MALDIVES CIVIL AVIATION AUTHORITY
Republic of Maldives

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# Notice of Proposed Rule Making
# NPRM 2020-05

## Appendix 3 – Background to the Proposal

**28 October 2020**

# CONTENTS

# 1 Executive Summary

Distress beacons are radio beacons installed on most aircraft in order to transmit distress signals in the event of an accident or emergency landing. The signal transmitted at 406 MHz is detected by the satellites of the COSPAS-SARSAT constellation providing the location of the beacon and activating the Search and Rescue (SAR) service, with the aim of increasing the chances of survival. The beacon also transmits a homing signal on 121.5 MHz to guide the SAR aircraft in the vicinity of the crash site.

There are various types of distress beacons such the Emergency Locator Transmitter (ELT) used in aircraft, the Emergency Position-Indicating Radio Beacons (EPIRB) used on ships and Personal Locator Beacons (PLB) used by individuals. This NPRM relates to ELTs and aviation-use PLBs.

This Appendix provides the rationale and methodology used by the CAA to determine beacon requirements to ensure an expeditious emergency response.

# 2 In summary — why and what

## 2.1 Why we need to change the rules — issue/rationale

The primary reason for a revision to the rules stems from the Accident Investigation Coordinating Committee's report number 2015/04. It recommended the CAA to determine if emergency locator transmitter requirements specified in Air Safety Circular AW-12 Issue 3 are adequate to meet an expeditious emergency response. They further recommended the CAA to revise, if necessary, the regulation based on the determination.

The CAA also identified, during the review, the following additional reasons to revise the rules on distress beacons.

1. ELT and PLB are passive and dormant devices, whose status is unknown until they are required to perform their intended function. The proposed rule intends to introduce additional continuing airworthiness requirements to ensure serviceability of distress beacons in an emergency.

2. The Search and Rescue Point of Contact (SPOC) informed that most of the alerts received by it in the past have been false alerts. Inadvertent activation of ELT systems is a serious problem that expends resources and can divert equipment and manpower away from real emergencies. Furthermore, high false alarm rates can desensitize response teams that may think the event is not real. Besides triggering an emergency response, ELT activation near an airport may render some radio communications channels useless. The proposed rule intends to prevent or reduce the number of false alerts received by SPOC due to inadvertent activation of distress beacons.

3. Currently, ELTs in storage do not require registration with CAA. Therefore, if an ELT in storage is activated it will not be easy to differentiate between nuisance/false alerts and genuine emergency alerts.

4. Research indicates automatic activation of beacons during an accidents has been low. The proposed rule aims to introduced a new beacon specification that provides better performance and issue guidance on ELT installation so that the ELT will be activated automatically during an accident.

5. The current beacon registration process does not collect the information required by ICAO Annex 10. The proposed rules introduces mandatory information that will need to be shared with the CAA in order to register a beacon.

6. Current beacon coding permits beacon coding with nationality and registration marks and serial number of the individual beacon. The proposed rule expands the permitted coding protocols.

### 2.2 What we want to achieve — objectives

The main objectives of the proposed rule are:

1. Ensure that beacons used onboard aircraft are of improved design which meets specifications of COSPAS-SARSAT, RTCA, EUROCAE and TSO/ETSO C126 ().

2. Ensure that ELT and associated components remains serviceable and function as required during an emergency.

3. Avoidance of installation methods (e.g. hook and loop fasteners) that may prevent from activation during an accident.

4. Eliminate or drastically reduce the number of false alerts generated by ELTs.

5. Standardisation of ELT and PLB coding protocols used in Maldives.

6. Introduce an easy to use form to capture all the details important for search and rescue operations.

7. Provide guidance on allowed ELT testing methods.

### 2.3 What are the view of the stakeholders — outcome of the consultation prior to publishing NPRM

The Maldives SPOC, i.e. MACL Air Traffic Control (ATC) was consulted prior to the issue of this NPRM. MACL ATC informed that most distress alerts received in the past were false alerts and that there is a need to reduce the number of false alerts.

The CAA also consulted all the registered owners of aircraft to assess the status of ELTs and PLBs used on the Maldivian fleet.

We intend to receive further comments from stakeholders (e.g. aircraft operators) by sharing this NPRM with all stakeholders.

## 2.4 What are the expected benefits and drawbacks of the proposals

The expected benefits include:

1. Use of ELT with improved performance specifications.
2. Proper installation of ELT.
3. Better chance of making the ELT function as intended during an emergency.
4. Avoid wasting SAR resources by reducing or eliminating false alerts by ELT.
5. Keeping ELT database up to date with all necessary information accessible to SAR services.

Drawbacks could include added cost of the annual inspection of the ELT and associated components. However, this is offset by the fact that the regulation changes the ELT functional check from 90 days to six months, if allowed by ELT manufacturer.

# 3 Regulatory Framework

### 3.1 Operational Rules

The rules which require the use of a beacon are specified in the operational rules. For example, MCAR-Air Operations, which establishes detailed rules on operation of aeroplanes, helicopters, balloons and sailplanes, specifies the following rules.

- Part-CAT: CAT.IDE.A.280 Emergency locator transmitter (ELT), CAT.IDE.A.285 Flight over water, CAT.IDE.A.305 Survival equipment, CAT.IDE.H.280 Emergency locator transmitter (ELT), CAT.IDE.H.300 Life-rafts, survival ELTs and survival equipment on extended overwater flights, CAT.IDE.H.305 Survival equipment, CAT.IDE.S.130 Flight over water and CAT.IDE.B.140 Flight over water)

- Part SPA: SPA.HOFO.165 Additional procedures and equipment for operations in a hostile environment

- Part-NCC: NCC.IDE.A.215 Emergency locator transmitter (ELT), NCC.IDE.A.230 Survival equipment, NCC.IDE.H.215 Emergency locator transmitter (ELT), NCC.IDE.H.227 Life-rafts, survival ELTs and survival equipment on extended overwater flights and NCC.IDE.H.230 Survival equipment.

- Part-NCO: NCO.IDE.A.170 Emergency locator transmitter (ELT), NCO.IDE.H.170 Emergency locator transmitter (ELT), NCO.IDE.S.135 Flight over water and NCO.IDE.B.130 Flight over water).

- Part SPO: SPO.IDE.A.190 Emergency locator transmitter (ELT), SPO.IDE.A.200 Survival equipment, SPO.IDE.H.190 Emergency locator transmitter (ELT), SPO.IDE.H.199 Life-rafts, survival ELTs and survival equipment on extended overwater flights —complex motor-powered helicopters, SPO.IDE.H.200 Survival equipment, SPO.IDE.S.135 Flight over water, SPO.IDE.B.130 Flight over water, SPO.SPEC.PAR.120 Flight over water

Refer to latest version of MCAR-Air Operations to check the requirements regarding carriage of ELT and PLB.

### 3.2 Airworthiness Requirements for Beacons

The current rules which specify the technical specifications, installation, testing and registration requirements are in Air Safety Circular AW 12 Issue 3 dated 3 August 2000.

### 3.3 Latest on Minimum Operational Performance Standard (MOPS) for ELT

The latest MOPS is given in FAA TSO-C126c which refers to RTCA DO-204 revision B and EASA ETSO-C126c which refers to EUROCAE ED 62 revision B.

The proposed rule does not require Maldivian registered aircraft to be equipped with the **latest revision** of TSO-C126(). This is to give flexibility to the operator although there are safety benefits in complying with TSO-C126c as highlighted in Canadian Air Transportation Safety Board recommendation A16-03 (closed on December 2019) in report A13H0001 dated 15 June 2016.

# 4 Beacons

## 4.1 406 MHz Beacons

406 MHz beacons are distress beacons installed on most aircraft/vessels in order to transmit distress signals in the event of an accident or emergency landing.

A 406 MHz distress beacon transmits, every 50 seconds, a half-second burst of data. The Cospas-Sarsat satellites relay this data, referred to as the beacon message, to Cospas-Sarsat earth receiving stations called Local User Terminals (LUTs) which automatically examine the beacon message and determine the geographical location of the distress beacon.

The use of the 406 MHz system are in accordance with the appropriate provisions of the International Telecommunication Union (ITU) Radio Regulations, and the alerting signals are in accordance with relevant ITU-R Recommendations.

It is essential that only beacons which satisfy Cospas-Sarsat specification and type approval requirements are used, to ensure that the system performance requirements are met and to maintain the quality of alert and location data forwarded to search and rescue (SAR) services. The list of Cospas-Sarsat type approved beacons is provided in the Cospas-Sarsat System Data document issued by the Cospas-Sarsat Secretariat, and is also published to the Cospas-Sarsat website at www.cospas-sarsat.org.

Beacons may contain optional features that are defined in COSPAS-SARSAT specification C/S T.018. Encoded location capability is optional, however in the case of ELT (DT) devices intended for in-flight automatic activation the inclusion of a GNSS capability is mandatory.

All types of beacons (except currently ELT(DT)s) may also be provided with the Return Link Service capability. The Return Link Alert Service provides the users in distress an acknowledgment message informing them that the alert has been detected and located.

## 4.2 Beacon Identification

Each message transmitted by a 406 MHz beacon must uniquely identify the beacon. The complete beacon identification code includes the protocol flag, protocol code, country code, and other identification data, all of which are encoded in the first protected data field (PDF-1) of the 406 MHz message.

Identification data is encoded together with the country code and other information in the beacon message in binary format. For the purpose of transmission to SAR services in the alert message produced by Cospas-Sarsat, the unique identification of a 406 MHz beacon encoded in bits 26-85 of the beacon message is provided as a 15 hexadecimal character string, referred to as the beacon 15 Hex Identification, or beacon 15 Hex ID.

The beacon 15 Hex ID is used:

a. to correlate all the messages transmitted by a particular beacon;
b. to provide SAR services with information on the ship, the aircraft or the beacon owner in case of beacon alert; and

c. to retrieve information from the beacon registration databases.

### 4.3 Coding Protocols

Cospas-Sarsat 406 MHz beacons can be used in different environments and for a variety of applications such as EPIRBs (marine), ELTs (aviation) or PLBs (personal use). The specification of the distress signal characteristics (Cospas-Sarsat document C/S T.001), which ensures that all 406 MHz beacons are compatible with the Cospas-Sarsat Space Segment, is applicable to all types of beacons.

However, different user groups have different needs – hence the need for various coding protocols. Cospas-Sarsat specification provides for various coding options to satisfy these requirements. These are divided in two groups of coding protocols:

- User Protocols; and
- Location Protocols.

The user protocols can be used for encoding the beacon identification and other data in the digital message transmitted by a 406 MHz distress beacon, but do not allow for encoding beacon position data. User protocol options are shown below:

Figure 1 List of Available Coding Options for User Protocols

| Application | Identification data | Protocols |
|---|---|---|
| ELT | Unique ELT Serial Number* | Serial User |
| | Aircraft Operator Designator & Serial Number* | Serial User |
| | Aircraft 24-bit Address | Serial User |
| | Aircraft Registration Marking | Aviation user |
| PLB | Unique PLB Serial Number* | Serial User |

The location protocols can be used for encoding beacon position data, in addition to the beacon identification data, in the digital message transmitted by a 406 MHz distress beacon

Figure 2 List of Available Coding Options for Location Protocols

| Application | Identification data | Location data | Protocols |
|---|---|---|---|
| ELT | Unique ELT Serial Number* | 4 minute resolution encoded in PDF-2 | User-location |
| | | position offset to 4 second resolution encoded in PDF-2 in addition to 15 minute resolution encoded in PDF-1 | Standard Location |
| | Aircraft Operator Designator & Serial Number* | 4 minute resolution encoded in PDF-2 | User-location |
| | | position offset to 4 second resolution encoded in PDF-2 in addition to 15 minute resolution encoded in PDF-1 | Standard Location |
| | Aircraft 24-bit Address | 4 minute resolution encoded in PDF-2 | User-location |

| | | | |
|---|---|---|---|
| | | position offset to 4 second resolution encoded in PDF-2 in addition to 15 minute resolution encoded in PDF-1 | Standard Location |
| | Aircraft Registration Marking | 4 minute resolution encoded in PDF-2 | User-location |
| | Serial number assigned by Administration | position offset to 4 second resolution encoded in PDF-2 in addition to 2 minute resolution encoded in PDF-1 | National Location |
| PLB | Unique PLB Serial Number* | 4 minute resolution encoded in PDF-2 | User-location |
| | | position offset to 4 second resolution encoded in PDF-2 in addition to 15 minute resolution encoded in PDF-1 | Standard Location |
| | Serial Number* Assigned by Administration | position offset to 4 second resolution encoded in PDF-2 in addition to 2 minute resolution encoded in PDF-1 | National Location |

The proposed Circular specifies which protocols may be used to code Maldivian registered aircraft to standardise the coding.

### 4.4 Encoded Position Data

Beacon messages encoded with the location protocols include position data in addition to the beacon identification data. Such position data can be derived from a satellite navigation system, such as GPS or GLONASS, using either a receiver integrated into the beacon, or an external navigation receiver connected to the beacon.

The incorporation of the position data into the beacon message provides locating capability for 406 MHz alerts received through geostationary satellites in the 406 MHz GEOSAR system.

GPS-equipped ELTs significantly increase the accuracy of positional resolution from approximately 5 km (non-GPS) to approximately 120 m (GPS)[1].

### 4.5 Format of the 406MHz beacon message

<u>General format of the 406 MHz beacon message</u>

Figure 3.1a Fields of the short message format

| | Bit Synchronization | Frame Synchronization | First Protected Data Field (PDF-1) | | | | BCH-1 | Non – protected data field |
|---|---|---|---|---|---|---|---|---|
| Unmodulated Carrier (160 ms) | Bit Synchronization Pattern | Frame Synchronization Pattern | Format Flag | Protocol Flag | Country Code | Identification or Identification plus Position | 21-Bit BCH code | Emergency Code/ National Use or Supplement. Data |
| Bit No. | 1-15 | 16-24 | 25 | 26 | 27-36 | 37-85 | 86-106 | 107-112 |

[1] Australian Transportation Safety Board (ATSB) Transport Safety Report no. AR-2012-128 dated 21st May 2013

Figure 3.1b: Fields of the long message format

| | Bit Sync | Frame Sync | First Protected Data Field (PDF-1) | | | | BCH-1 | Second protected data field | Non – protected data field |
|---|---|---|---|---|---|---|---|---|---|
| Unmodulated Carrier (160 ms) | Bit Sync Pattern | Frame Sync Pattern | Format Flag | Protocol Flag | Country Code | Identification or Identification plus Position | 21-Bit BCH code | | Emergency Code/ National Use or Supplement. Data |
| Bit No. | 1-15 | 16-24 | 25 | 26 | 27-36 | 37-85 | 86-106 | 107-132 | 133-144 |

The protected data field consisting of bits 25 through 85 shall be protected by an error correcting code and shall be the portion of the message which shall be unique in every distress beacon

Further technical information, if required, may be obtained from ICAO Annex 10 Volume 3 or the Cospas-Sarsat system documents. These are available for download from their website at https://www.cospas-sarsat.int/en. The documents felt to be of prime interest are:

- G.003 - Introduction to the Cospas-Sarsat System;
- G.005 - Guidelines on 406 MHz Beacon Coding, Registration and Type Approval;
- T.001 - Specification for Cospas-Sarsat 406 MHz Distress Beacons;
- T.012 - Cospas-Sarsat 406 MHz Frequency Management Plan; and
- T.018 - Specification for second-generation Cospas-Sarsat 406 MHz Distress Beacons

**Example of a Coding.**

Figure 4: Coding ELTs with the Aircraft Nationality and Registration Marking

| Bits | 25 | 26 | 27.......36 | 37....39 | 40..........................................81 | 82....83 | 84 | 85 |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | Country code | 0 0 1 | Aircraft Registration Marking (42 bits = up to 7 alphanumeric charact.) | ELT number | R | L |

| | |
|---|---|
| - Bit 25: | format flag set to "0" (short message); |
| - Bit 26: | protocol flag set to "1"; |
| - Bit 27 to 36: | country code = 3 digit decimal number encoded in binary notation; |
| - Bit 37 to 39: | protocol code, set to "001" (aviation user protocol); |
| - Bit 40 to 81: | aircraft nationality and registration marking, containing up to 7 alphanumeric characters, is encoded using the modified-Baudot code; if the aircraft nationality and registration marking include less than 7 characters, blank spaces should be encoded to the left of the characters using the modified-Baudot space symbol: "100100"; |
| - Bit 82 to 83: | Specific ELT number where “00” indicates the first ELT on the aircraft coded with this protocol and “01”, “10” and “11” identify additional ELTs on the same aircraft, all coded with the Aviation User protocol; |
| - Bit 84 to 85: | (RL) set to "01" if a 121.5 MHz radio-locating transmitter is included in the beacon. |

### 4.6 Operational Use of Beacon Registration Databases

It is crucial that 406 MHz distress beacons are registered in recognized beacon registration databases that are accessible to search and rescue authorities 24 hours a day. The information contained in these databases concerning the beacon, its owner, and the aircraft on which the beacon is mounted is vital for the effective use of Search and Rescue resources. The unique information encoded in the Cospas-Sarsat 406 MHz beacon message provides the information necessary to identify the register that should hold the registration information for that beacon, and it is also the unique key used for retrieving the registration details.

The proposed Circular introduces registration requirements to ensure vital information is transmitted to search and rescue authorities.

**4.7 Beacon Activation**

Data collected by Safety Investigation Authorities from accident investigation reports involving mainly helicopters and general aviation aeroplanes show that the availability of ELT signal transmission is low after a crash. As a consequence, SAR activity is delayed or unpractical. Finding the aircraft wreckage quickly not only increases the chance of survival of the occupants, but also reduces the risk to pilots of SAR aircraft who commonly need to operate in marginal weather conditions.

It is also important to remember that ELTs are an important safety device, not only for aircraft occupants, but also for SAR personnel. Even if an aircraft is destroyed in an accident and the occupants are deceased, a functioning ELT helps SAR in minimising search times, risk to rescue personnel, and use of SAR resources[2].

In accidents where ELTs did not work effectively (or at all), it was found that the performance of ELTs could be affected by:

- Not selecting the ELT activation to the armed position before flight;
- Inappropriate installation of the ELT or any of the activation sensors;
- Discharged batteries;
- Corrosion;
- Disconnection of the co-axial antenna cable from the unit during impact;
- Damage and/or removal of the antenna during impact;
- Radiation obstructed by the wreckage.

Some other issues such as human factors or maintenance may cause inadvertent activation, causing unnecessary SAR activity, or deployment of the ADELT, which can also create hazards to people on the ground and make the aircraft difficult to find if the ELT is deployed far away from the actual accident site.

The proposed Circular introduces TSO C126 revision A or higher to improve performance and requires additional continuing airworthiness tasks.

**4.8 Inadvertent activation of ELT**

Inadvertent activation of ELT systems is a serious problem that expends resources and can divert equipment and manpower away from real emergencies. Furthermore, high false alarm rates can desensitize response teams that may think the event is not real. While all ELT activations trigger a response from emergency response teams, only a small fraction are real emergencies. It is important, for this reason that all personnel that work around

[2] Australian Transportation Safety Board (ATSB) Transport Safety Report no. AR-2012-128 dated 21st May 2013

and with ELT equipment understand how the units are activated and deactivated, and what should be accomplished if one is inadvertently turned on.

The proposed Circular introduces newer specification, registration, continuing airworthiness tasks and guidance on installation to reduce inadvertent activation of beacons.

# 5 ELT Installation

### 5.1 ELT installation considerations.

The location of the ELT should be chosen to minimize the potential for inadvertent activation or damage by impact, fire, or contact with passengers or baggage.

The ELT unit should be mounted to primary aircraft load-carrying structures such as trusses, bulkheads, longerons, spars or floor beams (not aircraft skin). Otherwise, the structure should meet the requirements of the test specified in section 6.1.8 (a) of the EUROCAE[3] document ED-62A or later amendments. This test is quoted for quick reference:

"The mounts shall have a maximum static local deflection no greater than 2.5 mm when a force of 450 Newtons (l00 lbf) is applied to the mount in the most flexible direction. Deflection measurements shall be made with reference to another part of the airframe not less than 0.3 m or more than 1.0 m from the mounting location."

However, this does not apply to ELT (S), which should be installed or stowed in a location that is conspicuously marked and readily accessible, or should be integral to a buoyant device such as a life raft, depending if it is Class A or B.

Crash acceleration sensor installation can be also a source of nuisance triggers, missed activation or missed deployment due to improper installation.

Nuisance triggers can occur when the crash acceleration sensor does not work as expected or is installed in a way that it is exposed to shocks or vibration levels outside those assumed during equipment qualification, making it susceptible to activate inadvertently. It also can be activated as a result of improper handling and installation practices.

Non activation can occur when operational ELTs are attached to the aircraft in a way that prevents the crash sensor from sensing actual crash forces.

Particular attention should be paid to the installation orientation of the crash acceleration sensor. Equipment containing a crash sensor will be clearly marked by the ELT manufacturer to indicate the correct installation orientation(s), if appropriate, for crash sensing.

### 5.2 Location for Inertial Activation.

ELT (AF) devices are inertially activated ELTs to meet the g force requirements of TSO-C126(). Installation design should follow the instructions contained in the installation manual provided by the equipment manufacturer.

In general, for fixed–wing aircraft, the sensor should be installed in such a way that it senses forces at least in the main longitudinal direction of the aircraft.

[3] https://www.eurocae.net/

In the case of a helicopter installation, if the equipment has been designed to be installed on fixed-wing aircraft, the equipment manufacturer has historically recommended the installation to be oriented with an angle of 45 degrees with respect to the main longitudinal axis. This may help the sensor to detect forces in directions other than the main longitudinal axis, since during a helicopter crash, the direction of the impact may easily differentiate from the main aircraft axis. Nevertheless, it should be noted that this is not the unique solution for helicopters. There are products currently available on the market that are designed specifically for helicopters and/or designed to sense forces in several axes

**5.3 Location of ELT.**

ELT (AF) devices should be attached in a location free of moving parts, such as cables or other objects that may strike and inadvertently trip the g sensor.

Devices should not be mounted to thin walls that may vibrate and, as a result of vibration, trip the inertial sensor.

Devices should not be mounted in luggage compartments or areas used for stowage, as they will be susceptible to being bumped and inadvertently activated.

Aircraft-mounted devices should be mounted as far aft as practicable.

ELT (AF) and ELT (AP) devices meeting TSO-C126( ) are not to be mounted using hook-and-loop fastener systems such as Velcro®. Hook-and-loop fastener systems may act as a shock absorber and fail to trip the inertial g sensor within the ELT. Devices installed with hook-and-loop fastener mounting systems may fail to hold the device securely, leading to damage of the unit, antenna, or antenna cabling in a crash.

Manufacturers' instructions should be consulted when installing portable ELT devices.

The ELT system should be installed such that inadvertent activation in flight will not adversely affect any aircraft systems that perform a function whose failure would prevent the continued safe flight and landing, or significantly reduce the capability of the airplane, or the ability of the flightcrew to respond to an adverse operating condition.

**5.4 Location and Access of Controls.**

If used, remote controls are required to be within reach of seated crewmembers if the ELT device is not readily accessible in flight. Aircrews must be able to control the ELT system directly or through the use of remote controls to allow them to deactivate the system if it is inadvertently set to "on" in flight by severe turbulence or other events.

**5.5 ELT antenna installation**

The recommendations addressed under this paragraph do not apply to ELT(S).
The most recurrent issue found during accident investigations concerning ELTs is the detachment of the antenna (coaxial cable), causing the transmission of the ELT unit to be completely inefficient.

ED-62A chapter 6 addresses external antenna installation and provides guidance, in particular, about:
- Antenna location
- Antenna position relative to ELT Transmit Unit
- Coaxial cable characteristics
- Coaxial cable installation

The most effective antenna configuration for typical high-wing and low-wing aeroplanes is an external antenna, on top of the fuselage, and aft of the wing (high-wing), or near the vertical stabilizer (low-wing). ELT antennas should be located away from other antennas to avoid disruption of antenna radiation patterns. In any case, during installation of the antenna it should be ensured that the antenna has a free line of sight to the orbiting COSPAS-SARSAT satellites at most times when the aircraft is in the normal flight attitude.

**Location of Antenna**. Care should be given to antenna placement since this can have a significant impact on signal detection if the ELT is activated.

<u>Exterior Antenna Placement.</u>
1. If practical, ELT antennas should be placed on the exterior of the fuselage.
2. Typically, ELT antennas should be placed at least 30 inches (76.2 cm) away from other very high frequency (VHF) antennas. Testing should be performed to ensure ELT transmissions will not disrupt VHF systems if an ELT antenna is placed within 30 inches of a VHF antenna.
3. The antenna should be fully extended and in a vertical position when the airplane is in the normal flight attitude.
4. If the antenna is installed within a fin cap, the fin cap should be made of a material that is RF transparent and will not severely attenuate the radiated transmission or adversely affect the antenna radiation pattern shape

<u>Interior Antenna Placement.</u>
1. ELT antennas should only be installed inside an aircraft fuselage whenever an external mount is not practical.
2. Consideration should be given to placing the antenna so that it is in a vertical position when the airplane is in the normal flight attitude.
3. If an ELT antenna is mounted on a radio transparent aircraft, the antenna should be mounted to a ground plane.
4. In metal-framed aircraft, if the antenna cannot be mounted on the outside of the fuselage, the antenna should be as close to a window or similar radio frequency (RF)-transparent opening as possible since metal frames can block or diminish a radiated ELT signal.
5. If the antenna is placed in a window, the antenna should be located in the approximate center of the window so that at least 12 inches of the antenna length is exposed. The window should be at least 12 inches high and 12 inches wide to accommodate the antenna.

**5.6 Location of Antenna Cable.**

Care should be given to antenna cable placement. Installers should be familiar with AC 43.13-1(), Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair, and in particular, Chapter 11, Section 8, Wiring Installation Inspection Requirements.

Cabling should be mounted in a manner to preclude inadvertent damage from moving aircraft components, such as flight control cabling, or damage caused by items being frequently stowed on or near them.

In areas where the cable or antenna may come in contact with metal, such as a window frame, a fire sleeve meeting the requirements of SAE Aerospace Standard (AS) 1072, Sleeve, Hose Assembly, Fire Protection, should be installed to better prevent post-accident grounding of the antenna.

**5.7 Use of Hook-and-Loop Fasteners.**

Hook-and-loop fastener systems, such as Velcro®, should not be used to mount ELT devices to aircraft.

ELTs mounted to aircraft using hook-and-loop fastener systems have been found to dampen g forces, which directly impact the ability of the ELT to trigger.

Hook-and-loop fastener systems can allow an ELT device to vibrate free of its mount and change its orientation, which affects its ability to correctly detect a g shock.

Accident investigators have also noted hook-and-loop fastener systems have allowed ELT devices to be thrown from a crashed aircraft, breaking the antenna connection in the process, and rendering the device useless.

Hook-and-loop fastener systems are not allowed to be used to mount ELTs that meet the requirements of TSO-C126b or later revision.

For the reasons stated above, hook-and-loop fasteners are strongly discouraged on ELTs certified prior to the issuance of TSO-C126b.

**5.8 Post-Installation Test.**

Installers should carefully follow manufacturer’s instructions and perform any post-installation tests to verify that the ELT will function as intended.

**5.9 Deployment aspects of Automatic deployable ELT (ADELT)**

General recommendations about ELT installation are provided in ED-62A; however this standard does not provide detailed or extensive guidance for the particular case of ADELTs. ADELTs have particularities of the design and installation that need to be addressed independently of the general recommendations.

CAA UK has recently published the CAP1144 ADELT Review Report containing a thorough investigation of incidents and accidents reports where ADELTs failed or inadvertently deployed. This section aims to summarise the most important conclusions related to the installation and maintenance practices from this report.

The location of the ELT (AD) and its manner of installation should minimise the risk of injury to persons or damage to the aircraft in the event of inadvertent deployment. If a manual deployment of the ADELT is required, the means to manually deploy the ADELT should be located in the cockpit in such a way, and should be guarded so that, inadvertent manual activation of the ADELT is minimised.

Automatic deployable ELTs should be located so as to minimize damage to the aircraft structure and surfaces during deployment. The ELT deployment trajectory should be demonstrated to be clear of interference from the airframe or other part of the aircraft, or with the rotor in the case of helicopters. The installation should also not compromise the operation of emergency exits or of any other safety features.

The hydrostatic sensor used for automatic deployment should be installed in a location shown to be immersed within a short time after the crash, but not subject to water exposure in the expected aircraft operations.

### 5.10 Additional considerations

This section addresses additional considerations that contribute to the ELT performs its intended function:

<u>Human factors:</u>
The ELT controls should be designed and installed so that they are not activated unintentionally. These considerations should address the control panel locations, which should be clear from flight crew movements when getting into the cockpit and when operating the aircraft, and the control itself. The means for manually activating the ELT transmission should be guarded in order not to be activated unintentionally.

The Aircraft Flight Manual should document the operation of the ELT, and in particular, any feature specific to the installed model.

<u>Batteries:</u>
The ELT operates using its own power source. The ELT manufacturer indicates the useful life and expiration date for the batteries by means of dedicated label. The installation of the ELT should be such that the label indicating the battery expiration date is clearly visible without requiring removal of the ELT or other LRU from the aircraft. This would facilitate replacement of the battery and maintenance activities.

# 6 Abbreviations

| | |
|---|---|
| **AD** | Automatic Deployable |
| **AF** | Automatic Fixed |
| **AP** | Automatic Portable |
| **CAA UK** | Civil Aviation Authority of United Kingdom |
| **CAT** | Commercial Air Transport |
| **CM** | Certification Memorandum |
| **CofA** | Certificate of Airworthiness |
| **COAPAS-SARSAT** | COSPAS-SARSAT is an acronym for COsmicheskaya Sistyema Poiska Avariynych Sudov (Russian, meaning space system for the search of vessels in distress) Search And Rescue Satellite Aided Tracking. |
| **CPI** | Crash Position Indicator |
| **CS** | Certification Specification |
| **dB** | Decibel |
| **dBm** | Decibel-Milliwatts |
| **dBW** | Decibel-Watts |
| **EASA** | European Aviation Safety Agency |
| **ELT** | Emergency Locator Transmitter |
| **ELT (AD) or ADELT** | Automatic deployable ELT |
| **ELT (AF)** | Automatic fixed ELT |
| **ELT (AP)** | Automatic portable ELT |
| **ELT (DT)** | Distress tracking ELT |
| **ELT (S)** | Survival ELT |
| **ETSO** | European Technical Standard Order |
| **EUROCAE** | European Organization for Civil Aviation Equipment |
| **FAA** | Federal Aviation Administration of the United States of America |
| **GEOLUT** | Geostationary Local User Terminal |
| **ICA** | Instructions for Continued Airworthiness |
| **ICAO** | International Civil Aviation Organization |
| **LEOLUT** | Low Earth Orbit Local User Terminal |
| **MCC** | Mission Control Centers |
| **MHz** | Megahertz |
| **MOPSC** | Maximum Operational Passenger Seating Configuration |
| **NAA** | National Aviation Authority |
| **NCC** | non-commercial operations with complex motor-powered aircraft |
| **NCO** | non-commercial operations with other-than-complex motor-powered aircraft |
| **PDF-1** | First Protected Data Field |
| **PDF-2** | Second Protected Data Field |
| **RF** | Radio Frequency |
| **RTCA** | Radio Technical Commission for Aeronautics |
| **S** | Survival |
| **SAIB** | Special Airworthiness Information Bulletin |
| **SAR** | Search And Rescue |
| **SIB** | Safety Information Bulletin |
| **SPOC** | Search and Rescue Point of Contact |
| **TU** | Transmitting Unit |
| **VHF** | Very High Frequency |
| **VSWR** | Voltage Standing Wave Ratio |
| **$W/m^2$** | Watt per Square Meter |

# 7 References

The following documents and materials were referred in the development of the proposed rule:


1. The existing regulation on ELT requirements issued by Maldives CAA, ASC AW 12 issue 3 dated 03 August 2000

2. MCAR Air Operations, Issue 4.00 dated 05 January 2020

3. Civil Aviation Advisory Publications to MCAR Air Operations. CAAP Air OPS initial issue dated 01 March 2015

4. MCAR-1 Definitions and Abbreviations, Issue 3.00 dated 30 September 2020

5. Federal Aviation Administration (FAA) Advisory Circular (AC) 91-44A (Change 1): Installation and Inspection Procedures for Emergency Locator Transmitters and Receivers, dated Feb 1, 2018

6. EASA Certification Memorandum document CM–AS-008 Issue 01: Installation of ELTs, dated Dec 12, 2016

7. COSPAS-SARSAT document C/S T.018 Issue 1, rev 3: Specification for second-generation COSPAS-SARSAT 406-MHz distress beacons, dated June 2018

8. COSPAS-SARSAT document C/S G.005 - Issue 2 - Rev.6: COSPAS-SARSAT Guidelines on 406 MHz beacon coding, registration and type approval, dated Oct 2013

9. CASA Australia document AWB 02-002 Issue 2: Emergency Locator Transmitter (ELT) Installation and Maintenance, dated Nov 15, 2013

10. 7. UK CAA CAP 562 Leaflet 25-60 Guidance on Testing Emergency Locator Transmitters, dated April 15, 2011

11. Irish Aviation Authority (IAA) document: Testing of Emergency Locator Transmitters (ELT), dated Oct 18, 2017

12. EASA Safety Information Bulletin No.: 2019-09 ELT and PLB annual testing, dated June 17, 2019

13. UK Aeronautical Information Services document Aeronautical Information Circular P 053/2018, dated June 7, 2018

14. ICAO Annex 10, Volume 3, Chapter 5, dated July 22, 2007

15. Transportation Safety Board of Canada recommendation A16-07 Emergency locator transmitter: Prohibiting the use of hook-and-loop fasteners, updated on December 2016.

16. Transportation Safety Board of Canada recommendation A16-03 (Emergency locator transmitter system crash survivability standards) and its closing actions, related to accident investigation report A13H0001 on 15 June 2016

17. NASA document no. NASA/TM-2017-219584: ELT Survivability & Reliability study, dated February 2017

18. Australian Transportation Safety Bureau (ATSB) safety report named “A review of the effectiveness of ELTs in aviation accidents”, dated 21st May 2013.

19. Data gathered from air operators in Maldives identifying the details (i.e. manufacturer, model number, part number and coding protocol used) of the ELTs installed on aircraft registered in Maldives

20. Instructions for continued airworthiness given by the ELT manufacturers for the ELTs installed on aircraft registered in Maldives

21. Report issued by Aircraft Accident Investigation Coordinating Committee (AICC) after investigation of the accident, DHC-6-300, 8Q-MAN near Kuredu Resort on 2 July 2015.

22. Information gathered during the meeting held at CAA on the topic “Distress Beacon (ELT & PLB) Registration and Search and Rescue”. This meeting was held on 31st July 2019 and was attended by participants from Maldives Transport Authority, MNDF Coastguard, Communication Authority of Maldives, MACL Air Traffic Control and Maldives CAA.