

# Beacon Manufacturers Workshop

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Beacon Type Approval Updates for ELT-DTs

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## ELT(DT) Type Approval Process

- Fundamentally the process is the same as the current process for type approval for T.001 compliant beacons
- A few new tests (and conditions) have been added to address the ELT(DT) specific requirements in document C/S T.007
- ELT(DT) tests remain to be developed in document C/S T.021 for C/S T.018 beacons but are likely to be based on the tests implemented in C/S T.007



## FGB ELT(DT) Document Status

- Document C/S T.001, Specification has been submitted to the CSC-58 Session for approval in May 2017
- Document C/S T.007, Type Approval Standard, has been submitted to the CSC-58 Session for approval in May 2017
- Document C/S T.008 was updated with proposed amendments at TG-1 and may be further refined at JC-31.



# Main ELT(DT)s C/S T.001-related amendments Approved at CSC-57 (or Proposed at TG-1/2017)

## Para 2.2.1 Repetition Period

Repetition period 5 seconds ~~+/-0.1~~(+0 / -0.2 (per TG-1) seconds during the first 30 seconds after beacon activation; and after the first 30 seconds after beacon activation until the beacon is deactivated the period is randomised around a mean value of 28.5 seconds, so that time intervals between transmissions are randomly distributed on the interval 27.0 to 30.0 seconds.

## Para 2.2.4 Digital message

400 bps +0.1 percent.

ELT(DT)s shall also have means of deactivation by the same means of activation which shall be followed by a cancellation message sequence

## Para 2.3.1 Medium Term Stability

For ELT(DT)s, the requirement of medium term stability (mean slope and residual frequency variation) does not apply





# ELT(DT)s C/S T.001 related amendments

## Para 2.3.2 Output Power

For ELT(DT)s, the transmitter power output shall be within the limits of 36 dBm to 39 dBm measured into a 50-Ohm load.

This power output shall be maintained during 20-hour operation at any temperature throughout the specified operating temperature range.

Power output rise time shall be less than 2 ms measured between the 10% and 90% power points. The power output is assumed to rise linearly from zero and therefore must be zero prior to about 0.6 ms before the beginning of the rise time measurement; if it is not zero, the maximum acceptable level is -10 dBm

## Para 2.3.3 Gain :

-2 dBi and 6 dBi over 90% of the above region for ELT(DT)s





# ELT(DT)s C/S T.001 related amendments

## Para 2.3.6 Rise and Fall times

For ELT(DT)s, the rise times of the modulated waveform, shall be between 50  $\mu$ s and 150  $\mu$ s.

## Para 3.3 Cancellation messages

When the ELT(DT) is deactivated the ELT(DT) shall transmit 10 identical cancellation messages transmitted at intervals of 10 seconds  $\pm$ 0.5 seconds, after which time the beacon shall cease transmitting. In the case the ELT(DT) is activated (e.g. triggered) during the cancellation sequence, the beacon shall terminate the cancellation transmission sequence and reinitiate the alert sequence

## Para 4.2.1 Operating Temperature Range

Class 0: -55 °C to +70 °C

## Para 4.2.2 Temperature Gradient

New Figure 4.1: Temperature Gradient Graph to allow Class 0 testing

## Para 4.2.3 Thermal Shock

For ELT(DT)s all system requirements of section 2 shall be met, excluding the medium term frequency stability requirements, for measurements beginning with the first transmission after simultaneously activating the beacon and applying a thermal shock of 50 °C within the specified operating temperature range of the beacon. Subsequently, system requirements shall continue to be met for a minimum period of two (2) hours.





# ELT(DT)s C/S T.001 related amendments

## Para 3.3.8.1 new ELT (DT) protocol

- **PDF-1:**
  - bits 37 to 40: 4-bit protocol code defined as 1001,
  - bits 41 to 42: 2-bits for type of beacon identity set to “00” for Aircraft 24 bit address, “01” for Aircraft operators designator and serial number, “10” for TAC with serial number, and “11” for ELT(DT) Location Test Protocol.
  - bits 43 to 66: 24 bits of beacon identification data,
  - bits 67 to 85: 19 bits of position data to 30 minute resolution;
- **PDF-2:**
  - bits 107 & 108: means of activation
  - bits 109 to 112: encoded altitude
  - bits 113 & 114 encoded location currency
  - bits 115 to 132: 18-bit position offset to 4 second resolution.

## Para 3.3.8.2 New ELT (DT) test protocol

## Para 3.3.8.3 ELT (DT) cancellation message





# ELT(DT)s C/S T.001 related amendments

## Para 4.5.2

The minimum duration of continuous operation for an ELT(DT) to meet the ICAO GADSS requirement at any temperature throughout the specified operating temperature range shall be 20† hours.

## Para 4.5.5

New encoded position requirements, **and addition of “integral” GNSS system (at TG-1)**

## Para 4.5.6

For ELT(DT)s, the transmission shall start within 5 seconds after beacon activation, as defined in section 2.2.1.

ELT(DT)s shall allow for automatic and manual means of activation. ELT(DT)s shall also have means of deactivation by the same means of activation which shall be followed by a cancellation message sequence. Consequently: If the ELT(DT) has been automatically activated by the triggering system, it shall can only be de-activated by the same means. If the beacon has been manually activated (i.e. from the cockpit), it shall can only be manually de-activated. If the beacon has been activated by any combination of activation means, it can only be de-activated once each activation means has been deactivated.







# ELT(DT)s C/S T.001 related amendments

## Para 4.5.6.1

New Section (created at TG-1) for ELT(DT)s, that defines the operating modes.

## Para A.3.3.2.3

Clarified activation mechanisms and associated indicators at TG-1/2017.

If the beacon receives more than one triggering command, then the most recent triggering event is indicated in the bits 107-108.





## ELT(DT) Type Approval Summary of Process Changes (T.007)

- The concept of an “Armed” mode in which the ELT(DT) may be powered externally with some beacon features active has been introduced
- Medium term frequency stability test do not apply to ELT(DTs)
- A MEOSAR Satellite Qualification test has been introduced
- Navigation System Test is mandatory for ELT(DT)s





## ELT(DT) Type Approval Summary of Process Changes (T.007)

- A new navigation test using a simulator has been added to document C/S T.007 as Annex K
- Method of Activation and Cancellation Tests have been added to a new Section A.3.9 in document C/S T.007
- Changing the ELT(DT) EIRP limits to match those agreed in T.001 last year



## ELT(DT) Type Approval Summary of Process Changes (T.007)

- Adding an Altitude (height above sea level) test to all the navigation and location protocol tests
- Updating numerous tests to make them handle the ELT(DT) differences in C/S T.001 introduced at JC-30 last year
- Updates made to summary and other reporting forms and documentation





## ELT(DT) MEOSAR SAT/Qual Test (C/S T.007)

- Added into C/S T.007, Section A.2.5
- Commence without a 15-minute warm-up period after activation.
- Test data shall be obtained from MEOSAR satellites rather than LEOSAR.
- Performed at a known location 3 times for a period of between 15 to 20 minutes each time separated by a period of 5 to 7 hours between each test.



## ELT(DT) MEOSAR SAT/Qual Test (C/S T.007)

### Pass/Fail Criteria

- a) The MEOLUT shall produce an alert with a complete beacon message, including the correct beacon 15 hexadecimal identification, at least once every minute for greater than 90% of the total test time;
- b) The encoded location provided by the MEOLUT for each alert in a) above shall be accurate in the horizontal plane to within 200 metres for greater than 90% of the alerts; and
- c) The encoded location provided by the MEOLUT for each of the alerts in a) above shall be accurate in the vertical plane such that the altitude above sea level is correctly reported. The test shall be performed at an altitude of less than 4000 metres above sea level.





## ELT(DT) Navigation Test (C/S T.007)

- ELT(DT)s change the navigation signal (by using a GNSS RF simulator) at a speed of up to 1,000 km/h (277.8 m/s) in the horizontal plane and from -100m to 11,000m above sea level in altitude in accordance with Annex K.
- Annex K defines a simulated “flight profile” that the beacon is to be exposed to for performance validation.
- This test compares the simulated position to the encoded locations transmitted over the profile.



## ELT(DT) Activation/Cancellation Test (C/S T.007)

- Test Added to Section A.3.9 in C/S T.007
- Test is designed to check for correct activation and deactivation of the ELT(DT) coupled with the transmission of the Cancellation Message at the appropriate time, as defined in C/S T.001.
- Activation and Deactivation Tests
- Cancellation Message Tests
- Reactivation Test





# ELT(DT) Activation/Cancellation Test (C/S T.007)

Test No	Control Lines			Message Bits Status		ELT(DT) Status
	Auto Activation by beacon	Auto Activation by external means	Manual Activation	Bit 107	Bit 108	
1	Disabled	Disabled	Disabled	N/A	N/A	ARMED
2	Disabled	Enabled	Disabled	1	0	ON
3	Disabled	Enabled	Enabled	0	0	ON
4	Disabled	Disabled	Enabled	0	0	ON
5	Disabled	Disabled	Disabled	N/A	N/A	ARMED
6	Disabled	Enabled	Disabled	1	0	ON
7	Disabled	Disabled	Disabled	N/A	N/A	ARMED
8	Disabled	Disabled	Enabled	0	0	ON
9	Disabled	Enabled	Enabled	1	0	ON
10	Disabled	Enabled	Disabled	1	0	ON
11	Disabled	Disabled	Disabled	N/A	N/A	ARMED
12	Disabled	Disabled	Enabled	0	0	ON
13	Disabled	Disabled	Disabled	N/A	N/A	ARMED
14	Enabled	Disabled	Disabled	0	1	ON
15	Enabled	Disabled	Enabled	0	0	ON
16	Enabled	Enabled	Enabled	1	0	ON
17	Enabled	Disabled	Enabled	0	0	ON
18a	Disabled	Disabled	Disabled	N/A	N/A	ARMED
18b	Enabled	Disabled	Disabled	0	1	ON
19	Disabled	Disabled	Disabled	N/A	N/A	ARMED
20	Enabled	Disabled	Disabled	0	1	ON
21	Enabled	Enabled	Disabled	1	0	ON
22	Enabled	Enabled	Enabled	0	0	ON
23	Enabled	Enabled	Disabled	1	0	ON
24a	Disabled †	Disabled	Disabled	N/A	N/A	ARMED
24b	Enabled §	Disabled	Disabled	0	1	ON
25	Disabled	Disabled	Disabled	N/A	N/A	ARMED





## SGB ELT(DT) Document Status

- Document C/S T.018, SGB Specification has been submitted to the CSC-58 Session for approval in May 2017
- Document C/S T.021, SGB Type Approval Standard, is progressing but requires further development
- Document C/S T.008 was updated to include T.018 beacons (but requires additional work between now and JC-31)



## ELT(DT)s C/S T.018 related amendments

- Document C/S T.018, Approved at Issue 1, at CSC-57 in December 2016
- This release included requirements to address ELT(DT)s that were scattered throughout the document
- There are a few specific requirements that are different for ELT(DT)s

### Para 4.5.5.3 (new section at TG-1/2017)

- Consolidated the ELT(DT) Navigation requirements into one document section

### Para 4.5.6.1 (new section at TG-1/2017)

- New Modes of operation for ELT(DT)s





## ELT(DT)s C/S T.018 related amendments

Specific Requirements Modified for ELT(DT)

Para 2.4.2 – EIRP

Table 3.4 – **ELT(DT)** In-Flight Emergency Rotating Field



## ELT(DT)s C/S T.021 related amendments

- **Specific Type Approval Tests for ELT(DT) are TBD**
- **There is a high likelihood that some of the tests developed for C/S T.007 with respect to ELT(DT)s will be applicable and/or adaptable to C/S T.021**



## Certified Test Facilities

There are five accepted beacon test facilities certified for T.001 beacons as shown on the Cospas-Sarsat website:

- Cospas-Sarsat Beacon Certification Facility, Fort Huachuca, AZ, USA
- Test Center MAYAK BINCOS , Moscow, Russia
- Test Center “TC NIIR”, Moscow, Russia **(New)**
- Testing center "Omega", Sevastopol, Ukraine
- TÜV SÜD Product Service, Fareham, Hampshire, UK





# For More Information

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