

Advisory Circular

AC43-11

Revision 3

Aircraft Emergency Locator Transmitters Systems

27 November 2019

General

Civil Aviation Authority advisory circular contains guidance and information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rules and legislation.

However the information in the advisory circular does not replace the requirement for participants to comply with their own obligations under the Civil Aviation rules, the Civil Aviation Act 1990 and other legislation.

An advisory circular reflects the Director's view on the rules and legislation. It expresses CAA policy on the relevant matter. It is not intended to be definitive. Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate advisory circular. Should there be any inconsistency between this information and the rules or legislation, the rules and legislation take precedence.

An advisory circular may also include **guidance material** generally, including guidance on best practice as well as guidance to facilitate compliance with the rule requirements. However, guidance material should not be regarded as an acceptable means of compliance.

An advisory circular may also include **technical information** that is relevant to the standards or requirements.

Purpose

This advisory circular provides methods acceptable to the Director for showing compliance with Part 43 and Part 91.

Related Rules

This advisory circular relates specifically to Civil Aviation Rule Parts 43 *General Maintenance Rules* and Part 91 *General Operating and Flight Rules*, Subpart G.

Change Notice

Revision 2 amends the RCCNZ contact telephone number.³:

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- updates the title of this advisory circular
- revokes and replaces the content of this advisory circular to include the design, installation and testing requirements for Aircraft Emergency Locator Systems.

Cancellation Notice

This advisory circular cancels AC43-11 Revision 2 dated 12 June 2008.

Version History

History Log

Revision No.	Effective Date	Summary of Changes
0	03 March 1997	This was the initial issue of this advisory circular.
1	12 March 2008	Revision 1 revised the advisory circular to reflect the introduction of the mandatory carriage of 406 MHz Emergency Locator Transmitters.
2	12 June 2008	Revision 2 revised the syllabus of training for the instructor rating at Appendices A, B and C into a specific objective format.
3	27 November 2019	Revision 3 changes the title of this advisory circular; and revokes and replaces the content of this advisory circular to include the design, installation and testing requirements for Aircraft Emergency Locator Systems.

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1. Definitions and Abbreviations

In this advisory circular the following definitions and abbreviations apply:

Air Traffic Control [ATC] means the organisation responsible for providing air traffic control services.

1.1 Civil Aviation Rule Part 1

Emergency locator transmitter means an equipment that broadcasts a distinctive signal on a designated radio frequency to facilitate a search and rescue operation.

Emergency locator transmitter (automatic fixed) means an emergency locator transmitter that is automatically activated and permanently attached to an aircraft.

Emergency locator transmitter (survival) means an emergency locator transmitter that is stowed in an aircraft in a manner which facilitates its ready use in an emergency, is removable from an aircraft, and is manually activated.

Emergency position indicating radio beacon means an equipment that broadcasts a distinctive signal on a designated radio frequency to facilitate a search and rescue operation, is designed to float upright, and is manually activated.

Personal locator beacon means an equipment that broadcasts a distinctive signal on a designated radio frequency to facilitate a search and rescue operation, is designed to be carried on a person, and is manually activated.

RCCNZ means Rescue Co-ordination Centre New Zealand.

Transverse Separation, is the separation of the aircraft fuselage across the longitudinal axis.

TSO means a-1.2 Other terms.

Technical Standard Order (TSO) issued by the Federal Aviation Administration of the United States of America.

Aircraft Emergency Location System means a system that is installed in an aircraft and automatically broadcasts the aircraft location to search and rescue services in the event of a crash.

2. General

The operational Parts of the Civil Aviation Rules include a Subpart on equipment and instrument requirements. 2.2 Parts 91, 121, 133, 135, and 137 each include a Subpart F that specifies the equipment requirements for aircraft operating in New Zealand under the appropriate operating Part.

2.3 Each Subpart F is augmented by Part 91 Appendix A that provides standards and specifications equipment that must meet to be considered acceptable complied with.

Under 2.4 Except for specified circumstances, under rule 91.529, a person must not operate an aircraft a New Zealand registered aircraft within the New Zealand Flight Information Region unless it is equipped with an acceptable and fully operable automatic emergency locator transmitter. Rule 91.529 provides exclusions for the following aircraft:

An, approved AELS installed in the aircraft with no more than one seat if the pilot is equipped with an Emergency Locator Transmitter (Survival) [ELT(S)] or Personal Locator Beacon (PLB).

1. A glider or microlight aircraft if at least one person carried in the glider or microlight aircraft is equipped with an ELT(S) or PLB.
2. A glider or powered aircraft, including a microlight aircraft, that is equipped with no more than two seats, if the glider or powered aircraft is operated not more than 10 nm from the aerodrome from which the glider or powered aircraft took off.
3. A manned free balloon.

~~Under rule 91.5292.5 Furthermore, a person must not operate an aircraft with a New Zealand Certificate of Registration registration that is equipped with an ELT (which currently is an ELT (AF) that meets the standards in FAA TSO-C126) or carries an ELT (S), EPIRB, or PLB that operates on 406 MHz unless it is coded one of the circumstances in accordance with CAR rule 91.529(f)).~~ applies.¹

2.6 This advisory circular provides guidance for and summarises the requirements of performance, installation, and maintenance for ~~Emergency Locator Transmitters~~ AELS equipment.

Performance Requirements

The ELT equipment required by rule 91.529 has a minimum performance standard defined in Part 91 Appendix A as TSO C126.

For the purposes of this provision, routine maintenance is not considered to place the ELT unserviceable. Routine maintenance is required by rule 91.615 and includes:

1. Battery replacement
2. Tests and inspections in accordance with Part 43.

Emergency Operation

If an emergency develops in flight, activate the ELT; this will provide the RCCNZ with an early notification of distress and location. By activating the ELT RCCNZ can monitor the active beacon and will be able to commence search planning ahead of an accident. If, in a subsequent crash, the ELT system becomes inoperative, the crash location will still be known reasonably accurately, and so enhance the search and rescue operation.

After a crash, do not turn the ELT off; the emergency services will do this when they arrive. Also, do not remove the ELT from the aircraft unless it is fitted with an antenna.

If the emergency situation is recovered, turn the ELT off and advise ATC or RCCNZ as soon as possible. If the ELT is turned off and ATC or RCCNZ are not advised as soon as possible, it will be assumed that the aircraft has crashed and search planning will have commenced.

After any activation of any emergency beacon (ELT or PLB) either for a **REAL Emergency** or an **INADVERTANT** activation contact ATC or RCCNZ on: 0508 4RCCNZ (0508 472 269) as soon as possible.

Emergency Locator Transmitter Installations: Design Considerations

An ELT is an item of emergency equipment installed or carried on an aircraft to:

1. Facilitate the rescue of persons as quickly as possible;

¹ Refer also to NTC 91.529 Aircraft Emergency Location Systems

2. Facilitate the recovery of human remains as quickly as possible;
3. Reduce the risk to search and rescue personnel;
4. Reduce the time and cost of search and rescue operations;
5. Preserve evidence for subsequent investigation.

For the maximum benefits of an ELT installation to accrue, the installation needs to be designed to minimise the risk of the system being rendered inoperative by reasonably foreseeable events in a crash sequence. Points to be considered in the design of the installation are:

1. Install the transmitter on primary structure with the g switch sensitive axis aligned with the appropriate aircraft axis.
2. Locate the ELT in the aft fuselage area.
3. Where possible, design the ELT mounting structure so that it is unlikely that a transverse separation will occur between the transmitter and the antenna. If the structure between the transmitter and the antenna cannot be made strong enough using conventional structural methods, fit a high tensile cable between the regions and route the antenna cable adjacent to the cable.
4. Locate the antenna as close as practicable to the transmitter to minimise a transverse separation occurring between the antenna and the transmitter (between the same fuselage frames is preferred) and in a location that minimises the risk of it suffering substantial damage in a crash. Use structural features of the aircraft to provide protection where possible. For helicopters, avoid locations that are likely to be damaged by the rotors or by the transmission system being displaced in a crash.
5. If the aircraft is fitted with an ELT that can accept an external position input and has an area navigation system (FMS or GNSS) with a compatible output, it is strongly recommended that the position output of the navigation system be connected to the ELT. Output of a GPS position in the ELT message improves the location accuracy from 3 km to 100 m and reduces the search area from 28 km² to 0.031 km².
6. Covering the antenna cable with a fire resistant sleeving will increase the systems survivability.
7. Route the antenna cable to minimise the risk that dislocation of the aircraft structure will damage the cable. Fasten the cable so that it is restrained but can move in the event of a crash but not so loosely that it will either chaff or foul other cables or structure. The antenna cable must not cross a fuselage production joint.

Emergency Locator Transmitter Registration

406 MHz ELTs, EPIRBs or PLBs fitted to or carried in New Zealand registered aircraft must have a New Zealand country code (whether operating in New Zealand or overseas) and be registered with the RCCNZ, otherwise a substantial penalty may be incurred. Information on the registration of 406 MHz ELTs is on the web site <http://www.beacons.org.nz/>.

ELTs, EPIRBs or PLBs should be registered with RCCNZ prior to their being installed or carried in an aircraft. As part of the installation certification, the beacon registration should be sighted by the certifying engineer.

Any changes to registration details such as emergency contact numbers or name of the aircraft operator must be notified to RCCNZ.

System Installation: General Requirements

Part 43 requires that aircraft remain in their original or properly modified condition. The installation of an ELT constitutes a modification and a Form CAA 337 must be completed listing the acceptable technical data. The minimum standards for the installation of an ELT are detailed Part 91 Appendix A, paragraph A.15; this advisory circular provides other general requirements for the installation. Any 406 MHz ELT installation must be installed under the provisions for AC43-14 Appendix 2 or other approved modification.

The acceptable standards should produce reliable and effective ELT systems and keep unwanted activations to a minimum. The standards are based on the following sources:

1. RTCA DO-204 Minimum Operational Specification 406 MHz Emergency Locator Transmitters (ELT)
2. Comments from industry.

Not all of the recommendations from the above sources were suitable for incorporation in this AC. The following notes are a useful supplement to the requirements of Appendix A for planning an ELT installation:

3. Design and Installation Considerations

3.1 Conditions

3.1.1 For the maximum benefits of an AELS installation to accrue, the design and installation should be such that the system remains operable after an accident, as far as is reasonably practicable. The following conditions should be considered in the design and installation of the AELS.

Note: The below are considerations only meant for guidance in developing a design and for installation for subsequent approval of technical data. This advisory circular does not constitute Acceptable Technical Data and may not be referenced as such.

- (a) If a component of the AELS is required to be mounted to the aircraft, this should be to a primary load-carrying structure without reducing that structures capabilities. When a force of 450 newtons is applied to that component in the most flexible direction, it should not cause a static deflection of greater than 2.5 mm relative to a section of adjacent structure located between 0.3 m and 1.0 m from the attachment site.
- (b) Attachment of AELS components to thin partitions or to panels, such as the sides of baggage compartments, solely by means of Velcro strips and other flexible materials is not acceptable.
- (c) The AELS component can support a 100 g load in the plus and minus direction of the 3 principal axes of the aircraft.
- (d) The AELS components are preferably mounted as far aft as possible.
- (e) Any crash activation sensor should be designed and mounted so as to preclude inadvertent operation.
- (f) Any crash activation sensor should be oriented to sense a primary crash pulse along the longitudinal axis of the aircraft.
- (g) If the AELS includes an external antenna, it should be mounted to provide vertical polarisation with the aircraft in normal flight.

- (h) Any required cabling between the antenna and the AELS component(s) to be made as short as practicable.
- (i) Any external AELS antenna should not be mounted closer than 0.6 m from the nearest VHF antenna.
- (j) Any internal AELS antenna should be insulated from metallic structure and exposed to a window of not less than 0.3 m square.
- (k) The post-installation VSWR should ideally be less than 2:1 and not exceed 3:1.
- (l) Components of the system should be fitted with vibration proof RF connectors as required for the operation of the AELS.
- (m) Have the location(s) of the AELS identified as close as practicable to the point of access.
- (n) Any manual activation switch should be mounted within easy reach of the pilot.

3.2. Aeroplanes

3.2.1 When an aeroplane is upright an antenna located externally on top of the rear fuselage provides better overall efficiency than an internal cockpit area antenna.

3.2.2 When an aeroplane is inverted:

- (a) An internal antenna exhibits the best overall efficiency in a high-wing aeroplane.
- (b) Neither ~~an internal or external~~ antenna location has a significant advantage in a low-wing aeroplane.

3.2.3 Approximately one third of light aeroplanes come to rest inverted in a crash.

3.2.4 Select a location where the antenna can be installed close to the transmitter and preferably, where the aircraft structure can provide some protection to the system components in a crash. ~~Either install additional structure or a high tensile cable to minimise the probability of a transverse separation severing the antenna cable. Location of the antenna and its proximity of other aerials must also be considered.~~

3.3. Helicopters

3.3.1 In helicopter installations care needs to be taken to site the antenna so as to minimise vibratory response which could lead to premature fatigue failure.

3.3.2 Cases have been documented where ~~ELTAELS~~ whip antenna installed on certain helicopters have fractured in only a few ~~hours~~ hours' time in service.

3.3.3 In at least one case, the antenna subsequently came in contact with the tail rotor.

3.3.4 Locate the antenna as close as practicable to the transmitter and consider likely crash events when selecting the location.

3.3.5 Avoid installing the antenna on the side of the helicopter that is likely to be on the bottom in a dynamic roll-over. ~~Location of the antenna and its proximity of other aerials must also be considered.~~

ELT Mounting

The ELT mount must provide a load path from aircraft primary structural elements directly to the automatic activation system. The attachment should also be designed to minimise vibration. Excessive vibration may prevent satisfactory crash impact detection or may generate false crash signals. Alignment of the ELT sensitive activation axis must be in accordance with the manufacturer's instructions.

Attachments to thin partitions or to panels, such as the sides of baggage compartments, solely by means of Velcro strips and other flexible materials is not acceptable.

3.4. Antenna cable protection

3.4.1 As ~~approximately one fifth of~~ light aircraft accidents ~~can~~ result in fire, the coaxial cable between the ~~ELTAELS~~ and its external antenna should be sleeved with fire resistant materials.

3.4.2 The antenna cable should be installed with sufficient free cable ~~to not allow, so that the cable will not be damaged during any distortion of the airframe to cause the cable to be severed.~~ in normal flight situations.

3.4.3 The antenna cable ~~must~~ ~~should~~ not pass over a fuselage production joint. ~~Where possible, install the transmitter and antenna between the same frames with additional structure to minimise the transverse separation risk.~~

3.4.4 If possible, do not run the antenna cable through any bulkhead or other similar structure.

Antenna Installation

The presence of an ELT antenna in close proximity to a second antenna can cause some detuning and distortion of the radiation pattern of the second antenna and possibly interference by re-radiation of other signals.

There have been reports of VHF radio transmissions interfering with GPS equipment. The problem has been attributed to the VHF signal being received by the ELT antenna and the signal then exciting the output stage of the ELT. The ELT then radiated a weak harmonic signal that caused interference with the GPS. Ensure adequate separation from other antennae.

Components

The interaction of components in the ELT is often critical in arriving at acceptable overall performance. Component parts from other sources such as batteries, coaxial cables, and antennae should not be substituted for the original manufacturer's parts.

Batteries

The ELT battery (and remote control/indicator battery if applicable) expiration date must be recorded in the Aircraft Maintenance Logbook in accordance with rule 91.617(a).

Testing: Maintenance and Post Installation

Tests should be conducted only within the first five minutes after any hour and then only for a maximum of three audio sweeps of the transmitter. A VHF receiver tuned to 121.5 MHz should be used to monitor the tests.

The 406 MHz data message will be transmitted after 50 seconds of the ELT being activated.

The ELT system should be tested in accordance with the manufacturer's instructions for a new installation. This testing is to include verifying the ELT code and will usually require the use of an ELT system tester. The ELT remote control should be switched through each mode of operation according to the manufacturer's instructions to determine that the equipment is operating correctly.

Some ELT installations are fitted with a Configuration Module that automatically loads configuration data (coding, etc) into the ELT when it is installed. It is important that the Configuration Module data is correct for the particular aircraft, otherwise the ELT will be incorrectly coded. When an ELT is installed or updated, verify and / or update the Configuration Module data is in accordance with the manufacturer's instructions.

With the aircraft engine(s) off and the ELT transmitting, the aural monitor, if fitted, should be heard. If a visual monitor is provided it should be visible from the pilot's normal seated position.

To ensure that the ELT is not susceptible to inadvertent activation by conducted or radiated interference, tests should be conducted with all avionics equipment powered by the aircraft electrical power generating system operating. The test should be carried out with the ELT armed and monitored on both 121.5 MHz and the remote indicator panel and include the following steps:

1. Individually operate each item of electrical equipment and each system, except VHF/UHF communications transmitters, and evaluate all reasonable combinations of control settings and operating modes
2. Individually operate installed VHF/UHF transmitters on various frequencies over their frequency range
3. Repeat the second step with all electronic equipment operating collectively, evaluating reasonable combinations of control settings and operating modes.

Maintenance requirements

4. Emergency Locator Transmitter Registration

4.1 As required by rule 91.529(g) 406 MHz ELTs, EPIRBs or PLBs fitted to or carried in New Zealand registered aircraft must have a New Zealand country code (whether operating in New Zealand or overseas) and be registered with the Rescue Co-ordination Centre New Zealand (RCCNZ).

4.2 Information on the registration of 406 MHz ELTs is on the web site <http://www.beacons.org.nz/>.

4.3 As part of the installation certification, the beacon registration should be sighted by the certifying engineer.

4.4 Any changes to registration details such as emergency contact numbers or name of the aircraft operator must be notified to RCCNZ.

5. Maintenance Requirements

5.1 Scheduled maintenance

~~Rule 91.605 requires an operational check of the ELT in accordance with Part 43, Appendix F at intervals not exceeding 12 calendar months or 100 flight hours, whichever is the sooner~~ transport category aircraft are exempt from the 100 flight hours requirement in accordance with General Exemption 8/EXE/37 issued 20 December 2007. The inspection of the aircraft prior to the issue of a release to service should include the following inspections:

~~ELT, antenna, antenna cable and remote switch installation for~~ 5.1.1 The AELS should be maintained in accordance with the manufacturer's instructions for continued airworthiness, as well as any requirements called out in rule 91.605.

5.1.2 The testing as required by rule 91.605(e)(4) and specified in rule 43.65 and Appendix F of Part 43 set out the minimum NAA testing requirements as described by ELT manufacturers.

5.1.3 There are other requirements imposed by relative manufactures including but not limited to, battery replacements, g switch tests, VSWR check and 406 MHz power checks, however different manufactures have differing time periods for these maintenance activities as stated in the relative ICAs and manual.

5.1.4 To satisfy the requirements of rules 91.605(e)(4) and (f), rule 43.65, and Appendix F of Part 43, conduct the following:

1. ~~Inspect the ELT or AELS and its mountings and aerial connection for general condition, security and being free of~~ particularly for corrosion
 - (a) Placards or corrosion deposits, as well as placards for legibility.
 - (b) ~~System self~~Conduct a functional test ~~carried out~~ of an ELT or AELS system in accordance with the manufacturer's instructions, checking for satisfactory performance. This does not necessarily require an on-air (RF transmission) test.

~~For the purposes of this provision, routine maintenance is not considered to place the ELT unserviceable.~~

~~Rule 91.605 also requires an inspection for battery condition and expiry date. The battery expiration date must be recorded in the Aircraft Maintenance Logbook. If the remote control/indicator has a battery fitted, the expiration date of this battery must also be recorded in the Aircraft Maintenance Logbook.~~

5.1.5 The intent of this test is to test the performance of the VHF guard (121.5 MHz) transmitter of the ELT or AELS. Testing of the 406 MHz transmitter is not required and should be avoided for this test as it requires special test equipment to prevent live 406 MHz transmissions. Any live 406 MHz transmissions received by rescue authorities are treated as real emergencies regardless of time or length of transmission. If an unintentional live air transmission of 406 MHz occurs, RCCNZ should be informed immediately.

- (a) Only conduct the test within the first five minutes after any hour.
- (b) Contact the local air traffic control service unit and advise them of the intention to test.
- (c) Tune a VHF receiver to 121.5 MHz to monitor the test.
- (d) Activate the AELS/ELT for a maximum of 3 audio sweeps approximately 5 -10 seconds dependant on the manufacture's instructions.

Note: the reason for limiting the on-air test to a maximum of three audio sweeps of the transmitter is to prevent the transmission of a 406 MHz data message, which typically occurs 50 seconds after the ELT being activated. Some manufactures also include a UHF guard frequency transmitter (243 MHz). If a suitable receiver is available, then this should also be monitored. Some ELTs will transmit a very brief 406 MHz burst when the ELT is first activated. This 406MHz transmission is acceptable and is coded in a way that will not alert rescue authorities.

5.1.6 Batteries are required to be changed—:

- (a) ~~on or before the expiry date; or~~
 - (a) when the ~~transmitter~~ life of the battery, as established by the manufacturer, has ~~been~~ expired as required by rule 91.605(e)(4), or
 - (b) any other time specified in ~~use for more than one cumulative hour~~ the manufacturer's instructions.

5.1.7 If a battery is replaced, the date stamped on the replacement battery ~~must serve as~~ becomes the new expiration date and ~~should~~ be recorded in Section 6 of the Aircraft Maintenance Logbook aircraft maintenance logbook or the equivalent maintenance tracking tool/program. This includes any remote control/indicator battery as applicable.

~~At two yearly intervals, the ELT must be tested for serviceability in accordance with the manufacturer's instructions.~~

5.1.8 As stated above, manufacturers manuals and ICAs should be reviewed to determine what other testing and maintenance is required and the associated time periods. These requirements should be entered into the aircraft log book and/or maintenance tracking tool/program.

5.2 Temporary removal of an ELT/AELS

5.2.1 Rule 91.529(c) provides ~~an ability for~~ circumstances in which an aircraft ~~to~~ may be operated under Part 91 with an inoperative ELT/AELS or without an ELT/AELS fitted.

5.2.2 This operation is permitted to allow the aircraft to be ferried ~~from a place where repairs or replacement of an AELS could not be made to a place where repairs to, or installation of, an ELT can be carried out. The flight is deemed to be a ferry flight and no they could. No~~ passengers may be carried for any such flight.

5.2.3 In the case of a **ferry flight under** the above provisions the **ELT system**, or a suitable cockpit location, is required to be placarded **Inoperative** '**Inoperative**' and the appropriate maintenance entries made in the aircraft **log book** maintenance logbook in accordance with Part 43.