United Nations organizations have recognized the limitations of the 121.5-MHz ELTs and the superior capabilities of the 406-MHz ELTs. The U.S. Interagency Group on International Aviation also did not object to the discontinuation of 121.5-MHz satellite processing.

The Safety Board is concerned that, although the United States supports the termination of 121.5-MHz signal processing, there are an estimated 180,000 general aviation 121.5-MHz ELTs in service[18] with no requirement to upgrade to a 406-MHz ELT when the satellite service is terminated in February 2009. More importantly, absent a requirement, the Board is also concerned that most general aviation users will not opt to install 406-MHz ELTs, thus, causing a dangerous situation where, beginning February 1, 2009, 121.5-MHz ELTs will only be detected by ground-based receivers or by overflying aircraft. This will necessitate U.S. SAR authorities reverting to older, less effective search methods and techniques, which would greatly decrease the likelihood of finding downed aircraft in a timely manner.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Seek authority from Congress to require the installation of Technical Standard Order C126 [406 megahertz (MHz)] emergency locator transmitters (ELTs) in all applicable aircraft at the earliest possible opportunity. Further, the Federal Aviation Administration should strongly consider establishing a compliance date for upgrading to 406-MHz ELTs on or before the date that COSPAS-SARSAT will cease satellite processing of 121.5-MHz signals. (A-07-51)

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred with this recommendation.

[Original Signed]

By: Mark V. Rosenker
Chairman

[17] In Annex 10, Volume III, Chapter 5, ICAO recommends that "all installations of emergency locator transmitters should operate on 406 MHz and 121.5 MHz simultaneously."

[18] General Aviation Manufacturers Association, *General Aviation Statistical Databook 2004* (Washington, DC: GAMA, 2005).