



REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A16-04

Emergency locator transmitter system crash survivability standards - European Organisation for Civil Aviation Equipment

Background

On 31 May 2013, at approximately 0011 Eastern Daylight Time, the Sikorsky S-76A helicopter (registration C-GIMY, serial number 760055), operated as Lifelight 8, departed at night from Runway 06 at the Moosonee Airport, Ontario, on a visual flight rules flight to the Attawapiskat Airport, Ontario, with 2 pilots and 2 paramedics on board. As the helicopter climbed through 300 feet above the ground toward its planned cruising altitude of 1000 feet above sea level, the pilot flying commenced a left-hand turn toward the Attawapiskat Airport, approximately 119 nautical miles to the northwest of the Moosonee Airport. Twenty-three seconds later, the helicopter impacted trees and then struck the ground in an area of dense bush and swampy terrain. The aircraft was destroyed by impact forces and the ensuing post-crash fire. The helicopter's satellite tracking system reported a takeoff message and then went inactive. The search-and-rescue satellite system did not detect a signal from the emergency locator transmitter. At approximately 0543, a search-and-rescue aircraft located the crash site approximately 1 nautical mile northeast of Runway 06, and deployed search-and-rescue technicians. However, there were no survivors.

The Board concluded its investigation and released report A13H0001 on 15 June 2016.

TSB Recommendation A16-04 (June 2016)

In this occurrence, as in numerous others investigated by the TSB,¹ the ELT system was rendered inoperative nearly immediately or within seconds following impact by damage sustained during the crash sequence. As a result, the ELT was unable to transmit a distress signal to the Cospas-Sarsat SAR satellite system. In many instances, ELT signals have not reached the Cospas-Sarsat system due to a broken antenna or a break in the wire connecting the ELT unit to the antenna. In this occurrence, it was determined that although the ELT unit was operable, a broken ELT antenna prevented the signal from being transmitted. The crashworthiness design specifications are robust for the actual ELT unit; however, the specifications are significantly less stringent for the other key components (i.e., the wiring and antenna) of the ELT system.

¹ TSB aviation occurrences A09Q0111, A09Q0190, A10A0041, A10A0122, A10O0125, A10O0145, A10O0240, A10P0142, A10Q0098, A10Q0111, A10Q0132, A11C0047, A11P0117, A11W0151, A12C0005, A12O0170, A12P0070, A13C0150, A13P0127, and A13W0009.

One of the inherent limitations of a 121.5 MHz ELT is its requirement for a whip-style antenna, which extends outward from the aircraft fuselage, significantly increasing the likelihood that it will be damaged or broken by impact with terrain, trees, or other parts from the aircraft during a crash sequence. Modern 406 MHz ELTs permit the use of low-profile (i.e., flush-mounted) antenna installations, which are significantly less susceptible to such damage. TC has recently issued an NPA that would mandate 406 MHz ELTs; however, the NPA also states that the regulation will mandate the carriage of dual 121.5/406 MHz ELTs. According to TC, retaining the 121.5 MHz requirement for new 406 MHz ELT installations, in accordance with Technical Standard Order (TSO) C126b, is to allow for homing. If these dual-frequency units are designed to use a single antenna, that antenna would need to be whip-style to accommodate the 121.5 MHz frequency. Some 406 MHz ELT units now come equipped with a backup, internal global positioning system (GPS) receiver and antenna that meet the specifications of Radio Technical Commission for Aeronautics (RTCA) RTCA DO-204A and European Organisation for Civil Aviation Equipment (EUROCAE) document ED62A. However, the internal antenna has not been tested and approved by Cospas-Sarsat, whose standard does not include details on the design's radiation and power output. Finally, depending on the location of the ELT unit, the signal from an ELT using an internal antenna may be emitted at a reduced effectiveness due to shielding from aircraft components or terrain. TC has indicated that it will not stipulate a dual-antenna requirement for new dual 121.5/406 MHz ELTs. As a result, if the design standards allow for a single antenna, versus separate 121.5 MHz and 406 MHz antennas, to be used on dual-frequency units, the risks associated with the use of a whip-style antenna will persist.

The International Civil Aviation Organization (ICAO) establishes International Standards and Recommended Practices for member states. However, it has not established any ELT system design standards; these are currently determined by national regulatory bodies such as TC, the Federal Aviation Administration (FAA), and the European Aviation Safety Agency (EASA). In Canada, Canadian Aviation Regulations (CARs) Part V – Airworthiness Manual (Chapter 551: Aircraft Equipment and Installation) states that ELTs must meet the performance standards for 121.5 MHz and 406 MHz ELTs set out by the RTCA. In the United States, although there is no regulatory requirement for 406 MHz ELTs, the FAA only accepts requests for new ELT technical standard order authorizations for 406 MHz ELTs. As in Canada, the FAA relies on the performance specifications set out by the RTCA. In Europe, EASA has taken a similar approach, requiring that ELTs meet the design specifications set out by EUROCAE. A considerable body of research now indicates that current ELT design standards do not ensure a reasonable degree of crash survivability.

As a result, it is highly likely that aircraft equipped with ELT systems that meet the current design standards will continue to be involved in occurrences in which potentially life-saving SAR services will be delayed as a result of damage to the ELT system, decreasing the survivability of an accident.

Therefore, the Board recommended that

The European Organisation for Civil Aviation Equipment establish rigorous emergency locator transmitter (ELT) system crash survivability specifications that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

TSB Recommendation A16-04

The European Organisation for Civil Aviation Equipment's response to Recommendation A16-04 (December 2016)

Following receipt of the report, EUROCAE consulted WG-98 "Aircraft Emergency Locator Transmitters", which is currently working on an update of ED-62A, as well as the EUROCAE governance bodies, notably the Technical Advisory Committee and the Council.

As a result of these consultation and coordination processes, EUROCAE acknowledges the recommendation A16-04 to expand the existing crash survivability minimum requirements for the ELT system in the Minimum Operational Performance Specification (MOPS).

EUROCAE establishes rigorous ELT system crash survivability specifications that reduce the likelihood that an Emergency Locator Transmitter (ELT) system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

The EUROCAE WG-98 was created in November 2013 to update requirements for Minimum Operational Performance Specification (MOPS) ED-62A that would help increase the technological capabilities of the ELT for the purpose of providing more timely and accurate alerts to search and rescue authorities. The WG-98 will address and improve in particular crash survivability, antenna and cabling specifications of the ELT.

EUROCAE WG-98 is working in conjunction with RTCA Special Committee SC-229, 406 MHz Emergency Locator Transmitters (ELTs). The WG-98 and SC-229 are working jointly with the main task of developing a revision B of ED-62A and a revision B of DO-204A, respectively. The EUROCAE WG-98 is expecting to complete its work by mid-2018.

Additionally, EUROCAE has published ED-237 Minimum Aviation System Performance Specification for Criteria to Detect In-Flight Aircraft Distress Events to Trigger Transmission of Flight Information, in March 2016, to support early triggering of emergency messages before crash impact.

TSB assessment of the European Organisation for Civil Aviation Equipment's response to Recommendation A16-04 (December 2016)

The Board is encouraged by EUROCAE's involvement in the Joint EUROCAE WG-98/RTCA SC-229 Working Group. In particular, the Board is pleased to hear that the working group will be updating industry specifications ED-62A and DO-204A, as they relate to antenna, cabling, and crash safety specifications.

The Board is also pleased that EUROCAE has published ED-237, outlining the minimum specifications to be met for the in-flight activation of ELTs. This capability increases the likelihood that a distress signal will reach the Cospas-Sarsat satellite when the pilot(s) have sufficient time to activate the system during an emergency situation.

The Board considers that these changes, once fully implemented, will substantially reduce or eliminate the safety deficiency associated with Recommendation A16-04.

Therefore, the response to recommendation A16-04 is assessed as **Satisfactory Intent**.

The European Organisation for Civil Aviation Equipment's response to Recommendation A16-04 (September 2019)

The recommendation issued by TSB regarding the ED-62A was a valuable input into the update of ED-62. Indeed, since the last response, EUROCAE published jointly with RTCA ED-62B/DO-204B 'MOPS for Aircraft Emergency Locator Transmitters 406 MHz' (Dec 2018).

The new specifications include new crash safety specifications based on extensive crash test performed by NASA; further information on these tests is available at <https://www.nasa.gov/feature/goddard/2019/faa-adopts-nasa-aviation-distress-beacon-recommendations>.

The new MOPS also cover the NASA recommendations for improve crash survivability to vibrations, resistance of coaxial cables, flame test,...; further information is available at <https://www.nasa.gov/sites/default/files/atoms/files/eltsurvivabilityguidancepostcard.pdf>.

As outlined above, ED-62B/DO-204B has been published in December 2018 and it is expected that EASA will issue a European Technical Standards Order (ETSO) making reference to ED-62B. A corresponding FAA TSO is also expected.

Furthermore, ICAO Annex 6 should be updated to include the reference to the ED-62B. ICAO will be informed as part of the Standards Round Table (SRT).

In addition, EUROCAE had previously developed and published ED-237, 'MASPS for Criteria to detect In-Flight Aircraft Distress Events to trigger Transmission of Flight Information' (Feb 2016), which defines the minimum specification to be met for criteria which can be used to detect an in-flight aircraft distress event and to trigger the transmission of sufficient information for the purpose of locating an accident site.

A reference to ED-237 has been introduced into the ICAO provisions in ICAO Annex 6 (Annex 6 Part I, amended in Nov 2016).

The work is completed; no further actions required, except some minor clarifications which may be introduced through a change to ED-62B/DO-204B in the near future to address some comments/questions received post-publication.

As far as EUROCAE is aware, ED-62B/DO-204B and ED-237 are now recognised as the main reference documents and manufacturers are developing ELT in line with these requirements.

The in-flight triggering mechanism was introduced through the ICAO GADSS initiative and ED-237 specifies characteristics that are relevant to the logic used for event detection and trigger activation/cancellation. These characteristics should be useful as guidance material to regulatory authorities, designers, installers, manufacturers, service providers and users of systems intended for operation.

EUROCAE considers that the recommendation A16-04 was addressed through the update of ED-62A and with the publication of the new version, ED-62B, considers that the action is complete.

The ICAO GADSS initiative has introduced the in-flight triggering mechanism, and ED-237 provides the technical standard supporting its implementation.

EUROCAE is not in a position to provide quantitative data or statistics on this matter, but attention is drawn again to the above-mentioned NASA studies.

TSB reassessment of the European Organisation for Civil Aviation Equipment's response to Recommendation A16-04 (December 2019)

The Board is pleased that the European Organisation for Civil Aviation Equipment (EUROCAE) Working Group (WG) 98, working in conjunction with the Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC)-229, has completed its tasks and that the following actions to address Recommendation A16-04 have been taken:

- in December 2018, EUROCAE published ED-62B, a new Minimum Operational Performance Standard (MOPS) for first- and second-generation 406 MHz emergency locator transmitters (ELTs) that includes:
 - more robust antenna cabling specifications;
 - crash survivability specifications; and,
 - installation guidance, including mounting location for both external and internal antennas and additional information regarding antenna cables.
- in December 2018, RTCA published DO-204B, a technically equivalent document to ED-62B.
- in March 2019, the Federal Aviation Administration (FAA) issued a revised Technical Standard Order (TSO)-C126c, *406 MHz Emergency Locator Transmitters*, which incorporates RTCA/DO-204B.

The Board acknowledges that EUROCAE is not the issuing authority for European Technical Standards Orders (ETSO); they are issued by the European Aviation Safety Agency (EASA). EASA has informed the TSB that it will soon issue ETSO-C126c (expected release January 2020), which is in line with the corresponding FAA TSO. Likewise, the Board understands that EUROCAE will also be informing the International Civil Aviation Organization (ICAO) of the revised MOPS, for inclusion in ICAO Annex 6.

The Board is encouraged by EUROCAE's work to establish minimum specifications for the detection of in-flight aircraft distress events.

The Board considers that the actions taken by EUROCAE will significantly reduce the risks associated with the safety deficiency identified in Recommendation A16-04.

Therefore, the Board considers the response to the recommendation to be **Fully Satisfactory**.

Next TSB action

This deficiency file is **Closed**.