



REASSESSMENT OF THE RESPONSE TO AVIATION SAFETY RECOMMENDATION A16-02

Emergency locator transmitter system crash survivability standards – International Civil Aviation Organization

Background

On 31 May 2013, at approximately 0011 Eastern Daylight Time, the Sikorsky S-76A helicopter (registration C-GIMY, serial number 760055), operated as Lifeflight 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 (ELT). 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 A16-02 (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 search-and-rescue (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;

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.

however, the specifications are significantly less stringent for the other key components (i.e., the wiring and antenna) of the ELT system.

One of the inherent limitations of a 121.5 megahertz (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. Transport Canada (TC) has recently issued a Notice of Proposed Amendment (NPA) that would mandate 406 MHz ELTs; however, the NPA also states that the regulations 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 United States 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 International Civil Aviation Organization establish rigorous emergency locator transmitter (ELT) system crash survivability standards 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 A16-02

International Civil Aviation Organization's response to Recommendation A16-02 (November 2016)

ICAO is currently participating in the Joint EUROCAE WG-98/RTCA SC-229 Working Group, *406 MHz Emergency Locator Transmitters (ELTs)*. The terms of reference for this group includes specific guidance to review Cospas-Sarsat beacon requirements, and from an aviation perspective, develop technical standards for both first and second generation Cospas-Sarsat 406 MHz beacon systems which include antenna, cabling specifications and crash safety specifications in order to update industry specifications ED-62A and DO-204A. This work is expected to be completed by December 2017.²

Subsequently, ICAO will consider a consequential amendment to Annex 10 - *Aeronautical Telecommunications, Volume III - Communication Systems, Part II - Voice Communication Systems, Chapter 5, Emergency Locator Transmitter (ELT) for Search and Rescue*, in light of the above work.

ICAO is also coordinating closely with the International Cospas-Sarsat Programme on the development of second generation beacon specifications to enhance the effectiveness of the ELT. These specifications are expected to be completed by 2018 in time for implementation with the new Medium Earth Orbit Search and Rescue (MEOSAR) satellite detection system. A further consequential amendment to Annex 10 should also be conducted after completion of this work.

Board assessment of International Civil Aviation Organization's response to Recommendation A16-02 (December 2016)

The Board is encouraged by ICAO's involvement in the Joint EUROCAE WG-98/RTCA SC-229 Working Group and its work with Cospas-Sarsat on the development of second generation beacon specifications. 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 considers that these changes, once fully implemented, will substantially reduce or eliminate the safety deficiency associated with Recommendation A16-02.

Therefore, the response to Recommendation A16-02 is assessed as **Satisfactory Intent**.

² The European Organisation for Civil Aviation Equipment (EUROCAE) has indicated that work will be completed by mid-2018. (See EUROCAE's response to TSB Recommendation A16-04.)

International Civil Aviation Organization's response to Recommendation A16-02 (December 2019)

The terms of reference of the Joint EUROCAE WG-98/RTCA SC-229 Working Group, *406 MHz Emergency Locator Transmitters (ELTs)* includes specific guidance to review Cospas-Sarsat beacon requirements, and from an aviation perspective, develop technical standards for both first and second generation Cospas-Sarsat 406 MHz beacon systems which include antenna, cabling specifications and crash safety specifications, in order to update industry specifications ED-62A and DO-204A.

Completion of this work was delayed from 2017 to December 2018, when it was published as EUROCAE ED-62B/RTCA-DO-204B Minimum Operational Standard (MOPs) for Aircraft Emergency Locator Transmitters (406 MHz). As a result, crash-survivability of ELT systems has improved the likelihood that impact forces sustained during an aviation occurrence will [not] render the systems inoperative. This can be seen in increased fire resistance requirements, expansion of the vibration tests, and additional crash-shock tests for off-axis G-forces. All conclusions derived from a NASA study.

Certain states have already included the new MOPs into their national regulations, including the FAA as TSO-C126c, since 3 July 2019. On this basis ICAO is in the process of evaluating the need for a consequential amendment to Annex 10 – *Aeronautical Telecommunications, Volume III – Communication Systems, Part II – Voice Communication Systems*, Chapter 5, Emergency Locator Transmitter (ELT) for Search and Rescue.

This assessment was expected to be completed during the early part of 2019; however, RTCA and EUROCAE are currently working on a revision in the form of ED-62B, Change 1. ICAO will be in a better position to determine what changes to ICAO provisions are necessary once this revision is finalized.

TSB reassessment of the International Civil Aviation Organization's response to Recommendation A16-02 (March 2021)

The Board is pleased that the International Civil Aviation Organization (ICAO) has been involved in Joint EUROCAE WG-98/RTCA SC-229 Working Group, *406 MHz Emergency Locator Transmitters (ELTs)*. As a result of this working group's efforts, updated standards for first- and second-generation 406 MHz ELTs were published in December 2018 as EUROCAE ED-62B/RTCA-DO-204B Minimum Operational Standard (MOPs) for Aircraft Emergency Locator Transmitters (406 MHz). These new standards include:

- 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.

The Board is aware that in March 2019, the Federal Aviation Administration issued a revised Technical Standard Order (TSO)-C126c, *406 MHz Emergency Locator Transmitters*, which incorporates RTCA/DO-204B. Likewise, in July 2020, the European Aviation Safety Agency also adopted this updated standard. Finally, Transport Canada has amended the *Canadian Aviation Regulations* (CARs) to require that, as of 07 September 2020, new applications for design approval of ELTs meet the latest CAN-TSO-126c, which meets RTCA/DO-204B.

In addition to the above steps, the TSB is also encouraged that ICAO is considering a consequential amendment to Annex 10 – *Aeronautical Telecommunications, Volume III – Communication Systems, Part II – Voice Communication Systems, Chapter 5, Emergency Locator Transmitter (ELT) for Search and Rescue*. This will help ensure that other states adopt the standards published in EUROCAE ED-62B/RTCA-DO-204B.

The Board considers that the actions taken by ICAO, and other agencies, will significantly reduce the risks associated with the safety deficiency identified in Recommendation A16-02.

Therefore, the response to Recommendation A16-02 is assessed as **Fully Satisfactory**.

Next TSB action

This deficiency file is **Closed**.