



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: FLIGHT RECORDER AND COCKPIT VOICE RECORDER UNDERWATER LOCATING DEVICES	Date: 4-19-83 Initiated by: ANM-110	AC No: 21-10A Change:
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1. PURPOSE. This advisory circular provides an acceptable means of showing compliance with the underwater locating device (ULD) requirements of the Federal Aviation Regulations (FAR) for recorder ULD's. Like all advisory circular material, it is not mandatory and does not constitute a regulation. It is for guidance purposes and to provide an example of a method which has been found acceptable.

2. CANCELLATION. Advisory Circular 21-10, Flight Recorder Underwater Locating Devices, dated May 20, 1971, is cancelled.

3. RELATED FAR SECTIONS.

- a. Sections 25.1457(g)(3) and 25.1459(d)(3) of the FAR.
- b. Sections 121.343(f) and 121.359(c)(2)(iii) of the FAR.

4. BACKGROUND. Federal Aviation Regulations Amendments 25-25 and 121-66 established requirements for a ULD to assist in locating flight data recorders (FDR) under water. Amendment 121-135 established a similar ULD requirement for cockpit voice recorders (CVR). In addition, Amendment 121-135 permitted a single ULD installation, provided the FDR and the CVR are installed adjacent to each other in such a manner that they are unlikely to become separated during crash impact. In most cases, acoustic beacons (pingers) have been installed as the ULD.

5. ACCEPTABLE MEANS OF COMPLIANCE. An underwater acoustical beacon is acceptable for use as a recorder ULD provided:

a. Test Criteria.

(1) Environmental Tests. The beacon is subjected to the following in the order given:

(i) Condensation. The beacon is cold soaked at $-9^{\circ} + 3^{\circ}$ C. ($15^{\circ} + 5^{\circ}$ F.) for 6 hours, and then immediately placed in a chamber maintained at $35^{\circ} + 3^{\circ}$ C. ($95^{\circ} + 5^{\circ}$ F.), and at a relative humidity of 95 + 5 percent for 18 hours. This environmental cycle is conducted 15 times. Condensation is not to hamper proper operation, cause corrosion of vital parts, or activate the ULD transmitter.

(ii) Temperature (Storage). The beacon is stored at a temperature of $-54^{\circ} +3^{\circ}$ C. ($-65^{\circ} +5^{\circ}$ F.) for 48 hours, and then at a temperature of $71^{\circ} +3^{\circ}$ C. ($160^{\circ} +5^{\circ}$ F.) for 48 hours.

(iii) Vibration. The beacon is exposed to continuous scan vibration for 1 hour in each of the three major mutually perpendicular axes. The scan is from 5 to 2,000 Hz, with a maximum total excursion of 0.020 inches and a maximum acceleration of 3g.

(iv) Pressure. The beacon is exposed to an external pressure of 8,700 psi for a period of 5 minutes. The pressure may be applied as a uniformly distributed force in an incompressible liquid as would be exerted at an ocean depth of 20,000 feet.

(v) Impact. The beacon or beacon installation package, as applicable, is exposed to a half sine wave impact shock having a peak acceleration of 1,000g. The time duration at the base of the half sine wave should be at least 5 milliseconds. Apply the impact shock in the most critical direction. The shock may be applied by placing the beacon or beacon installation package, as applicable, on a flat surface and accelerating the surface.

(vi) Static Crush. The beacon is exposed to a static crush force of 5,000 pounds for 5 minutes. Apply the crush force in the most critical direction. The crush force may be applied by placing the beacon between two flat surfaces and bringing the surfaces together until the 5,000 pound force is developed.

b. Performance. The beacon utilized for the above environmental tests is exposed to the following performance tests upon completion of the environmental tests:

- (1) Output frequency: 37.5 ± 1 kilohertz;
- (2) Minimum pulse length: 9.0 milliseconds;
- (3) Minimum pulse repetition rate: 0.9 pulse per second;
- (4) Minimum initial acoustical output as tested in fresh water: 1,500 dynes per square centimeter peak pressure at 1 meter distance;
- (5) Operating life: 30 days;
- (6) Minimum acoustical output after 30-day operation: 1,000 dynes per square centimeter peak pressure, at 1 meter distance;
- (7) Actuation: Within 4 hours after immersion in fresh water or salt water, at all depths to 20,000 feet;
- (8) Operating temperature range: -2° to $+38^{\circ}$ C. (28° to $+100^{\circ}$ F.); and
- (9) Operating depth range: Surface to 20,000 feet.

c. Installation.

(1) The ULD is installed such that it is unlikely to separate from its associated FDR or CVR, or that the ULD, FDR, CVR package of single ULD installations is unlikely to become separated when subjected to crash impacts. The 1,000g impact shock test criteria specified in paragraph 5a(1)(v) have been found acceptable in demonstrating that the beacon and associated recorder or recorders are unlikely to separate when subjected to crash impacts. In lieu of the actual impact test, a crash condition analysis has also been found acceptable that substantiates the ULD package's ability to meet the 1,000g impact shock test parameters specified in paragraph 5a(1)(v).

(2) The installed ULD radiates its rated free space acoustic output over 80 percent of a spherical pattern. If more than one beacon is necessary to achieve that pattern, the installation should include sufficient beacons in specified relative positions.

6. CERTIFICATION OF COMPLIANCE. Compliance with §§ 25.1457(g)(3) and 25.1459(d)(b) and/or 121.343(f) and 123.359(c)(2)(iii) may also be achieved: (1) through use of ULDs as installed by the recorder manufacturer through his compliance with all TSO and AC requirements; or (2) by installation of the ULD by the operator through use of approved manufacturer's field service bulletin and installation kit, provided mounting and clearance are adequate for those recorder installations not presently equipped with the ULD.

A handwritten signature in black ink, appearing to read "Leroy A. Keith". The signature is fluid and cursive, with the first name "Leroy" written in a larger, more prominent script than the last name "Keith".

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