406MHz ELT's and 406MHz Antenna's

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406MHz only

- I am being specific re 406MHz as many ELT data reports in the past few years have mixed up both

  TSO91 (121.5/243MHz)

  and

  TSO126 (406/121.5MHz)

- (That includes the ATSB Transport Safety Report May 2013)

Reasons as to failures

- **Most Helicopter ELT failure to alert RCC are due to**
- Broken antenna *(as it is on the outside of the aircraft)*
- Separation of BNC connectors on Coax Cable
- Failure of the coax cable by earthing
- Failure of the ELT to stay in the mounting bracket *(see above)*
- Incorrectly mounted to allow G switch to activate
- *(many Artex ME406 mounted in AF configuration)*
- ELT not correctly encoded *(factory maintenance code)*

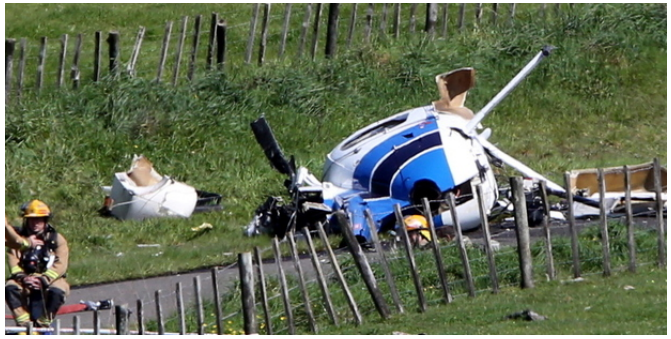
NZ Helicopter accidents

- 12 months ending March 2015- 7 fatalities
- Accidents recorded as per NZ CAA = 19
- Accidents that CAA records showed that ELT activated was 1 / 19- Actual was 6/19
- Of 19, nine were slow or dynamic rollover or auto rotate- ELT would not have operated.
- Ten where ELT would have been expected to activate

Antenna Location

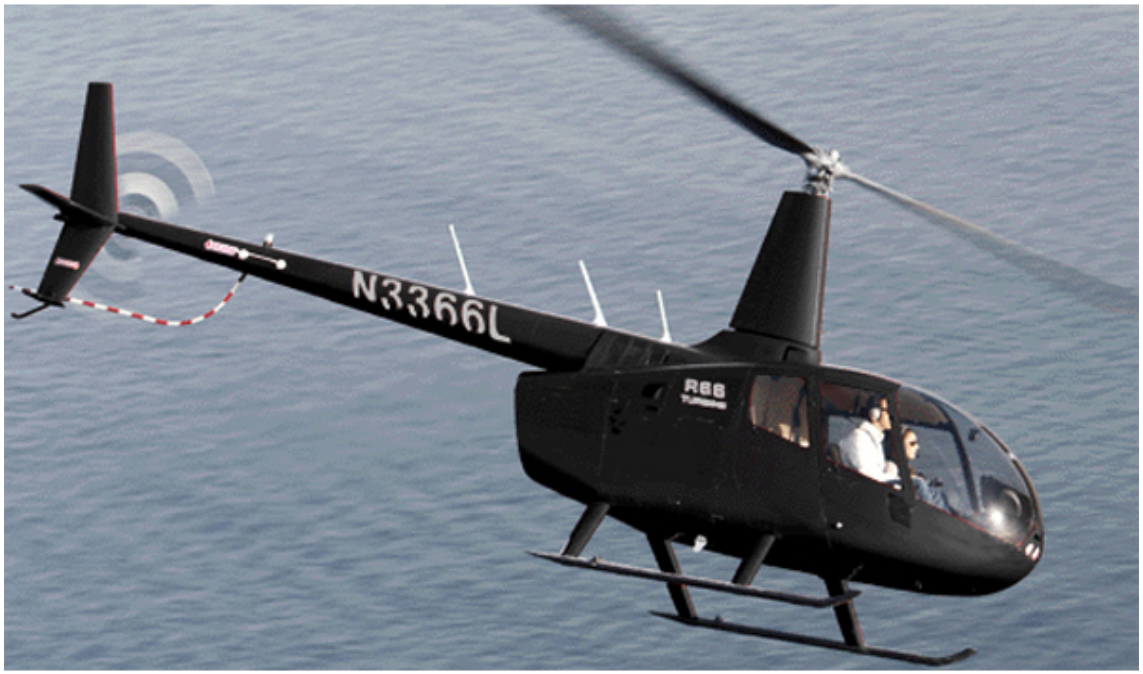
One of the major issues is the location of the Antenna

- Many are installed on the side of the helicopter – **Which side**?
- ***The side that the helicopter naturally lies on due the torsional rotation of the blades***



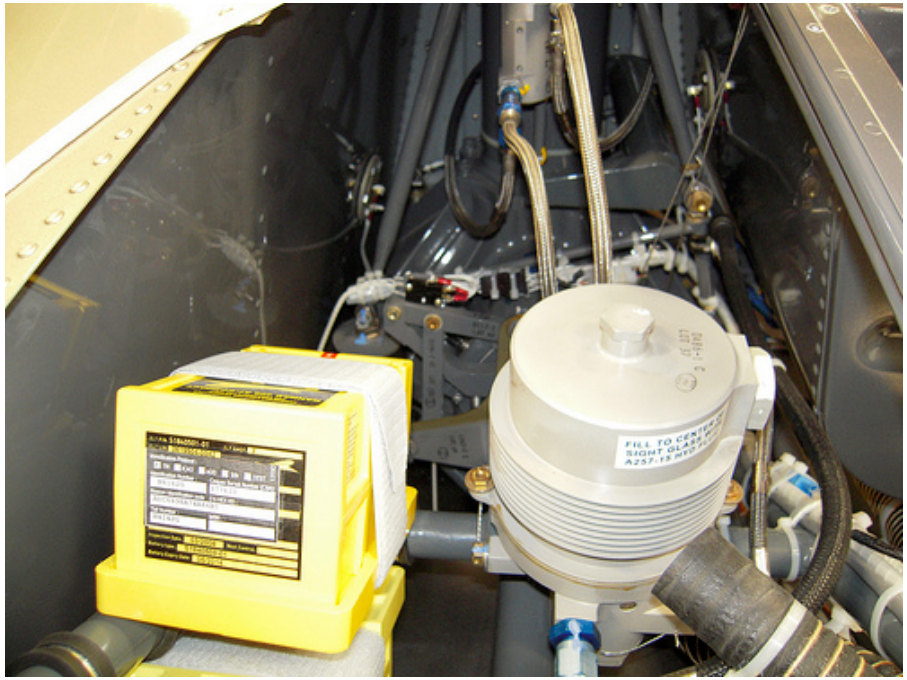
Antenna Location

The rest are on the top and just as vulnerable

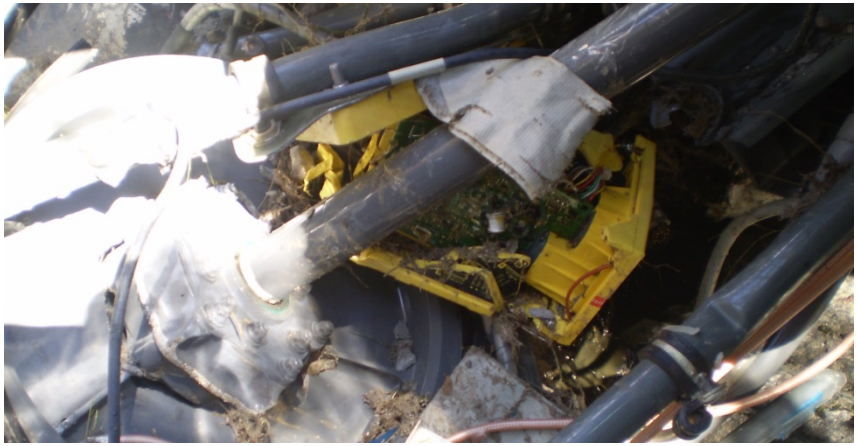


Results of ELT location

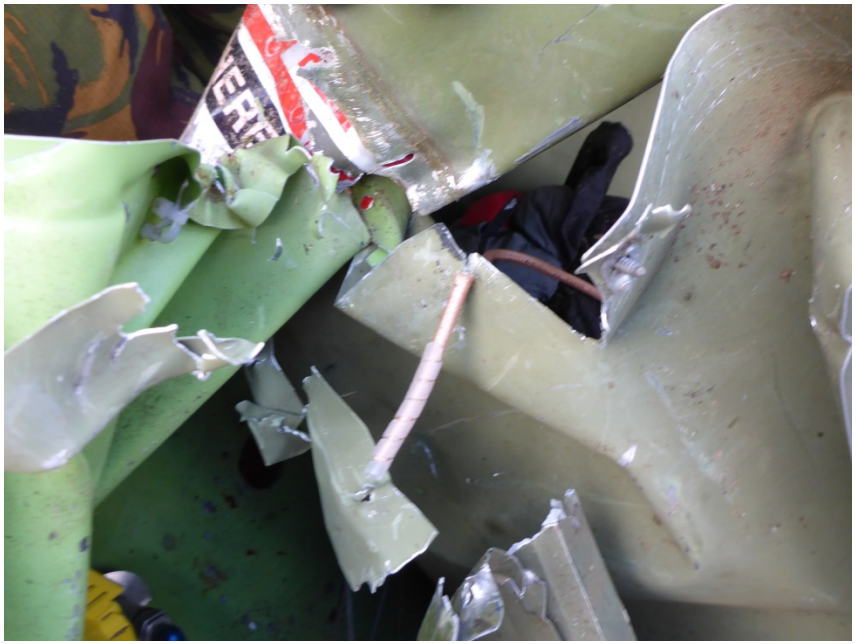
Then there is the issue with the location of the ELT !

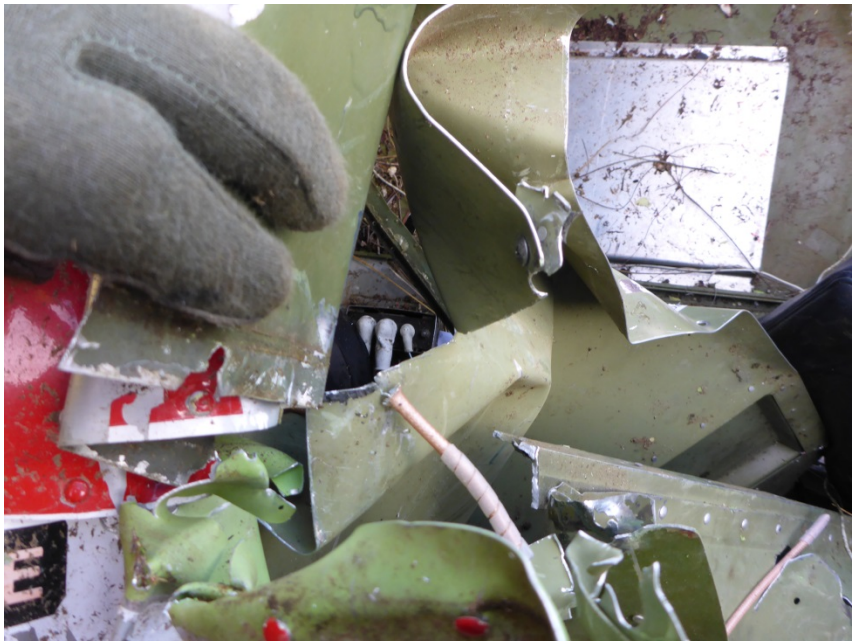


The main mast to the rotor can crush the ELT especially if it is a R22 or R44

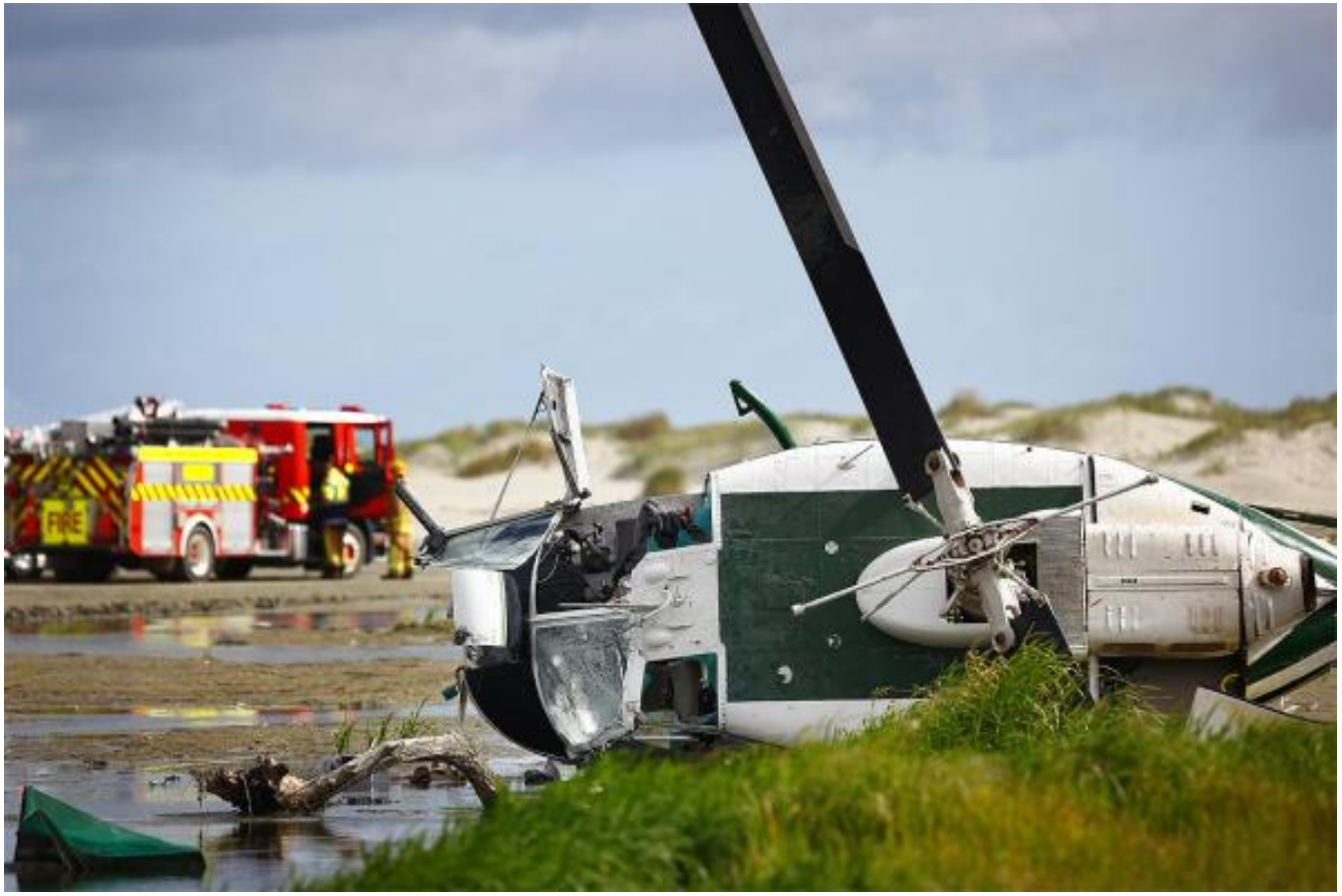


Antenna Cables through bulkheads
The new cable “stripper”



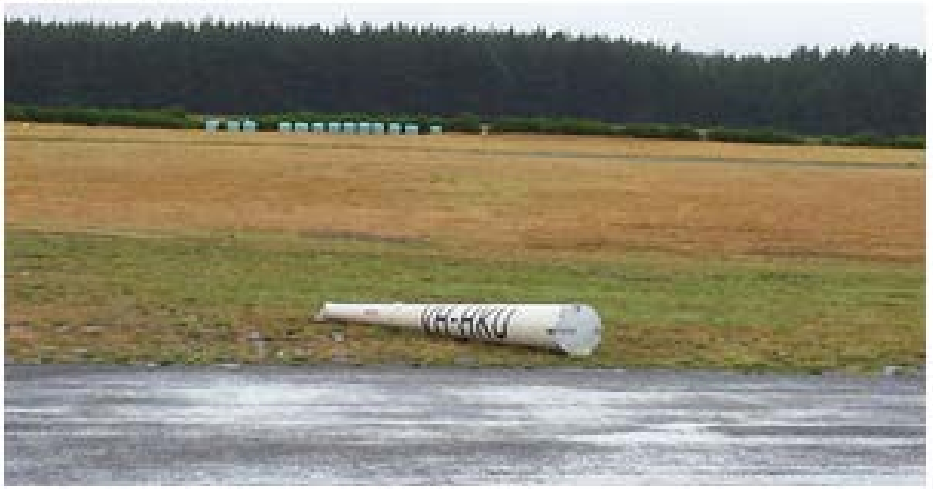


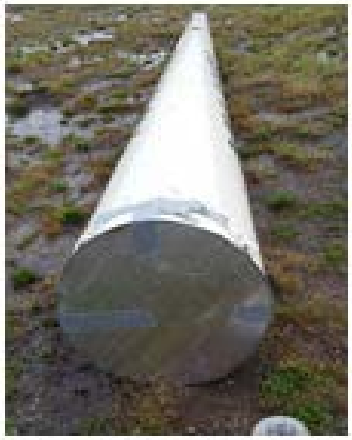
So what is to be done ?



Testing an antenna within a Tail Boom – R44

Test location Taupo

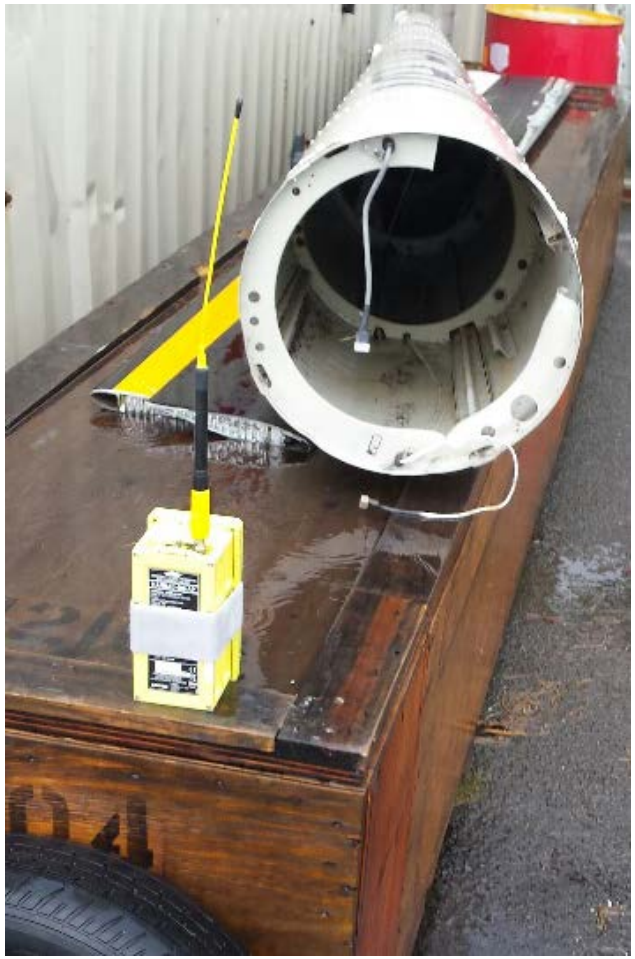




Test of an antenna within a tail boom

- **Check BT100 2015- 043**

- **Power measured BT100 = 35.2dBm**
- **Power receipted on GEO satellite**
- **-134.55 dBm average**



Test- (successful)

406AP- Vertical Antenna bent in "h" shape to fit boom then boom enclosed

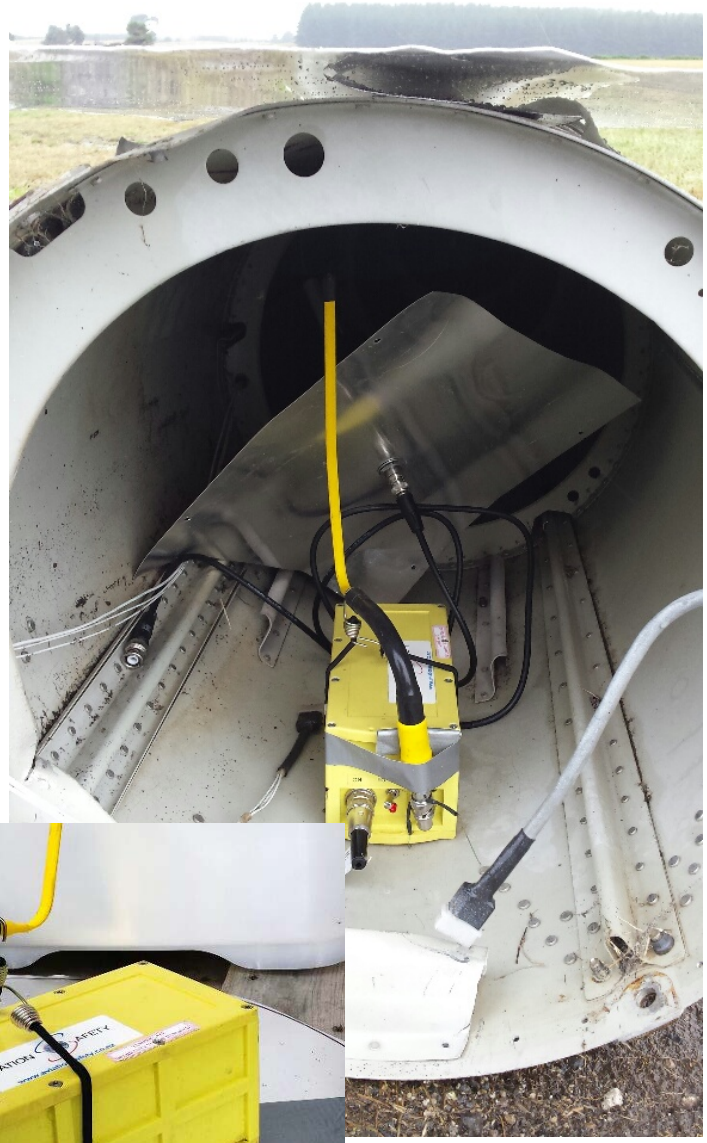
External Radiated power measured BT100 2015-045 = 43%

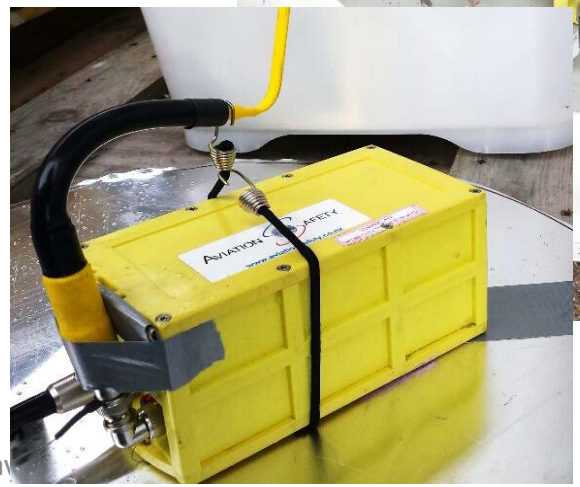
Power measured on LEO satellite

-138.23dBm average

Satellite location correct
Latitude 37.74823
longitude 176.07684

This test was also successfully repeated with a whip antenna enclosed in the tail boom





Testing on three separate occasions has proven

- ***That a 406MHz antenna within an aircraft fuselage will transmit successfully to the Cospas-sarsat system***
- ***The tests show that it matters little if the fuselage material is composite or aluminium***

  i.e. You do not need a window
- **NOTE *that the signal will not transmit through a carbon fibre fuselage***

The Issues

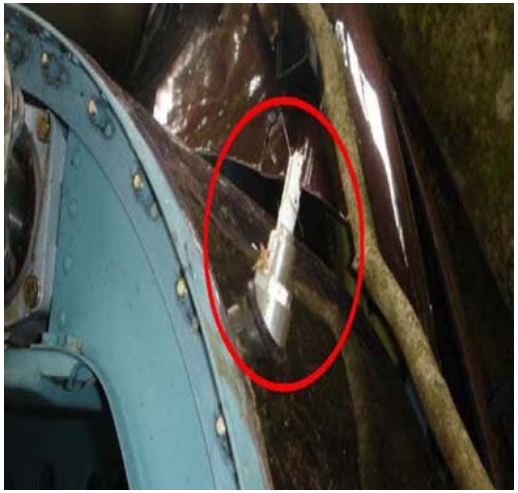
- We need to change some of the wording of the RTCA document D-204A
- This is to do with antenna location
- The word ***shall*** needs to be replaced with **should**
- Current Wording DO-204A
- 3.1.10.1 Antenna Polarization The antenna *shall* / should be mounted to provide either right-hand circular or vertical polarization when the aircraft is in the normal flight attitude.
- Remember most 406MHz ELT antennas are now omni directional

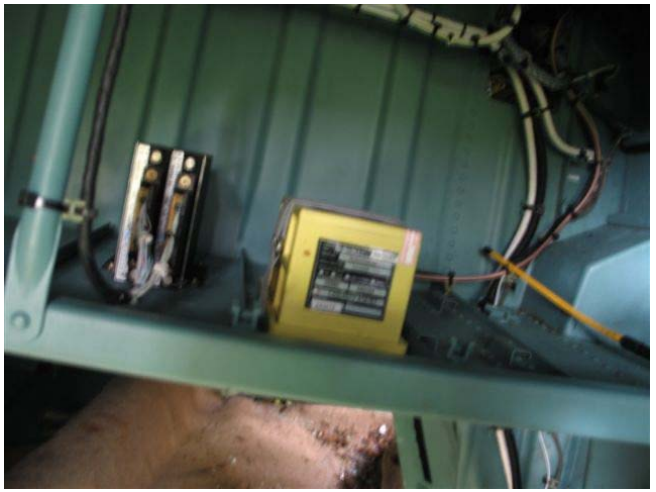
The Issues

- **3.1.10.4 Internal Antenna Location**
  - *The antenna **shall / should** be installed as close to the ELT unit as practicable, insulated from metal window casings and restrained from movement within the cabin area. The antenna **shall / should** be located such that its vertical extension is exposed to a RF transparent window.*
- *The proximity to the vertical sides of the window and to the window pane and casing and the minimum acceptable window dimensions **shall / should** be in accordance with the equipment manufacturer's instructions*
- *This part of the regulation written around 121.5/243MHz ELTs*

Results if wording change

- ***Engineers will be able to install 406MHz ELT systems in the most crash worthy position and still comply with regulations***
- ELT systems currently fail due to regulations that prevent ELT antennas being placed in a crash worthy position





What can you do to assist

- The data collected from accidents often leaves a lot to be desired.
- We continue to struggle to receive accurate ELT information from most accidents
- Helicopter accidents in particular have a high failure of ELT systems generally due to broken antennas
- Loss of control -slow roll overs will not activate an ELT even with multi axis G -Switches

Under review

- As a result of AF447 and MH370, a new Generation 406MHz is now underway
- IN-FLIGHT EVENT DETECTION & TRIGGERING
- *The in-flight event detection and triggering criteria logic shall be designed to process data pertaining to aircraft status and provide output(s) information to transmission system(s)*

Second generation Cospas-Sarsat 406MHz beacon systems

- next generation ELTs specifications,
- Mandatory GNSS specifications (GPS)
- PLUS In-flight activation because of flight anomaly
- Power source options?
- Crash safety (crash worthy) specifications?
- Return link services specifications options?
- Second generation homing ?Maybe just 406MHz
- Improved Antenna and Cabling Specifications
- Currently RTCA are developing aviation-based 406 MHz MEOSAR distress alerting and location proposals / papers for consideration by Cospas-Sarsat
- Defining the frequency of transmission of data and applicable parameters

However in the meantime

- Ensure that all accidents have a higher level of audit around the ELT installation

and

- reasons for both not working or working
- Support a change in location of antennas to crash worthy positions via the regulator
- Ensure all ELT installations are ***engineered***

Questions ??