



ELT406 with GPS Installation, Operation and Maintenance Manual

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NOTE Appendix C is maintained by Cospas Sarsat and may be changed without notice.
See their website at http://www.itu.int/cgi-bin/htsh/glad/cga_mids.sh

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1.1 Basic Information

How does it work?

The Emerging Lifesaving Technologies ELT406GPS is a self-contained Emergency Location Transmitter that combines the new standard digital 406.037 Mhz radio distress beacon with GPS generated latitude/longitude location data. The signal is received by the Cospas/Sarsat satellite-based search and rescue (SAR) system. In flight, the GPS unit automatically updates your present position every 15 seconds. Upon activation, a 5 watt signal bursts every 50 seconds to the Global Satellite System. Your location within 25 meters* will then be transmitted to search and rescue personnel. * Note Currently the Cospas Sarsat system only will receive Lat/Long in 4 sec increments. This represents about 300 feet on the equator.

Who's in Control?

The International Cospas-Sarsat Program provides accurate, timely, and reliable distress alert and location data to help search and rescue authorities assist persons in distress.

COSPAS (КОСПАС) is an acronym for the Russian words "Cosmicheskaya Sistema Poiska Avariynyh Sudov" (Космическая Система Поиска Аварийных Судов), which translates to "Space System for the Search of Vessels in Distress".

SARSAT is an acronym for Search And Rescue Satellite-Aided Tracking. The SARSAT system was developed in a joint effort by the United States, Canada, and France. In the United States, the SARSAT system is under the authority of the National Oceanic and Atmospheric Administration (NOAA) which is a part of the U.S. Department of Commerce.

For more information, visit: <http://www.cospas-sarsat.org>
<http://www.sarsat.noaa.gov>

See Figure 1.1 provided by Cospas/Sarsat for more information.

1.2 Application

The 406ELT is an AF (automatic fixed) emergency locator transponder that is designed for aircraft use. This manual provides "acceptable data" to support installation into certified aircraft. This installation requires that a certified person installs and completes the required paperwork. For US registered aircraft that requires a (FAA Form 337). See section 4 of this manual for a more detailed explanation of required documentation.

For Canadian registered aircraft the requirements of Canadian Aviation Regulations Part V, CAR 551.104 applies. Each country has their own requirements and you should contact the local authority for specific details in returning the aircraft to service.

ELT406 with GPS has meet or exceeded the minimum performance standards required for TSO approval. A TSO (Technical Standard Order) provides minimum standards of operation and safety for any given item. It is the installer's responsibility of this equipment to ensure that the aircraft installation meets both the local governing authority and the airframe manufacturers' instructions.

The TSO was issued to the ELT406 w/GPS as a system and this system was designed, tested and certified as a unit. All four components are required to meet the TSO. Substitution of any part is strictly prohibited. They will include in some variant:

- ELT Transmitter w/ Integral Battery
- ELT Mounting Tray
- ELT Antenna
- ELT Remote Switch

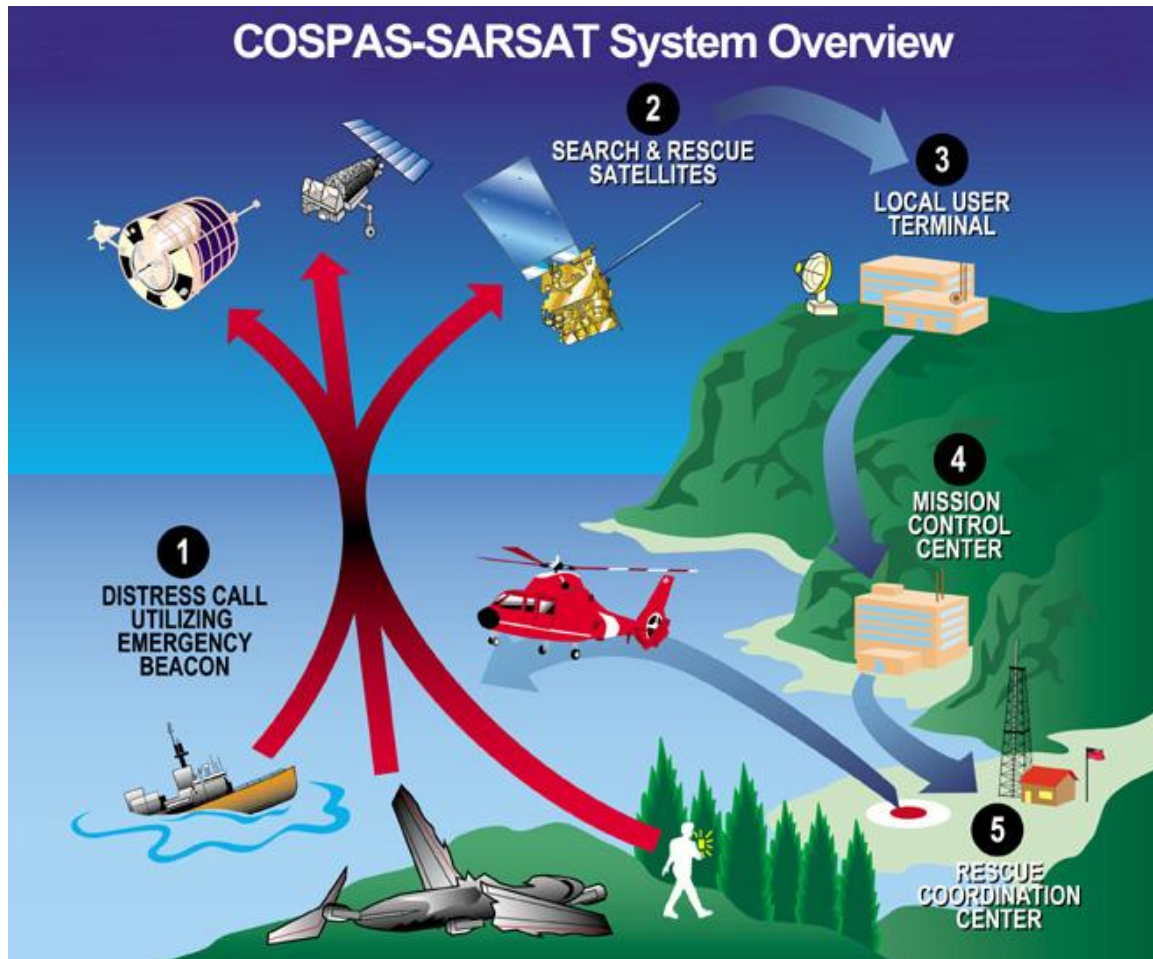


Figure 1.1 provided by Cospas/Sarsat

1.3 System Description

All ELT 406 p/n 51220 products are type AF (automatic fixed beacons). The different variants include those with internal GPS -042; Helicopter models p/n 51228 are equipped with a 6 axis G-switch module that allows the ELT to be activated in any of six axes.

Certain functions of the different variants are described by the FAA in Notice 8150.3. “Non-TSO’d functions”.

These “non-TSO’d” functions have the following characteristics:

- Due to the nature of helicopter operations it is important to note that there is normally operation in more than just the forward axis. The additional 5 axis “G” switch continues to provide crash sensing in the axes other than “forward” at a nominal 12 “G” threshold. This may change the performance specifications, software, hardware, environmental, or qualification levels of the standard ELT 406 i.e. vibration etc.
- A GPS receiver may be installed in the unit and will function independently of the base unit. External power is required to operate the GPS system.
- There are no changes to the installation and operating instructions or limitations. The instructions for continued airworthiness (ICA) remain unchanged, for these non-TSO’d functions.
- No additional failure modes or hazards introduced by use of the non-TSO’d functions have been noted or anticipated.
- None of these functions change any of the TSO’d functions of this unit.

The system has been designed to ensure that any inputs, whether shorts or opens in the harness or any effect of electrostatic discharge (ESD) and connections to +28V or ground can cause the unit to fail from automatic activation.

The only exception is the coax connected to the antenna. It must remain connected and undamaged to ensure proper functions after automatic activation. Any failure can be tested by the pilot using the cockpit controller. See section 6 for proper testing.

The RF output is through a single BNC connector. A second SMA connector is used between the antenna and the unit for receiving real-time GPS information. All functions are under microprocessor control. Software is approved per the requirements of RTCA/DO-178B for Level D software.





The battery pack consists of three D-size, LiMnIon cells mounted on the rear cover of the unit. See Sec 7 for detail on battery replacement. These are 5 year life expectancy batteries. An internal clock keeps up with actual battery use and alerts the pilot when there is less than the minimum required battery life as specified by FAR 91.207(c).

406ELTs with GPS come with an antenna, remote switch, mounting plate, coaxes, and install kits. Standard hardware and wiring are not supplied. See section 2.9 for details

1.4 Parts List

Product picture	Nomenclature	Description	Part Number
	406 ELT	Automatic Fixed ELT	51220
	406 ELT with GPS	AF ELT with Internal GPS	51220-042
	406 ELT 6 axis	Helicopter ELT	51228
	406 ELT 6 axis with GPS	Helicopter ELT with Internal GPS	51228-042

	<p>406 ELT Military</p>	<p>ELT 6 axis with Internal GPS</p>	<p>91315</p>
	<p>Battery Pack</p>	<p>Replaceable Battery Pack</p>	<p>217-406-001</p>
	<p>Mounting Tray</p>	<p>Universal Mounting Tray</p>	<p>217-406-062</p>
<p>Picture Not Available</p>	<p>Whip Antenna</p>	<p>9" Whip Antenna</p>	<p>114-406-047</p>
	<p>406 GPS Dual Mid Speed Antenna</p>	<p>250 KTAS at 35k Feet</p>	<p>114-042-250</p>
	<p>406 GPS Dual High Speed Antenna</p>	<p>600 KTAS at 50K Feet</p>	<p>114-042-600</p>

	<p>406 GPS Dual Military Antenna</p>	<p>600 KTAS at 50K Feet</p>	<p>914-042-600</p>
	<p>Walk Away Antenna</p>	<p>Rubber 406 Walk Away BNC</p>	<p>231-406</p>
<p>Picture Not Available</p>	<p>GPS Walk Away Antenna</p>	<p>Rubber Internal Battery SMA GPS Walk Away</p>	<p>231-406-042</p>
	<p>Remote Switch with Aural Alert</p>	<p>Self Test Remote Switch with Internal Aural alert</p>	<p>816-59-06</p>
	<p>406 Coaxial Cable BNC to BNC</p>	<p>6 Feet of RG58 Coax with BNC Connectors</p>	<p>315-12-06</p>
<p>Picture Not Available</p>	<p>GPS Coaxial Cable SMA to SMA</p>	<p>6 Feet of RG316 Coax with SMA Connectors</p>	<p>315-17-06</p>
<p>Picture Not Available</p>	<p>Shipping Plug</p>	<p>Plug to Prevent Accidental Activation During Shipping</p>	<p>41415</p>

 <p>The image shows a clear plastic bag containing an 'ELT Self Test Card'. The card has a header with the 'ELT' logo and the text 'Self Test Card'. Below the header, there are two columns: 'Flashes' and 'Deposition'. Under 'Flashes', there are three colored circles (green, red, blue) and the text 'Steady System Autopilot XHD Support'. Under 'Deposition', there is a '1' and the text 'GPS Antenna Position'. At the bottom of the card, there is a section for 'Antenna Position' with a diagram of a boat and an antenna. The 'ELT' logo is also visible at the bottom left of the card.</p>	<p>ELT Install Kit</p>	<p>DB9 Male Plug DB9 Hood DB15 Male Plug DB15 Hood Self Test Card</p>	<p>60599-044</p>
 <p>The image shows a clear plastic bag containing an 'Antenna Install Kit'. The bag has the 'ELT' logo at the top left. Inside the bag, there are several metal washers and nuts of various sizes.</p>	<p>Antenna Install Kit</p>	<p>Mounting Template 8 Washers 8 nuts</p>	<p>60599-035</p>
 <p>The image shows the cover of a spiral-bound manual. The cover features a yellow box with a blue top and a white bottom, set against a background of a blue sky with white clouds. The text on the cover reads: 'Install Operation and Maintenance Manual for ELT406 with GPS'. At the bottom, it says 'Emerging Lifesaving Technologies 1271 Cherry Road Ann Arbor, MI 48106-1171'.</p>	<p>Manual Hard Copy</p>	<p>Paper Copy of Install, Operation and Maintenance Manual</p>	<p>4028-083</p>
 <p>The image shows a CD-ROM disc with the 'ELT' logo on a black background. The disc is partially covered by a white paper sleeve that has a blue and white graphic at the bottom.</p>	<p>Manual CD Format</p>	<p>CDROM Copy of Install Operation and Maintenance Manual with Test Data</p>	<p>4028-34</p>

1.5 Weights

Nomenclature	Part Number	Weight	CG
406 ELT	51220	1.52 lbs	4.0
406 ELT w GPS	51220-042	1.60lbs	4.0
406 ELT Helicopter	51228	1.68lbs	3.9
406 ELT w GPS Helicopter	51228-042	1.76 lbs	3.9
Military 406	91315	1.78 lbs	4.0
Universal Mounting Plate	217-406-062	.34 lbs	3.8
Remote Switch	816-59-06	.15 lbs	1.8
406/121.5/GPS Antenna	114-042-250	.70 lbs	5.4
Replacement Battery	217-406-001	.98 lbs	4.4
Whip Antenna	114-406-047	.35 lbs	0

Note CG is measured in inches from the front of the box to the center of gravity of the item.

1.6 Unpacking and preliminary inspection

Remove the units from the box and inspect for any physical damage. Notify the shipper and dealer immediately if it is determined that the unit might have been damaged in transit.

The 406 unit has a transport plug installed from the factory. This strapping plug is designed to keep the unit from inadvertent activation during shipping or installation. The strap should remain on the unit until final installation is made. If the **green light** on the front of the unit comes on when strap is removed then reset the G-Switch by placing the ON/ARM switch to ON for five seconds and then back to ARM. The light should go out.

If you do not reset the ON/ARM switch properly then the 406 ELT will send a real distress call signal after only 50 seconds of the **green light** illuminating.

Caution should always be taken not to send out a false emergency signal to Cospas/Sarsat. A false signal unduly activates precious SAR resources.

1.7 Special Shipping Instructions

If for any reason this unit must be shipped, it is important to prevent any inadvertent activation of the unit. All 406 ELTs are shipped with a strapping plug that will make the unit dormant.

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2.1 Operational Frequencies

406 ELT transmits on both 406.037 Mhz which is monitored by the Cospas/Sarsat system and a homing beacon on 121.5 that is currently unmonitored.

2.2 Out Put Power

The 406.037 will transmit a 5W pulse (440ms) every 50 seconds for up to 72 hours. An internal battery clock will inform the pilot during normal self-test if the available transmit power drops below 36 hours.

2.3 Activation

The pilot has control of a remote that has been installed on the aircraft instrument panel. The remote is equipped with an ON/ARM switch, a bi-color (red/green) LED, and an aural alert. With this remote you can run the self-test or activate the unit in flight if conditions warrant. The self test looks at eight different functions but will only indicate four during the pilots' self-test.

COLOR	NO. OF FLASHES	DISPOSITION
Green	Steady	System Activated Transmit Normal
Green	5 flashes	All Tests Good
Red	2 flashes	406 Antenna Failure
Red	3 flashes	Transmitter Chain Failure
Red	4 flashes	Minimum Battery Life
Red	5 flashes	GPS Inaccurate or Inop

Each flash has duration of ½ second and will repeat the failure after a 4 second pause. See Trouble shooting guide Appendix D for details.

In the event of a crash the unit has an automatic activation accelerometer or G-Switch. Accelerometer changes of 4.5ft./sec (2.3G) senses a dramatic change in speed and activates the 406 transmitter. In the case of a helicopter unit it has a six-axis accelerometer to compensate for the different attitudes of flight that might occur.

When the unit is activated by the G-Switch an aural alert (85db) will go off in the cockpit. The unit can be reset using the remote switch or the redundant switch mounted on the front of the unit by holding the ON switch for five seconds, returning to the ARM position.

2.4 Temperature

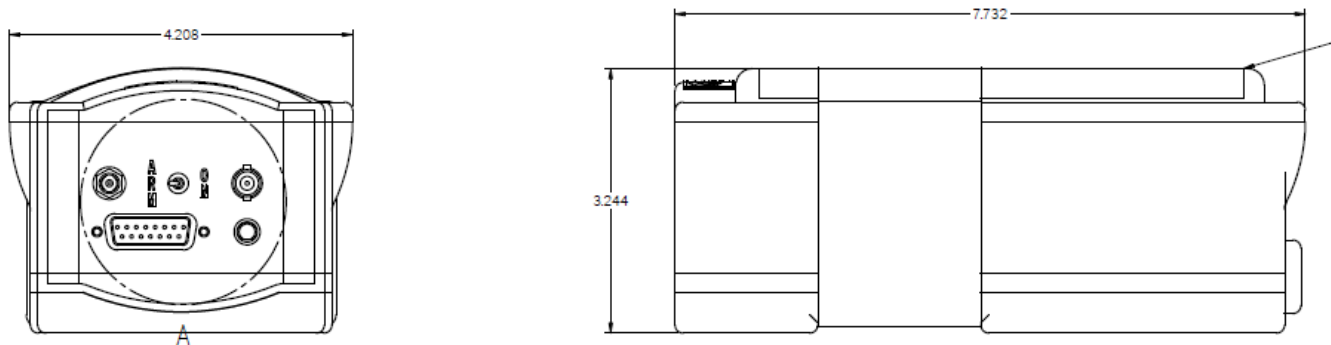
The 406 has gone through extensive Cospas/ Sarsat, TSO, and Environmental testing and has proven to work at -20°C and +55° C

2.5 Aircraft Power Requirements

The 406 ELT is completely self-contained for normal operations. In order to preserve internal battery power a 1 amp circuit should be provided for the GPS function. If an avionics buss is installed it is preferable use this buss.

2.6 Mechanical Characteristics

The 406 ELT is made of high impact polycarbonate that has been especially designed for Emerging Lifesaving Technologies. With this design the 406ELT far exceeds the minimum performance standards. It has a base unit that is made of the same material and is secured to the base plate using a Velcro material. This allows for easy removal and reinstallation.



2.7 Electrical Characteristics

The 406 ELT will work without any outside inputs. A remote switch is installed to give the pilot control of the unit from the cockpit. Additionally, a 1 amp circuit should be installed to operate the GPS. The system will accept between 10 to 33vdc.

Pre-made harnesses are available in various lengths. Contact the manufacturer for more information.

2.8 Coaxes

A coax is supplied with each 406 ELT with BNC fittings. They are pre-made and are (6) six feet long. This is considered to be the optimum length. Excess should be stored as prescribed in AC43.13-1B/2A. If you require longer coaxes please contact the manufacturer.



2.9 Minimum Wiring Requirements

406ELTs are manufactured for both certified and non-certified aircraft. It is important to note that there are many types of wires that are used in aircraft today. Some are airworthy and some are not.

Generally no PVC wiring or off-the-shelf phone cords meet the requirements found in AC43.13-1B/2A. They must be strong enough and have the durability to withstand normal operations. A minimum of 19 strands is required and to be made of a material that does not produce excessive line loss and be on the Qualified Products List.

Emerging Lifesaving Technologies requires the wires meet the current FAA requirements. We require that the wire be Mil Spec 22759/24, MIL-W-16878, M27500 or their commercial equivalent. Either 24 or 22ga is acceptable. An 8-conductor bundled wire of Mil Spec 22759/18-24 is also acceptable.

Pre-made harnesses are available in various lengths. Contact the manufacturer for more information.

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3.1 Accuracy

To locate a specific beacon the satellites, upon sensing 406 ELT activation, determines position by calculating differential Doppler shift. LEO (Low Earth Orbiting) satellites pass overhead and chart the position as it passes over the beacon.

The time required to listen to the *short message format* and make this calculation using the initial detection of the orbiting satellites is about 45 minutes, maximum 90 minutes. Subsequent satellite passes every 60 minutes will refine the position, with a maximum time of 90 minutes for each pass.

Cospas/Sarsat reports that a 1-3 nm (2-5 km) accuracy on average is determined this way. This makes the search area approximately 25 sq. nm (65 sq. km) or about 3700 square acres. The accuracy is increased by multiple passes over your position by the satellite.

406 ELTs equipped with GPS send a *long message format* that includes the Lat and Long within 4 sec of the location. This gives you an accurate position of better than 300 feet.

GPS position that is sent on the *first burst* or initial alert provides a near-instantaneous accurate fix using the SARSAT geostationary satellites.

Proprietary software allows the GPS to be updated every second and that information is cached for analysis and “trend monitoring”. This allow for any “*nominal*” signal information that is out of norm to be discounted and thereby insuring a high degree of reliability. Each 15 seconds the ELT is updated with the latest combined data.

Each 406 beacon sends a specific ID combined with registration data and point of contact information. This allows for a potential near real-time immediate launch of SAR assets to your exact location. There is no need to wait for LEO to come around and check your position over and over to provide a manageable search area for SAR.

Emerging Lifesaving Technologies 406 ELT with GPS can be activated while still in the air and send accurate positional data every 50 seconds. This gives SAR the ability to calculate the course and speed. If for some reason the aircraft is too damaged to send information to SAR after the incident, this could mean the difference between rescue and recovery.

3.2 Remote Switch Operation

If required, the pilot can activate the system by using the remote switch in flight. The unit can be reset from the cockpit should the crew determine an emergency no longer exists.

3.3 Operation

In the event of a crash the unit has an automatic activation accelerometer or G-Switch. Accelerometer by 4.5ft./sec (2.3G) senses the dramatic change in speed and activates the 406 transmitter. In the case of a helicopter unit it has a six-axis accelerometer to compensate for the different attitudes of flight that might occur.

When the unit is activated by the G-Switch an aural alert (85db) will go off in the cockpit along with a visual alert of a steady green LED located on the Remote switch. The unit can be reset using the remote switch or the redundant switch mounted on the front of the unit by holding the ON switch for five seconds, returning to the ARM position.

3.4 Self-Test mode

The pilot has control of a remote switch that is installed on the aircraft instrument panel. The remote is equipped with an ON/ARM switch, a bi-color (red/green) LED, and an aural alert. With this remote you can run the self-test or activate the unit in flight if conditions warrant. The self test looks at eight different functions but will only indicate four during the pilots' self-test.

COLOR	NO. OF FLASHES	DISPOSITION
Green	Steady	System Activated Transmit Normal
Green	5 flashes	All Tests Good
Red	2 flashes	406 Antenna Failure
Red	3 flashes	Transmitter Chain Failure
Red	4 flashes	Minimum Battery Life
Red	5 flashes	GPS Inaccurate or Inop

Each flash has duration of ½ second and will repeat the failure after a 4 second pause. See Trouble shooting guide Appendix D for details.

3.5 Programming

The 406ELT has a great deal of embedded firmware that is set at production. There is no open source code for that information. Additionally, certain items can be re-programmed using a GUI based program that is available to dealers only. With this program, testing and basic identification items may be modified or updated. The HEX code can never be changed in the field, or parameters that ensure the safe operation of the ELT.

The 406 ELT and all its variants are pre-programmed at the factory during the manufacture. The programming includes the use of the long message format. This allows for additional information to be transmitted to Cospas Sarsat.

The United States accepts the following protocols:

- Serial Number
- Tail Number
- 24-Bit Aircraft Address
- Aircraft Operator Designator/Serial Number
- Latitude and Longitude

All countries may not accept the same protocols. Check with your local authorities for their specific protocol regimens.

For a complete discussion of ELT programming protocols please see COSPAS-SARSAT documents G.005 and T.001 available at www.cospas-sarsat.org.

Contact your dealer or the manufacturer for any programming updates you require.

3.6 Certification

- The 406 ELT has been certified by Cospas/Sarsat for operation with the world wide detections system by complying with COSPAS-SARSAT T.001 and TESTED TO T.007
- The FAA has certified that the 406 ELT meets the requirements of TSO 126a and C91a in the 121.5/406 MHz configuration as referenced in TSO-C126, paragraph (e) FAR Part 91 – mandatory automatic ELT requirements
- ETSO 2C126
- Transport Canada
- Industry Canada (IC:121.5B-ME406AF)
- 47 CFR Part 87 (FCC requirements) The FCC does not issue certificates for ELTs
- 47 CFR § 2.902, the ELTs were tested using the Verification Method.

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4.1 Cospas Registration

All 406 transmitters must be registered. Load the DVD that comes with this unit and you will be prompted to complete the registration form. You can also go online by going to <http://www.beaconregistration.noaa.gov/>. You must have your hex code available to register online.

4.2 Warranty Registration

There is a three-year warranty which must be activated at the time of Cospas registration. Load the DVD that comes with this unit and you will be prompted to complete the registration form. A confirmation copy of your registration will be emailed to you. Please retain for your records. You can fax this document to 903-592-0017 to activate the warranty.

Emerging Lifesaving Technologies
Warranty Activation

Name _____ Date _____

Address _____

Phone _____ E-Mail _____

Aircraft Make _____ Model _____

N-Number _____ Total Time _____

Model Number _____ Serial # _____

ELT Hex code _____

Name of Installer _____

Organization _____

Certification _____

Phone _____ E-Mail _____

A confirmation copy of your registration will be sent to you. Please retain for your records.
ELT Doc-4.1 Dated 12-1-2009

4.3 FAA Form 337

All 406 ELTs require that new antennas be installed on the aircraft. This function requires that an authorized A & P do the work and a FAA form 337 may be completed. The installer should determine if this constitutes a major or minor alteration.

Load the DVD that comes with this unit and you will be prompted to complete the form 337. The form has most of the information needed to comply with the latest FAA requirements. You can go online to the FAA website and fill out the form. See <http://forms.faa.gov/forms/faa337.pdf>

[This website is generic in nature and does not contain any pertinent data for an ELT installation.](#)

All information in the manual is considered to be “*acceptable data*” for the completion of all FAA documents, including any 337 or STCs.

4.4 Weight and Balance Report

You must modify your weight and balance anytime equipment is removed or new equipment is installed. Load the DVD that comes with this unit and you will be prompted to complete this form supplied by Emerging Lifesaving Technologies. This form meets the basic requirements of: AC 43.13 (Acceptable Methods, Techniques, and Practices – Aircraft Alterations), specifically, Chapter 10

4.5 Radio Station License USA

The FCC does not require a radio station license for Emergency Locator Transmitters (ELTs).

The FCC web site <http://wireless.fcc.gov/aviation/fctsht4.html> now reads:

“On October 26, 1996, the FCC released a Report and Order in WT Docket No. 96-82, FCC 96-421 eliminating the individual licensing requirement for all aircraft operating domestically. This means that you do not need a license to operate a two-way VHF radio radar, or ELT aboard aircraft operating domestically.”

FCC Form 605 replaced FCC Form 404 in 1999; however, it is not required to file one in order to use an ELT. For additional information you can contact the FCC at:

Federal Communications Commission
445 12th Street SW
Washington, DC 20554
1-888-CALL-FCC (1-888-225-5322)
E-mail: fccinfo@fcc.gov

4.6 Canadian Registration

All 406 transmitters must be registered. Load the DVD that comes with this unit and you will be prompted to complete the registration form. You can also go online by going to http://www.nss.gc.ca/site/cospas-sarsat/emergencyBeacon_e.asp. You must have your hex code available to register online.

4.7 World Wide Registration

Each country maintains its own Search and Rescue (SAR) system. It is important to register your information with the appropriate Aviation Authority in your country. Your beacon must have your country's prefix programmed into the message. The label on the top of the unit will state the country code. If your country code is not on that label do not install until re-programming has been complete.

4.8 Log Book Entry

An entry in the permanent aircraft records is required when an ELT is installed. The entry should include a copy of the battery life-limit sticker. See your local aviation governing authority for guidance on record keeping.

4.9 Special Programming

Check the top of the ELT to insure the country code that matches the country of registry. See appendix C for to verify code.

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5.1 Introduction to Installation

Installations must be made by qualified personnel in accordance with FAA regulations. Since aircraft rules regarding installation of equipment changes it is important to check the current FAA rules. Simply removing your old ELT and installing a new 406ELT may not meet today's minimum requirements. A good rule of thumb would be to refer to the following:

- FAA – Advisory Circular (AC) 43.13 (Acceptable Methods, Techniques, and Practices – Aircraft Alterations), specifically, Chapters 1 through 3, 11 and 13
- TSO C126 paragraph D Requirements:

You can find this information at www.faa.gov

Every aircraft is different and these only represent general guidelines. It is also important to consult with the airframe manufacturer, Type Certificate Data Sheet, any STCs, or Service Bulletins for any specific information on ELT installations. The FAA requires the use of **approved data** for all aircraft installations and accepts AC 43.13 as approved data. The information in this manual is generally acceptable as **acceptable data** from which you can generate the proper documentation for this installation.

It is important for the installer to determine if this change constitutes a major or minor alteration. In most installations in non-pressurized areas ELT and their antenna systems are not considered as a major alteration by the FAA.

5.2 Special Considerations

Care must be made in planning the installation on any new piece of equipment on the aircraft. The control switch should be mounted in a location that is easily accessible to the pilot during normal operations. There are other important factors to consider when planning the installation. Remember the wise old sage that said,

“Those who fail to plan, plan to fail”.

5.2.1 Survivability

It has been reported by different agencies that an estimated 30 - 70% of all ELT's have failed during a real emergency. The reasons vary and no real long-term study has ever been done but here are some of the causes most often cited:

- Aircraft hit too hard. Excessive impacts break housing; wire harnesses, switches and antennas come off.
- Aircraft came to rest in unusual attitudes and the antenna is masked from satellite or SAR surveillance.
- Aircraft catches fire or lands in water.

What then can be done to make the unit more survivable?

Emerging Lifesaving Technologies examined this problem and designed many safety features into the unit. The most common internal failure appears to be loss of battery power. Some units use off-the-shelf alkaline batteries that corrode and dissipate quickly. They are installed like flashlight batteries and have little if any shock absorption capabilities. Other batteries have solder

tabs that seem to fail in the 3 to 4g range. Still others have deteriorated over time without any warning to the flight crew.

Emerging Lifesaving Technologies uses only welded-tabs batteries and our internal tests show survivability over 20g. In addition, the specific battery chemistry lends to long shelf life, no corrosion, and no natural decay. This battery pack has proven to provide over 72 hours of continuous operation. The battery pack is attached to the back plate with a shock absorber material to prevent them from rattling around during normal flight. A battery life monitor is installed to ensure at least 36 hours of operation. This is 50% more than the minimum 24 hours required by the FAA.

In addition, the PC board is mounted on shock absorbers and all loose wires and connections are sealed with a potting compound to reduce failures.

Emerging Lifesaving Technologies has tested far and above the minimum requirements and all of our units are capable of being installed in any aircraft or helicopter.

Our blade antennas are both vertically and horizontally polarized. This means that unless the aircraft is completely up-side-down it will not be masked from satellite surveillance. Low speed, mid range (250 kts), and high speed (600 kts) antennas are available up to 50,000 ft.

Note: Helicopters require different G-switches due to different attitudes of flight but the basic unit is the same.

For a full list of environmental and operations tests check out our compliance to Cospas/Sarat T007 and DO 160 testing.

In addition RTCA DO-182 recommends:

“All ELT system components which must survive a crash intact should be attached to the airframe in such a manner that the attachment system can support a 100g load...in the plus and minus directions of the three principal axes of the aircraft.”

RTCA, Inc.
1828 L Street, NW
Suite 805
Washington, DC 20036
Web site: www.rtca.org

5.2.2 Electrical Paths

When planning any wiring on an aircraft it should be done by a qualified person who is familiar with the latest rules and regulations of the FAA and the manufacturer of the aircraft. The standard **acceptable data** that is found in AC) 43.13 (Acceptable Methods, Techniques, and Practices – Aircraft Alterations), specifically Chapters 11 and 12, will be of immense help in planning your installation. Care should be taken to ensure the cabling crosses high power cabling at 90⁰ to avoid introduction of RMI or EMI into the ELT system.

5.2.3 Electrical Loading

Emerging Lifesaving Technologies 406ELT with GPS requires that an external power source be used to power the GPS receiver during normal operations. Installation of new electrical or electronic equipment will change the load on the aircraft's power generating system. Although the 406ELT only draws 50 mw of power it is necessary to install a 1-amp fuse or fusible link to protect the wire harness and the integrity of the aircraft's electrical system. Detailed information can be found in:

[AC\) 43.13 \(Acceptable Methods, Techniques, and Practices – Aircraft Alterations\)](#), specifically, Chapter 11 sec 3 para. 11-36, and sec 4 para. 11-47 thru 11-52

Changes to the electrical load require that an appropriately rated individual perform the analysis and make the needed connections to the ship's power distribution network. If possible, the ELT circuit breaker should be connected to the Avionics Buss.

5.2.4 Antenna Placement

The placement of the ELT has many important considerations such as:

- Location should be in keeping with Current Airframe Manufacturers Instructions
- Location should be in keeping with Current FAA rules and regulations
- Location should be designed to allow for the greatest possibility of survival
- Location should be kept away from structures that may mask the signal
- Location should be as close as possible to the ELT Transmitter
- Location should also be aesthetically pleasing to the owner/operator

Remember the old antenna location may not be the best location

5.3 Elt Mounting

5.3.1 Existing Installations

ELT406s come with an interlocking base plate that holds the transmitter on with a Velcro strap. This allows for quick and easy removal of the unit if needed. The base plate has been designed to reuse many of the popular hole patterns of previously installed ELT's

Compatible patterns include:

- Artex 100/110, G406, C406 and B406 series and Narco ELT-910, ELT-10
- Artex ELT-200 series
- Pointer model ELT 3000-series

Remove the old ELT and its mounting rack. A close inspection is required to ensure the underlying structure is sufficient to mount the unit. You should consult the airframe manufacturer's structural repair manuals and AC) 43.13-2 (Acceptable Methods, Techniques, and Practices – Aircraft Alterations), specifically, Chapter 1 and 2 to determine if the structure meets the latest approved data.



In order to ensure a high rate of survivability it has been determined that the ELT must meet the current guidelines for loading in all three axes. The mounting location must conform to the requirements of RTCA DO-204 and AC 43.13. DO-204 Sec 3.1.8 reads:

“The ELT shall be mounted to primary aircraft load carrying structures such as trusses, bulkheads longerons, spars, or floor beams (not aircraft skin). The mounts shall have a maximum static local deflection no greater than 2.5 mm (0.1 in.) when a force of 450 Newtons (100 lbs) 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 meters (1-foot) nor more than 1.0 m (three feet) from the mounting location.”

The use of the 8-32 X 5/8” Phillips, pan-head screws, nuts and flat washers to a sufficient structure will provide the sufficient strength. Stainless steel hardware is acceptable because of its ability to resist corrosion; however, all hardware used should conform to an accepted standard such as AN or Mil-Spec.

5.3.2 New Installations

If this is a new installation or if the current installation is unacceptable, the following guidelines can help to find a suitable location:

- RTCA suggests the aft section of the fuselage. This gives the greatest rate of survivability as it is least likely to receive damage during a crash.
- Care should be taken in choosing a location that allows ease of maintenance.
- Accessibility in case of a crash.
- Locate the unit to minimize cable runs to the antenna (under six feet is optimum).
- Avoid locations that are subjected to chemical fluids such as de-icing compounds, cleaning fluids, and hydraulics. Although the unit has been designed to withstand most of these compounds, any long term exposure to these chemicals will damage aircraft wiring.

Mount the ELT so that the longitudinal axis of the ELT (the axis extending through the longest dimension) is aligned with that of the aircraft within 10°. The ELT mount can be rotated about the longitudinal axis, i.e. the ELT can be mounted on the floor, walls or overhead, so long as it 'points' to the front of the aircraft.

A template has been provided to lay the basic hole pattern for installation. Make sure the pattern is laid out to ensure the forward mark is pointing toward the nose of the aircraft. Mark and drill four mounting holes using a #20 drill bit. Install the mounting tray. Use the 8-32 X 5/8" screws and fasteners provided.

5.3.3 Helicopter installations

As with any installation it is important to adhere to all helicopter manufacturers' instructions and the latest FAA rules and regulations. For a non-US registered aircraft consult your local aviation authority for any specific requirements.

Traditional helicopter ELT installations required the unit be mounted at a 45° downward sloping angle to be most likely activated in the event of a crash. The existing 45° mount should not be re-used. Changes to TSO C91a and TSO C126 increased the sensitivity of the G-switch over the older TSO C91 requirements. The 45° mounting angle tends to preload the G-switch, and results in false activations from abrupt landings, severe maneuvers, etc.

The Emerging Lifesaving Technology 406 ELT p/n 51228 or 51228-042 with internal GPS both are equipped with six (6) axis G-switches. This allows the installation be made at any angle, but the standard has become +/- 10° of centerline. Always face the unit towards the nose of the aircraft.

5.4 Antenna Mounting

As in all installations it is important to follow aircraft manufacturers' instructions and the latest FAA Rules and Regulations. In some cases a FAA form 337 may be required to complete any antenna installation. (pressurized areas, structural changes, etc.)

It is important for the installer to determine if this change constitutes a major or minor alteration. In most installations in non-pressurized areas ELT and their antenna systems are not considered as a major alteration by the FAA.

The best location is the upper aft portion of the fuselage. In order to achieve maximum 'visibility' of satellites, the 406 MHz antenna must be mounted on the top of the aircraft. If the unit is equipped with GPS the internal antenna in the 406 must also have an unobstructed view of the GPS satellite constellation. It should be mounted vertically and not be shadowed by other structures such as larger antennas, propellers, or tail surfaces.



RTCA/DO-204, Section 3.1.10 and RTCA/DO-183 Section 3.1.10 give the following guidelines:

- Locate the antenna at least 30 inches (75 cm) away from other antennas, wires, vertical stabilizer, etc. to minimize distortion of the radiated field and interference with other equipment.
- The antenna must be installed VERTICALLY (within $\pm 15^\circ$ of the vertical plane is acceptable).

Emerging Lifesaving Technologies has data on file that the 406 portion transmits both vertically and horizontally. For Smith Charts contact our customer service division for full details.

The 406ELT is currently certified to be used with the automatic fixed "AF" configuration with following antennas:

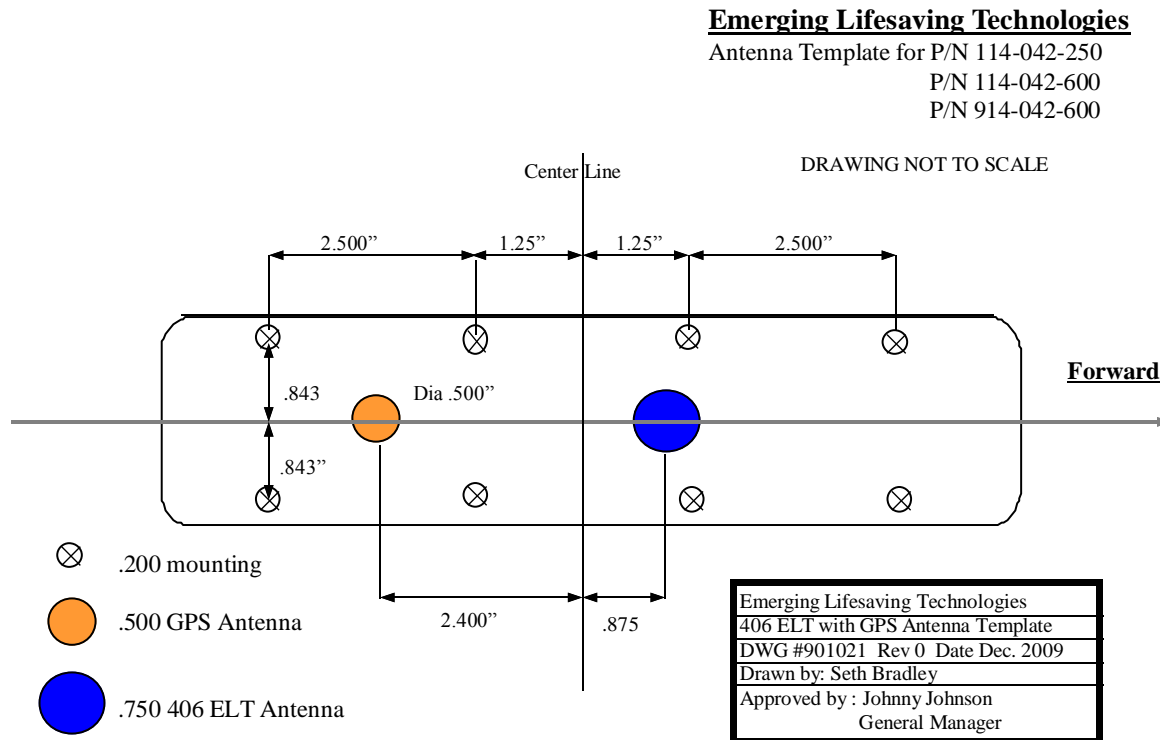
406 GPS Dual Mid Speed Antenna	250 KTAS at 35k Feet	114-042-250
406 GPS Dual High Speed Antenna	600 KTAS at 50K Feet	114-042-600
406 GPS Dual Military Antenna	600 KTAS at 50K Feet	914-042-600

5.4.1 Metal Aircraft

AC 43.13-2A describes several different techniques to install antenna doublers. This is an extra layer of sheet metal, such as aluminum, that is mounted under the aircraft skin.

It is important to anchor these doublers to other structures such as longerons or former rings to insure stability. See Fig 3.6 and 3.8 (reprints from AC 43.13-2A)

Use the template supplied to lay out the hole pattern. (Note: ensure the forward arrow of the template is pointed towards the nose of the aircraft). Drill the holes as indicated on the template. See Drawing 901021 for details.



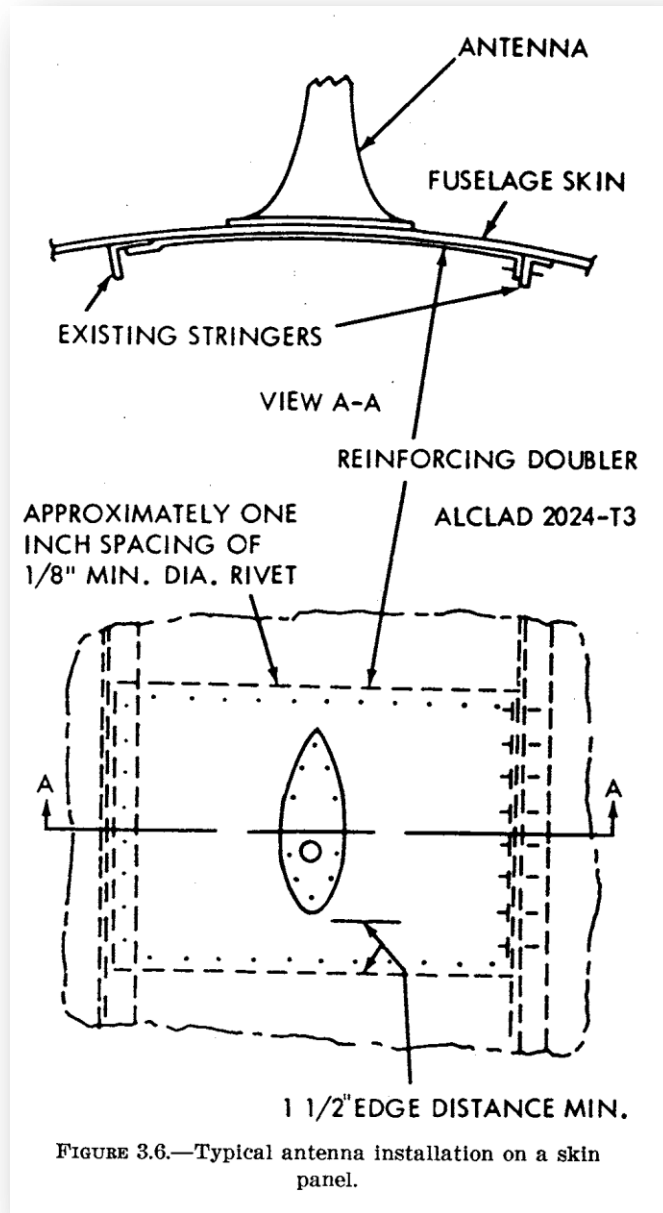
Determine the size and location of the doublers. If the antenna installation is to be made in a pressurized area then sealant is required.

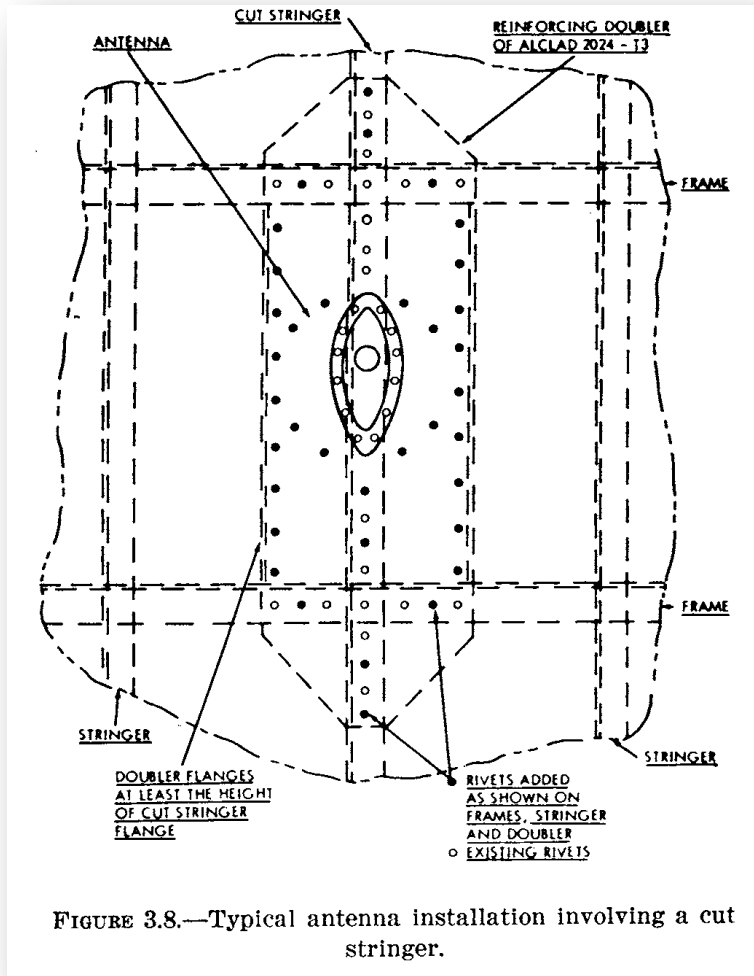
It is a good idea to dry fit all the parts, then remove and clean all surfaces from any debris before continuing. Small metal chips or other foreign items can keep the antenna from properly seating to the fuselage.

The antenna requires a ground plane of at least 100 square inches. This can be achieved on metal aircraft if the surface is sufficiently clean of paint, dirt, or any oils to meet these requirements. **Since the antenna uses a pin-based mounting system it is only necessary to clean the underside of the doublers approximately 1/2" around each hole.**

Install the appropriate sealant to the mating edge of the antenna and fuselage to prevent any water damage.

This information is supplied as approved data.





This information is supplied as approved data.

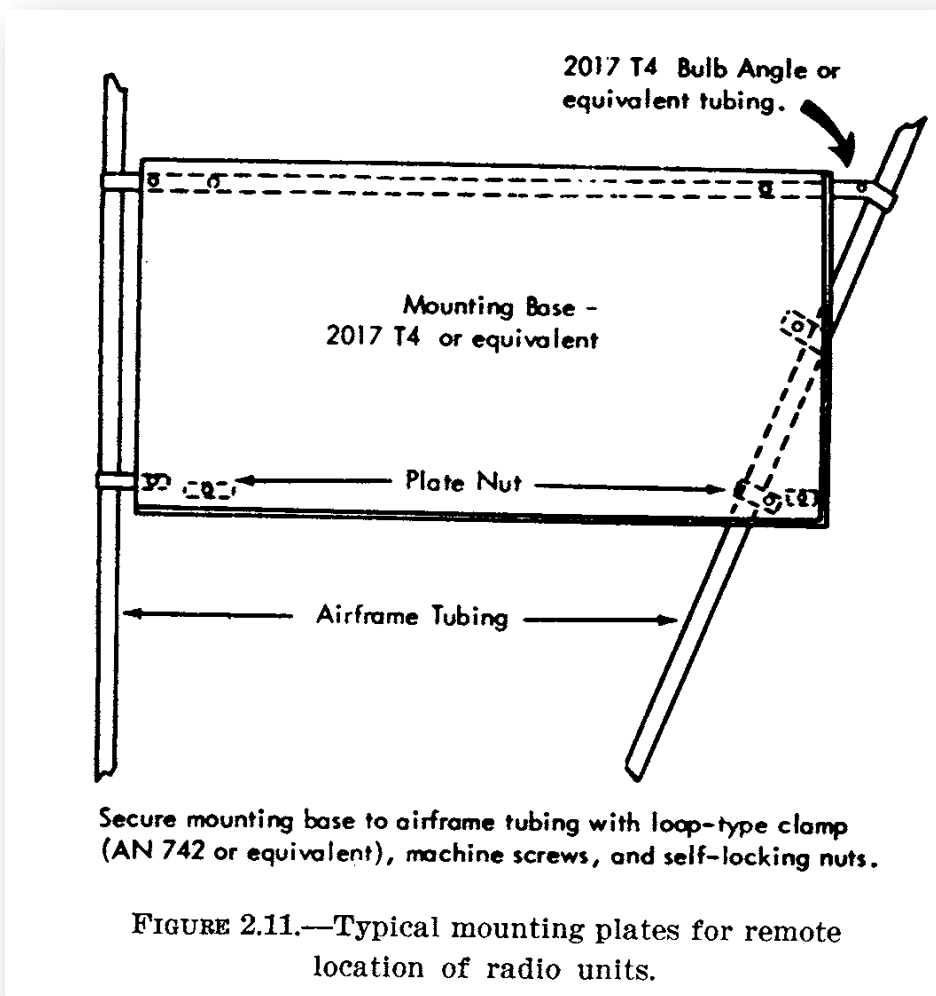
Specific antenna installation instructions follow. AC 43.13 provides additional guidance for antenna installations.

5.4.2 Composite or Fabric Aircraft

The antenna requires a ground plane of at least 100 square inches. On aircraft constructed with non-conductive materials, such as composite materials or fiberglass, a ground plane must be added.

One method is to install the antenna inside the fuselage. The signal will radiate through the composite or fabric. It is important, however, to choose the location carefully. The same restrictions, not shadowing or masking the signal by metal obstructions, still apply. Aircraft structures such as tubing or ribs do not generally constitute an obstruction.

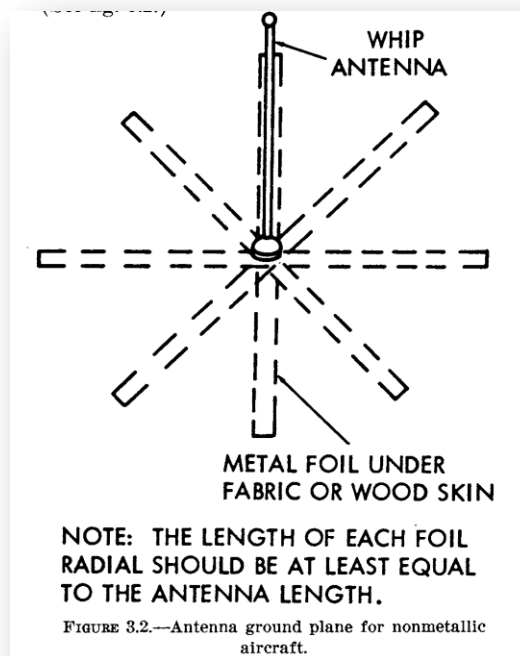
The ground plane may be installed as described in AC 43.13-2a fig 2.11. See Below



This information is supplied as approved data.

Due to the size of the antennas, it is questionable if mounting on fabric is a good idea. Depending on the type of composite it is acceptable to mount the antenna on the surface. Care should be taken to ensure the structural integrity of the site and an electrical ground plane must be provided.

In order to achieve the proper size ground plane it is important to have radial conductive material from the antenna mounting point at least 24 inches in every direction. Eight (8) radials will be sufficient. See the example in AC 4313-2A figure 3.2

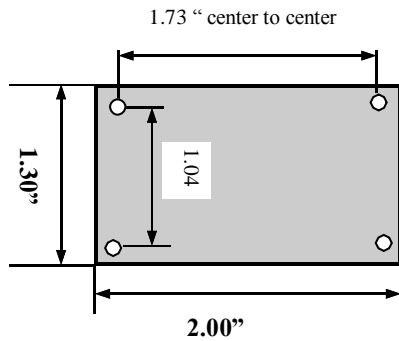
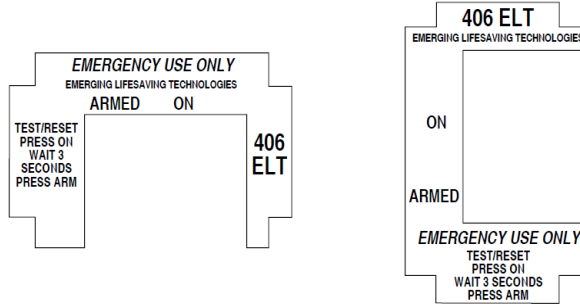


This information is supplied as approved data.

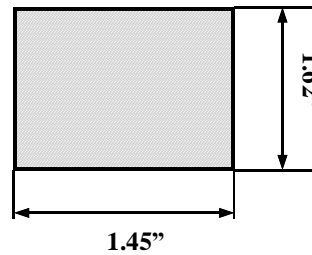
5.5 Mount Remote Switch

The pilot's controller (remote switch) is designed to give the pilot control over the functions of the ELT. It should be installed on the instrument panel or any other location that easily accessible to the pilot. The shape and size is consistent with many other model ELT's

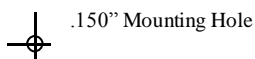
The unit can be mounted vertically or horizontally. Two decals are included in the install kit which will allow you to mount the controller either way.



Mounting Hole Pattern



Panel opening required



.150" Mounting Hole

5.6 Optional Audio (“buzzer”) Installation

An aural alert has been installed in the controller to alert the aircrew in the event of the activation of the G-Switch. If desired or required this internal alert may be de-activated and an external unit can be installed. See aircraft wiring for details.

The Optional Buzzer must be installed in such a manner as to be structurally sound and meets the same criteria as any other item installed on an aircraft.



5.7 Aircraft Wiring

We do not recommend or approve of anything other than wiring that is approved for certified aircraft. If a previous installation used PVC or telephone wire it is **not acceptable to re-use** those harnesses for this installation.

Generally, no PVC wiring or off-the-shelf phone cords meet the requirements found in AC43.13-1B/2A. Wiring must be strong enough and have the durability to withstand normal operations. A minimum of 19 strands is required and must be made of a material that does not have excessive line loss and must be on the Qualified Products List.

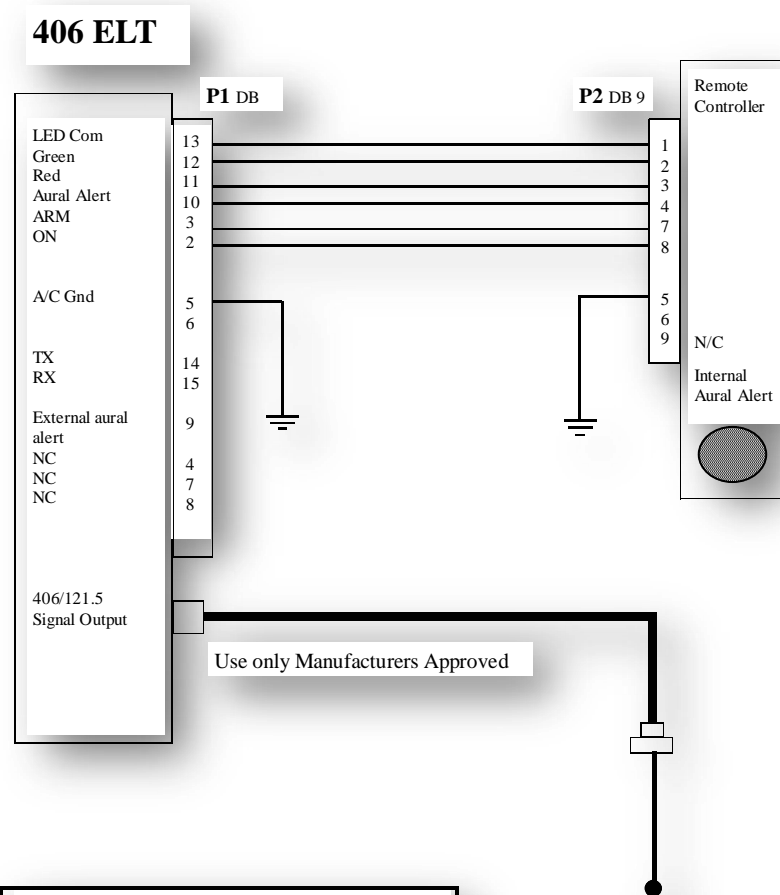
Emerging Lifesaving Technologies requires the wires meet the current FAA requirements. We require that the wire be Mil Spec 22759/24 or MIL-W-16878, or M27500 or their commercial equivalent. Either 24 or 22ga is acceptable. An eight (8)-conductor bundled wire of Mil Spec 22759/18-24 is also acceptable.

All aircraft wiring must adhere to the aircraft manufacturer's instructions, current FAA rules and regulations, and any advisory circulars that may be applicable, e.g. AC 43.13

It is important that anyone changing or altering an aircraft's electrical system be appropriately trained and certified to do those functions.

**CAUTION: MISTAKES IN INSTALLATION MIGHT KEEP
HELP FROM EVEN KNOWING YOU ARE IN TROUBLE**

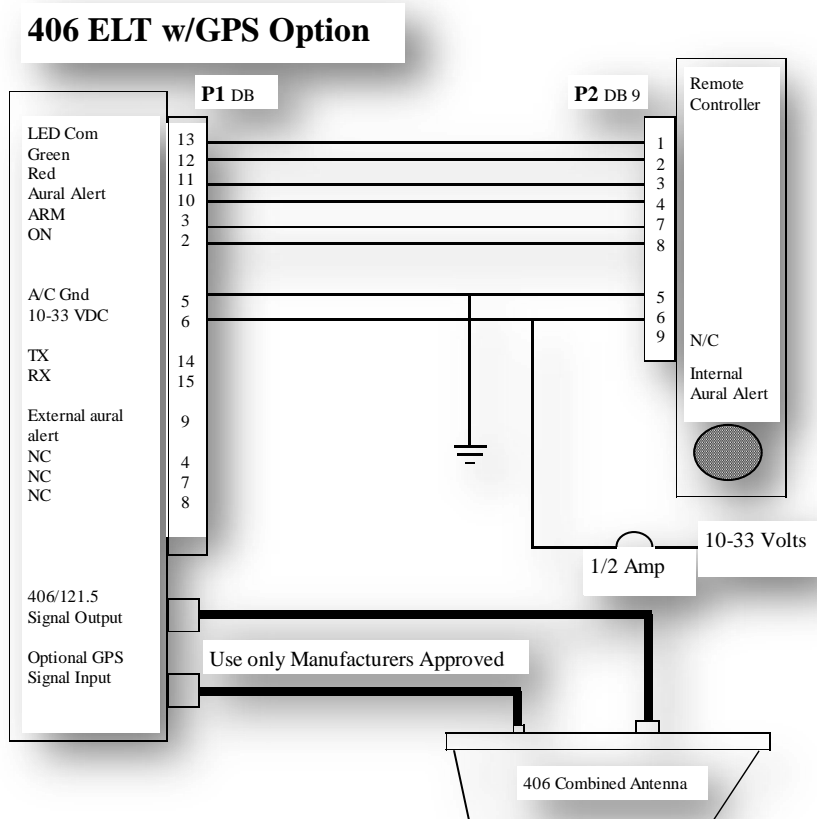
5.7.1 Harness Wiring – Basic 406 ELT



- Notes:
1. All wire to be 24 ga. or larger
 2. All wire to be Mil Spec 22759/24, MIL-W-16878, M27500 or their commercial equivalent.
 3. 6-conductor bundled wire of Mil Spec 22759/18-24 is also acceptable.
 4. 1/2 Amp fuse, Circuit Breaker or Fuse-able Link
 5. Connectors must have Strain Relief Backshells installed

Emerging Lifesaving Technologies
406 ELT with GPS
DWG #904021 Rev 0 Date Dec. 2009
Drawn by: Seth Bradley
Approved by : Johnny Johnson General Manager

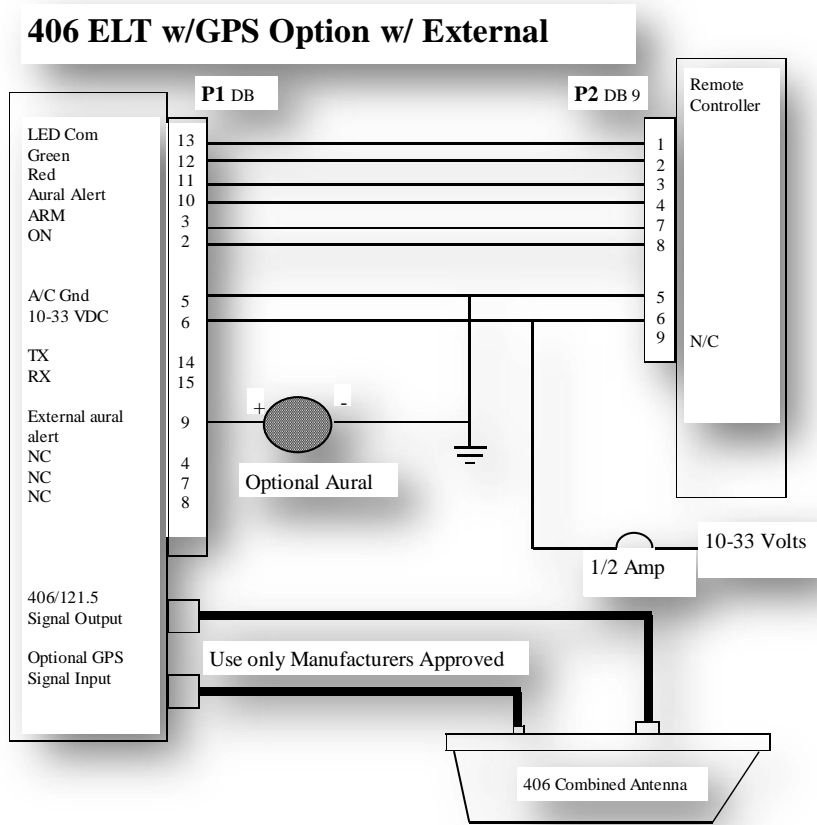
5.7.2 Harness Wiring – 406 ELT With GPS



- Notes:
1. All wire to be 24 ga. or larger
 2. All wire to be Mil Spec 22759/24, MIL-W-16878, M27500 or their commercial equivalent.
 3. 6-conductor bundled wire of Mil Spec 22759/18-24 is also acceptable.
 4. 1/2 Amp fuse, Circuit Breaker or Fuse-able Link
 5. Connectors must have Strain Relief Backshells installed

Emerging Lifesaving Technologies
406 ELT with GPS
DWG #904021 Rev 0 Date Dec. 2009
Drawn by: Seth Bradley
Approved by : Johnny Johnson General Manager

5.7.3 Basic Wiring w/ GPS and External Buzzer



- Notes:
1. All wire to be 24 ga. or larger
 2. All wire to be Mil Spec 22759/24, MIL-W-16878, M27500 or their commercial equivalent.
 3. 6-conductor bundled wire of Mil Spec 22759/18-24 is also acceptable.
 4. 1/2 Amp fuse, Circuit Breaker or Fuse-able Link
 5. Connectors must have Strain Relief Backshells installed

Emerging Lifesaving Technologies
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5.7.4 Connect RF Coaxial Cable

Coaxes have been supplied with the installation kit. It is critical to the function and accuracy of this unit that both the 406 and the GPS signals are not impeded in any way. If the cables are not of sufficient length for your application please contact customer service for further instructions.

Coaxes should never be bent at 90⁰ angles. You can stow extra harnesses by coiling the coax in rings of no less than a 6” diameter. Avoid over-tightening clamps or tie-wraps as this will change the electrical characteristics of any coax. See AC 43-13-1B Chapter 11.



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6. Post installation Testing

It is important to note that as of December 2009, the FAA has not given any clear guidelines to testing the 406 portion of the C126a TSO'd units. They have left it up to the manufacturers to set up what tests they require.

During the INITIAL tests Emerging Lifesaving Technologies strongly suggests that a complete and comprehensive test be done using a WST or equivalent. Test should include but not be limited to:

- Power Output
- Frequency Stability
- GPS Information for Accuracy
- Hex Coding
- Country Coding

6.1 Self-Test

The pilot has control of a remote that is to be installed on the aircraft instrument panel. The remote is equipped with an ON/ARM switch, a bi-color (red/green) LED, and an aural alert. With this remote the pilot can run a self-test or activate the unit in flight if conditions warrant. The self-test looks at eight different functions.

6.2 Self-Test Failure Chart

With this remote you can run the self-test. The self test looks at eight different functions but will only indicate four during the pilots' self-test.

COLOR	NO. OF FLASHES	DISPOSITION
Green	Steady	System Activated Transmit Normal
Green	5 flashes	All Tests Good
Red	2 flashes	406 Antenna Failure
Red	3 flashes	Transmitter Chain Failure
Red	4 flashes	Minimum Battery Life
Red	5 flashes	GPS Inaccurate or Inop

Each flash has a duration of ½ second and will repeat the failure after a 4 second pause. See Trouble shooting guide Appendix D for details.

6.3 Transmitter Test

The 121.5 frequency is tested using the method as described in AC 43.13.2a Para. 12-21

Caution should be made not to allow the test to last over 30 seconds. At 50 seconds the 406 will burst the initial pulse which will activate the SAR response. This test should be done at the top of the hour and no later than five (5) minutes after the hour. These precautions will reduce the likelihood of false alerts and reduce the demand on the overburdened SAR system.

Tune one of the aircraft radios to 121.5 and turn on the ELT. Listen for three pulses and then reset. To determine if there is sufficient signal strength, tune a low quality AM radio and hold six(6) inches from the antenna; repeat the test.

6.4 Record of inspections

A.C. 43.13-1B para. 12-23 (f) suggests the following sign-off after inspection:

I inspected the 406ELT system in this aircraft according to applicable Aircraft and Manufacturer's instructions and applicable FAA guidance and found that it meets the requirements of section 91.207(d)

Signed _____ Certificate _____ Date _____

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7. Instructions for Continuing Airworthiness and Maintenance

The following are considered to be minimum requirements and shall be supplemented by the owner/operator, aircraft manufacturer, and the local aviation authority as they deem necessary.

7.1 Regulations

The minimum FAA standards for annual inspection are found in FAR 91.207(d) which states

d) Each emergency locator transmitter required by paragraph (a) of this section must be inspected within 12 calendar months after the last inspection for--

- (1) Proper installation;
- (2) Battery corrosion;
- (3) Operation of the controls and crash sensor; and
- (4) The presence of a sufficient signal radiated from its antenna.

As part of the annual/100 hour inspections FAR 43, Appendix D the FAA guidelines include:

- (i) Each person performing an annual or 100-hour inspection shall inspect the following components of the radio group which includes the ELT:
 - (1) (ELT unit and mount) for improper installation and insecure mounting.
 - (2) Wiring and conduits - for improper routing, insecure mounting, and obvious defects.
 - (3) Bonding and shielding - for improper installation and poor condition.
 - (4) Antenna, including trailing antenna-for poor condition, insecure mounting, and improper operation.

7.2 Battery Service

No rechargeable batteries are installed in Emerging Lifesaving Technologies ELT.

Emerging Lifesaving Technologies 406 ELT batteries have a life limit. That limit (or replacement date) is marked on the outside of the battery pack and a sticker is supplied for the aircraft records. The type, make, model of ELT, the battery chemistry, and the expiration date are indicated on the battery pack.

The internal battery clock will indicate during self-test if a minimum of 36 hours of normal operations is still available.



Only Emerging Lifesaving Technologies approved batteries with the appropriate stickers can be used in Emerging Lifesaving Technologies ELTs. See section 4.4.1 for battery replacement and section 6.1 for self test.

Batteries Must be Replaced.

- After use of the ELT in an emergency
- After an inadvertent activation of unknown duration
- When the cumulative time of all known transmissions exceeds one hour
- Battery life-monitor indicates less than 36 hours
- On or before the proposed battery replacement date

7.3 Bi-Monthly Test

It is suggested that the pilot perform a Bi-monthly ELT self-test. The aircraft must be outside and away from any overhead obstacles. With the aircraft power on, turn on the Avionics Buss. Wait 5 minutes for the internal GPS to stabilize in the ELT. This test is best done as part of the run-up at the end of the runway before takeoff.

Using the pilot's remote controller that is installed on the aircraft instrument panel, a self-test can be preformed. The remote is equipped with an ON/ARM switch, a bi-color (red/green) LED, and an aural alert. Place the switch onto the ON position for three (3) seconds and return to arm. This will start the self-test. The self-test looks at eight (8) different functions including antenna hook up, operational status, GPS accuracy, and even has a battery life monitor to ensure a minimum of 36 hours of use remaining. If a fault occurs then the system will flash a number of red flashes. If the system checks good then the LED will flash green five (5) times. If red flashes occur, check the troubleshooting guide Appendix D before proceeding.

A RED FLASHING LIGHT INDICATES A FAILURE OF SOME PART OF THE ELT SYSTEM AND INDICATES THE UNIT MAY NOT WORK IF ACTIVATED

The self test looks at eight different functions but will only indicate four during the pilots' self-test.

COLOR	NO. OF FLASHES	DISPOSITION
Green	Steady	System Activated Transmit Normal
Green	5 flashes	All Tests Good
Red	2 flashes	406 Antenna Failure
Red	3 flashes	Transmitter Chain Failure
Red	4 flashes	Minimum Battery Life
Red	5 flashes	GPS Inaccurate or Inop

Each flash has a duration of ½ second and will repeat the failure after a 4 second pause. See Trouble shooting guide Appendix D for details.

7.4 Annual Test

Caution

To ensure that a false alarm is not generated, make sure the constant green light does not remain on more than 10 seconds. Although when activated the ELT is transmitting at 121.5 MHz immediately, no response will be made if the test is at the hour + 5 minutes. If the test lasts longer than 50 seconds then the 406 will burst a live signal to the satellites and the SAR process will begin.

An annual test must be preformed annually as described by FAR 91.207d

1. Check that the unit is properly installed and secure
2. See section 8.5 for detailed corrosion inspection
3. See section 3.4 for self-test information
4. See section 8.1 for radiated signal test

FAR 91.207d

(d) Each emergency locator transmitter required by paragraph (a) of this section must be inspected within 12 calendar months after the last inspection for--

- (1) Proper installation;
- (2) Battery corrosion;
- (3) Operation of the controls and crash sensor; and
- (4) The presence of a sufficient signal radiated from its antenna.

7.5 Corrosion Inspection

Emerging Lifesaving Technologies ELT is designed and tested to the highest environmental testing standards. The unit is made out of a specially designed polycarbonate that is resistant to the harshest applications in aviation today. The unit is sealed and should not allow moisture or most chemicals or fluids to infiltrate the system.

While it is very unlikely, caution should be made to ensure that regular (annual) inspections are made of the outside of the units. IF ANY deterioration or corrosion is found, a more detailed inspection is warranted. Return the unit to the manufacturer for inspection.

Special Inspection During Battery Replacement

During routine battery replacement, an inspection should be made inside the battery cavity for signs of corrosion or any residue that is out of place. Should any be found contact the manufacturer for further instructions.

7.6 Battery Replacement

The batteries are manufactured with a six (6) year life expectancy; however, from manufacture to installation there may be a lapse of as many as six months. Each unit will have a sticker installed, noting when the battery must be replaced. An identical sticker is supplied with the unit to be placed in the log book as a reminder.

All batteries should be replaced in the event of any one of the following:

- After use of the ELT in an emergency;
- After an inadvertent activation of unknown duration;
- When the cumulative time of all known transmissions exceeds one hour; and,
- On or before the proposed battery replacement date.

The owner/operator or any A&P can change the batteries. A new pack comes mounted to the new bottom cover of the unit. Unscrew the cover and install the new unit. A two pin Quick Disconnect Plug makes installation easy. Replace the gasket with the new one that will be provided.

NO SPECIAL TOOLING IS REQUIRED.

The quick disconnect will not allow for the polarity of the batteries to be reversed



Special note: While it is always important to be careful with Electro-Static-Discharge ESD, there are no exposed circuits to be concerned with during normal battery replacement. Never remove the top cover of the unit without ESD protection. There are no user replaceable parts or service items under the top cover of the ELT.

7.7 Battery Disposal

Always use caution when disposing of batteries. Check with your local waste management authority for their guidelines.

NEVER BURY OR BURN OLD ELECTRONICS OR BATTERIES

7.8 Verification of Digital Message

It is highly recommended to check the digital format on the initial installation of the unit. This is done with the use of a WST or equivalent tester. There are no requirements for annual retest of this information.

7.9 Antenna Test

It is highly recommended to check the antenna for proper operation on the initial installation of the unit. This is done with the use of a WST or equivalent tester. There are no requirements for annual retest of this information.

As part of the annual type inspection:

- Ensure that the antenna is securely fastened to the aircraft
- Check for cracks or abrasions in the surface of the antenna
- Ensure the antenna has proper sealing around the base to skin
- Ensure that coaxes are properly secured with strain-relief provided
- Ensure that coaxes are not interfering with any moving parts

7.10 G-Switch Check

Emerging lifesavings Technology provide a test fixture 941-406-800 and instructions to activate the G-Switch for test purposes. A rapid forward motion that comes to an abrupt stop (football pass method) will usually set of the G-switch. Always check to insure the green light comes on and then reset the unit with 30 seconds of the test. These or any other method approved by the local aviation governing authority is acceptable.

It is never acceptable to just drop in on the floor

7.11 Records Keeping

ICA that is performed on US registered aircraft is required to be annotated in the permanent records of the aircraft. The annual check should be incorporated into the annual-type inspection and include reference to 91.207d. It is not required to annotate the bi-monthly inspection.

A.C. 43.13-1B para. 12-23 (f) suggests the following sign off after inspection:

I inspected the 406ELT system in this aircraft according to applicable Aircraft and Manufacturer's instruction and applicable FAA guidance and found that it meets the requirements of section 91.207(d)

Signed _____ Certificate _____ Date _____

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8.Special Canadian Maintenance Requirements

NOTE: Canada requires the following checks during the annual inspection. These tests use the internal battery and should be performed in as short an amount of time as is possible. The unit has a battery that has an optimal life of 72 hours of use. These tests, over time, will reduce the life expectancy of the battery. Emerging Lifesaving Technologies has an internal battery counter that will ensure a minimum of 36 hours of use. During the normal self-test cycle (see section 7.1) if the battery life falls below minimum standards the light will **flash red** seven (7) times. Replacing the battery is required once the “**seven flash**” error occurs.

8.1 Performance Test

To ensure the SAR system is not activated, these tests should be done in such a manner that no radiated signal escapes. Use of an RF screen room or attenuator chamber is required. A WST tester or equivalent is required.

All 406 ELTs that are installed in Canadian aircraft require a performance test during the annual maintenance. A performance test must be done by a ratings certified avionics shop and proper equipment. The avionics shop will test per CAR Part V, Standard 571, appendix G for the following:

- (i) ELT operational tests only provide the aircraft operator with an indication that the ELT is transmitting; however, a positive result cannot be interpreted as meaning that the ELT meets all operational parameters.
 - (ii) The periodicity of operational checks is at the operator's discretion, but the check shall only be conducted during the first five minutes of any UTC , (co-ordinated universal time) hour, and restricted in duration to not more than five seconds.
- (c) **Performance Testing**
- (1) Testing of any ELT shall be conducted in a screen room or metal enclosure, or, the transmitter power output shall be connected to a suitable dummy load to minimize radiation.
 - (2) For ELTs powered by other than water activated batteries, the performance test shall be performed using the ELT's own battery. An alternate power source can be used where lengthy servicing, other than the performance test, is anticipated.

An acceptable procedure for operational tests is:

- Tune the aircraft or other VHF receiver in the area to 121.5 MHz
- Activate the ELT for not more than five seconds, while monitoring the VHF receiver; approximately three ELT audio sweeps are to be heard
- Reset the ELT to ARM or AUTO, as applicable, and continue to listen to 121.5 MHz for a few seconds to ensure that the ELT does not continue to transmit after the test is terminated
- Note any failures of the self-test by RED flashing lights

The self test looks at eight different functions but will only indicate four during the pilots' self-test.

COLOR	NO. OF FLASHES	DISPOSITION
Green	Steady	System Activated Transmit Normal
Green	5 flashes	All Tests Good
Red	2 flashes	406 Antenna Failure
Red	3 flashes	Transmitter Chain Failure
Red	4 flashes	Minimum Battery Life
Red	5 flashes	GPS Inaccurate or Inop

Each flash has a duration of ½ second and will repeat the failure after a 4 second pause. See Trouble shooting guide Appendix D for details.

8.2 Frequency Check

To ensure the SAR system is not activated, these tests should be done in such a manner that no radiated signal escapes. Use of an RF screen room or attenuator chamber is required. A WST tester or equivalent is required.

Measure the frequency after three (3) minutes of operation. The use of a WST tester or equivalent is required. A spectrum analyzer can be used to measure frequency, but usually the accuracy is less than required.

- Check to ensure the 406.037 Mhz signal for accuracy
- The frequency tolerance is .001Mhz

8.3 Peak Power Test

To ensure the SAR system is not activated these tests should be done in such a manner that no radiated signal escapes. Use of an RF screen room or attenuator chamber is required. A WST tester or equivalent is required.

Measure the output power after 3 minutes of operation. The use of a WST tester or a suitable Spectrum Analyzer is required. Use a suitable impedance matching device and/or attenuator in line with the ELT

- Check to ensure the 406 MHz signal bursts approximately every 50 seconds
- Ensure the duration is 440 ms in duration
- Ensure the output power of the 406 is equal to 37 ± 2 dBm (5 watts)
- Ensure the output power of the 121.5 is equal to 19 dBm (25 mw)

Note: The signal at 121.5 MHz is active except when the 406 MHz signal is active. It turns off for two seconds while the 406 bursts its information every 50 seconds. The two power output levels are different.

8.4 Message Verification

Ensure the information transmitted on the long message is accurate. If GPS is installed you must power the system for 5 minutes. This should be done in the aircraft using a WST or equivalent.

Information received should include:

- Check to ensure the 406 MHz signal bursts approximately every 50 seconds
- Ensure the duration is 440 ms in duration
- Serial Number
- Tail Number
- 24-Bit Aircraft Address
- Aircraft Operator Designator/Serial Number
- Latitude and Longitude (If GPS is Installed)

8.5 Corrosion Inspection

Emerging Lifesaving Technologies ELT is designed and tested to the highest environmental testing standards. The unit is made out of a specially designed polycarbonate that is resistant to the harshest applications in aviation today. The unit is sealed and should not allow moisture or most chemical or fluids to infiltrate the system.

While it is very unlikely, caution should be made to ensure that regular (annual) inspections are made of the outside of the units. IF ANY deterioration or corrosion is found a more detailed inspection is warranted. Return the unit to the manufacturer for inspection.

Special Inspection During Battery Replacement

During routine battery replacement, an inspection should be made inside the battery cavity for signs of corrosion or any residue that is out of place. Should any be found contact the manufacturer for further instructions.

Transport Canada IAW CAR V Standard 571 Appendix G:

(a) **Corrosion Inspection**

ELTs installed in aircraft are subject to extreme environmental conditions which may cause corrosion to develop in circuit boards and battery compartments. As a minimum, corrosion inspection shall be performed during each required battery replacement and performance test.

8.6 Battery Replacement

No rechargeable batteries are installed in Emerging Lifesaving Technologies ELT s; therefore, CAR V Standard 571 Appendix G part 4 does not apply.

Transport Canada CAR V Standard 571 Appendix G states:

- (5) Capacity tests and recharging shall be accomplished at the time intervals, and in accordance with the procedures established by the manufacturer.

Emerging Lifesaving Technologies 406 ELT batteries have a life limit. That limit (or replacement date) is marked on the outside of the battery pack and a sticker is supplied for the aircraft records. The internal battery clock will indicate during self-test if a minimum of 36 hours of normal operation is still available.

The type, make, model of ELT and the expiration date is indicated on the battery pack. Only Emerging Lifesaving Technologies approved batteries with the appropriate sticker can be used in Emerging Lifesaving Technologies ELTs. See section 4.4.1 for battery replacement and section 6.1 for self test.

Transport Canada CAR V Standard 571 Appendix G

(d) Battery Replacement and Recharging

- (1) Battery manufacturers are required to indicate the type, model, part number, ELT type & model(s) for which the battery has been approved, and the battery's expiry date.
- (2) The following general guidelines relate to the replacement of ELT batteries:
 - (a) only batteries approved for the particular ELT type are to be installed;
 - (b) following each battery replacement, recharge or capacity test, the date when the next replacement, recharge or capacity test becomes due shall be marked in a legible and permanent manner on the external casing of the ELT and, where the ELT is installed on a life raft, on the outside of the life raft;
 - (c) an operational test shall be performed following reinstallation in an aircraft of an ELT which has been removed for any reason.

Transport Canada has required that the battery pack must be replaced in the event of any of the following:

CAR V Standard 571 Appendix G :

- (3) Non-rechargeable batteries shall be replaced by serviceable batteries:
 - (a) After use of the ELT in an emergency;
 - (b) After an inadvertent activation of unknown duration;
 - (c) When the cumulative time of all known transmissions exceeds one hour; and,
 - (d) On or before the proposed battery replacement date.

8.7 Audio Modulation Check

Tune the aircraft radio to 121.5. Using the remote switch, activate the ELT by placing the switch in the ON position. Observe the following:

- Typical audio warble of a 121.5 ELT. Listen for at least three sweeps
- The light on the ELT remains on and **GREEN** during test
- Unit shuts off when switch returns to ARM position

Transport Canada CAR V Standard 571 Appendix G

(c) the audio modulation, which shall be recognizable as a typical ELT signal, and shall meet the specifications of the ELT manufacturer;

Caution

To ensure that a false alarm is not generated, make sure the constant green light does not remain on more than 10 seconds. Although when activated the ELT is transmitting at 121.5 MHz immediately, no response will be made if the test is at the hour + 5 minutes. If the test lasts longer than 50 seconds then the 406 will burst a live signal to the satellites and the SAR process will begin.

8.8 Current Draw Check

Remove ELT from aircraft and remove battery. Install test adapter P/N 217-406-005 at the quick disconnect. Check the following:

- In the ARM position the current draw does not exceed $\leq 2\mu\text{A}$.
- In the ON position the current draw does not exceed 4A during 406 burst
- In the ON position the current draw does not exceed 78mA to 88mA during 121.5-transmission

Transport Canada CAR V Standard 571 Appendix G

(d) the measured current draw in the "Arm" or "Auto" position, and in the "On" position as specified by the ELT manufacturer; and

8.9 Automatic Activation System Check

Transport Canada has required this test be done IAW CAR V Standard 571 Appendix G which states: (e) a test of the automatic activation system.

Emerging lifesavings Technology provide a test fixture 941-406-800 and instructions to activate the G-Switch for test purposes. A rapid forward motion that comes to an abrupt stop (football pass method) will usually set of the G-switch. Always check to insure the green light comes on and then reset the unit with 30 seconds of the test. These or any other method approved by the local aviation governing authority is acceptable.

It is never acceptable to just drop it on the floor

8.10 Digital Message Verification

The FAA does not require this check under FAR 91.207d but it is highly recommended that at the initial installation all units are checked.

In Canada this test is mandatory.

During the INITIAL tests Emerging Lifesaving Technologies strongly recommends that a complete and comprehensive test be done using a WST or equivalent. Test should include but not limited to:

- Power Output
- Frequency Stability
- GPS Information for Accuracy
- Hex Coding
- Country Coding

Perform the test as follows:

- Move aircraft outside to allow GPS to receive GPS satellite information
- Turn on aircraft power and allow GPS 3 minutes to stabilize
- Disconnect the 406 portion of the antenna coax cable at the ELT. Use new test coax to connect test set to the 406
- Perform the 406ELT self-test by cycling local or remote switch from ARM/OFF to ON for 3 to 5 seconds and back to ARM/OFF
- Verify GPS information is correct
- Verify that the information being transmitted matches information on the tag
 - 1) Country Code
 - 2) Aircraft ID
 - 3) Hex Code

8.11 Documentation of Inspection

All maintenance performed on aircraft or their sub-systems must be documented in the appropriate records. See the applicable CARs for the format and sign off of these records.

Transport Canada CAR V Standard 571 Appendix G

(5) Following satisfactory completion of a performance test, the date on which the test was performed shall be marked on the external casing in a legible and permanent manner.

8.12 Special Shipping Instructions

If for any reason this unit must be shipped, it is important to prevent any inadvertent activation of the unit. All 406 ELTs are shipped with a strapping plug that will make the unit dormant.

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9. Installation and Instructions for Continuing Airworthiness and Maintenance Typical (Other Countries)

Each country has its own aviation authority. It is important to ensure the right people are notified in the event of an accident, and to contact the appropriate Civil Aviation Authority in that country for guidelines and documentation needed to assure proper registration.

406ELTs are programmed with the country code in which the aircraft has been registered. Always follow the national procedures. The correct information for registering the radio transmitter may require including the following information:

- Serial Number of ELT
- Tail Number
- 24-Bit Aircraft Address
- Owner/Operator Contact Information
- Aircraft Operator Designator/Serial Number

APPENDIX A- Glossary and Abbreviations

NOTE: Some of the following definitions have been deliberately simplified to make them more easily understood by those who do not speak English as their first language.

AC	<u>Advisory Circular</u> Federal Aviation Administration (FAA) bulletins that contain specific information on specific subjects. This does not reference alternating current type of electricity
AN	<u>American National Standard</u> For aircraft approved hardware
AU	<u>Aural Alert</u> 85db signal to alert the crew if G-Switch activation has triggered the 406 ELT
AF	<u>Automatic Fixed</u> Type of ELT that is designed for aviation use
AWG	<u>American Wire Gauge</u> Look for this in front of a wire size number
BNC	<u>Coax Connector</u> BNC is the type of connector used to attach the 406 transmitter to the 406 antenna MHZ
CAR	<u>Canadian Aviation Regulation</u> Transport Canada's rules for aircraft modifications and airworthiness.
CFR	<u>Code of Federal Regulations</u> The library of rules and regulations for all US rules and regulations. Title 14 is specific to aviation
COSPAS-SARSAT	<u>International search and rescue consortium</u> – For more information see www.cospas-sarsat.org .
EASA	<u>European Aviation Safety Agency</u> See www.easa.eu.int
EMI	<u>Electromagnetic Interference</u> Electronic-type noise that introduces spurious interference in other systems
ELT	<u>Emergency Locating Transmitter</u> ELTs are installed on aircraft to alert SAR of an accident or emergency
FAA	<u>Federal Aviation Administration</u> The US government agency responsible for aircraft safety and regulation
FAR	<u>Federal Administration Regulations</u> The rule books that FAA personnel use to regulate aviation

FCC	<u>Federal Communications Commission</u> – The US government agency that regulates the public use of the radio airwaves
G-switch	An <u>accelerometer</u> that senses sudden changes in speed. This is used to active the ELT after a crash
LED	<u>Light Emitting Diode</u> Semiconductor device that emits light when activated. This unit uses both red and green
LEO	<u>Low Earth Orbiting</u> One of the satellite constellations used for detecting 406 beacons
Mil-Spec	The US <u>military specifications</u> that apply to wire, hardware, electronic components, etc. Quality is usually very high
P/N	<u>Part Number</u> The identifier for each part that has been assigned by the manufacturer
PVC	<u>Poly-Vinyl- Chloride</u> A type of exterior coating for some wires. It is not generally accepted as airworthy as some variants release poly-cyanide gases when burned
Retrofit	To remove old systems and install ones in their place
RMI	<u>Radio Magnetic Interference</u> Electrical noise generated by Radio Frequencies that are transmitted into other electronic devices
RF	<u>Radio Frequency</u> The energy that is transmitted from the device
RTCA	<u>Radio Technical Commission for Aeronautics</u> US agency that sets standards for airworthiness. See http://www.rtca.org/aboutrtca.asp
SAR	<u>Search and Rescue</u> The system, usually government controlled, for locating and rendering aid to those in distress.
SMA	The <u>special type of connectors</u> for the GPS Antenna Connectors
STC	<u>Supplemental Type Certificate</u> A change in the original type certificate (TC) that allows for modification from the original design. This guarantees the airworthiness of the aircraft after modification
Sub-D	<u>Sub-miniature electrical connector</u> Used for electrical interface between the ELT and remote switch (looks like a D)
TSO	<u>Technical Standard Order</u> The Federal Aviation Administration issues TSOs to indicate approval of a manufactured item for use on aircraft.

APPENDIX B- Environmental Test Plan

ELT Test Plan			
DO-160F section:	Test Name	ELT	Antenna
4.0	Temperature and Altitude	(see DO-204A)	Category D2
5.0	Temperature Variation	(see DO-204A)	Category A
6.0	Humidity	Category A	Category B
7.0	Operational Shocks and Crash Safety	(see DO-204A)	Category B
8.0	Vibration	Category R	Category R
9.0	Explosive Atmosphere	N/A	N/A
10.0	Waterproof	(see DO-204A)	N/A
11.0	Fluids Susceptibility	N/A	Category F
12.0	Sand and Dust	N/A	N/A
13.0	Fungus Resistance	N/A	N/A
14.0	Salt Fog	Category S	N/A
15.0	Magnetic Effect	Category A	Category A
16.0	Power Input	Category BRX	Category BRX
17.0	Voltage Spike	N/A	Category A
18.0	Audio Frequency Conducted Susceptibility	N/A	Category Z
19.0	Induced Signal Susceptibility	Category ZC	Category ZC
20.0	Radio Frequency Susceptibility	Category WW	Category WW
21.0	Emissions of Radio Frequency Energy	Category L	Category L
22.0	Lightning Induced Transient Susceptibility	N/A	Category A3C3X
23.0	Lightning Direct Effects	N/A	Category 2A
21.0	Icing	N/A	Category C
25.0	Electrostatic Discharge	Category A	Category A
26.0	Fire, Flammability	(see DO-204A)	N/A

DO-204A Sections:			
2.3.1 (in lieu of DO-160F section 4.0)	Temperature and Altitude	required	
2.3.2(in lieu of DO-160F section 5.0)	Frequency Stability and Other Electrical Tests	required	
2.3.4 (in lieu of DO-160F section 7.0)	Shock, Impact and Crush Tests	required	
2.3.8 (in lieu of DO-160F section 10.0)	Waterproof	required	
2.3.14 (in accordance with DO-160F sec. 16.0)	Power Input	required	
2.3.7.1 (in lieu of DO-160F section 26.0)	Flame Test	required	

Environmental Categories: D1XBC[204][204]XRXXFXXZAZA[204]H[XXXX]XXA

RTCA/DO-160D, Appendix A describes the complete explanation of Environmental Categories. References to “Per DO-204” are for tests performed in accordance with RTCA/DO-204.

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533	Malaysia
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661	Rwanda (Republic of)
662	Sudan (Republic of the)

663	Senegal (Republic of)
664	Seychelles (Republic of)
665	Saint Helena
666	Somali Democratic Republic
667	Sierra Leone
668	Sao Tome and Principe (Democratic Republic of)
669	Swaziland (Kingdom of)
670	Chad (Republic of)
671	Togolese Republic
672	Tunisia
674	Tanzania (United Republic of)
675	Uganda (Republic of)
676	Democratic Republic of the Congo
677	Tanzania (United Republic of)
678	Zambia (Republic of)
679	Zimbabwe (Republic of)
701	Argentine Republic
710	Brazil (Federative Republic of)
720	Bolivia (Plurinational State of)
725	Chile
730	Colombia (Republic of)
735	Ecuador
740	Falkland Islands (Malvinas)
745	Guiana (French Department of)
750	Guyana
755	Paraguay (Republic of)
760	Peru
765	Suriname (Republic of)
770	Uruguay (Eastern Republic of)
775	Venezuela (Bolivarian Republic of)

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Appendix D Troubleshooting Guide

Emerging Lifesavings Technologies were designed to be as worry free as possible but with any complex electronic system faults can occur. A large array of tests were performed during the manufacturing and certification process of each unit. The use of the Self-Test feature will help identify any aircraft maintenance that will maintain the airworthiness of the ELT.

Indication	Status	Action	Corrective Action
Green Light	System has been activated either by the G-switch or by Pilot's remote switch	Reset system by going from ARM to ON for 3 seconds. Light should go out	If light fails to go remove battery install shipping strap and return to manufacture for repair
Green Flashing Light	System Checks good	No further action is required	
2 Red Flashes	Antenna Failure	The antenna is not properly hook up. Check for mating connectors being completely "snapped tight" Check to insure the antenna is properly installed and grounded to the airframe	Replace Cable Remount antenna and grounding system
3 Red Flashes	Transmitter Chain Failure	This test looks at a number of internal test that verify the accuracy of the ELT and it's ability to send out a completed code within the parameters as set forth by Cospas/Sarsat	There are no field repairable items during this test. Install shipping strap and return to manufacture for repair.
4 Red Flashes	Low Battery	This indicates that the system no longer has enough store power in the internal batteries to operate for at least 36 hours	Replace battery pack.
5Red Flashes	No GPS	The GPS is not sending data to the ELT to allow transmission of the current	Check for power on Pin 6 and ground on pin 5

5Red Flashes cont.		location.	of both the ELT and the remote switch. If the failure continues Install shipping strap and return to manufacture for repair.
Aural Alert	Constant beeping	The aural alert only goes off when the G-Switch has been activated and the ELT is transmitting	Reset the unit by moving the switch from ARM to On for five seconds and then returning to ARM. If the green light stays on disconnect the ELT harness and try to reset at the unit. If the system does not reset Install shipping strap and return to manufacture for repair.
No Self Test	No Lights after test	Check harness to insure good connections between the unit and remote controller. Try the self test at the ELT box.	If the ELT test good replace the remote switch. If the system does not test install shipping strap and return to manufacture for repair.