

Cancelled 00-20

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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

SUBJECT: EMERGENCY LOCATOR BEACONS - CRASH, SURVIVAL, PERSONNEL

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1. PURPOSE. This circular provides information concerning recent activities relating to emergency locator radio beacons. It defines the class of beacons by Crash Locator Beacon, Personnel Locator Beacon, and Survival Radio Equipment. Additionally, it describes for users the means by which such signals will be monitored or heard and by which the likelihood of rescue will be enhanced. It encourages aviation operators and industry to continue their interest in this program through cooperation and coordination with the FAA and other interested organizations.
 2. CANCELLATION. Advisory Circular 170-4, Emergency Signalling Device for Aircraft in Distress, dated January 9, 1964, is canceled.
 3. DEFINITIONS.
 - a. Crash Locator Beacon - means an electronic device attached to the aircraft structure as far aft as practicable in the fuselage, or in the tail surface, in such a manner that damage to the beacon will be minimized in the event of crash impact. It may be automatically ejectable or be permanently mounted. If it is automatically ejectable it will also have provision for manual removal and operation. The beacon operates from its own power source on 121.5 MHz and 243.0 MHz emergency frequencies, transmitting a distinctive downward swept audio tone for homing purposes, and is designed to function without human action after an accident.
 - b. Survival Radio Equipment - means a self-bouyant, water resistant, portable emergency radio signalling device which operates from its own power source on 121.5 MHz and 243.0 MHz emergency frequencies, transmitting a distinctive downward swept audio tone for homing purposes, which may or may not have voice capability, and which is capable of operation by unskilled persons. (This type equipment is agreed upon internationally, for extended overwater operations, and is presently required equipment for air carriers engaged in
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extended overwater operation.)

- c. Personnel Locator Beacon - means a portable, lightweight beacon, manually operated, which is designed to be carried on the person, in the cockpit of an aircraft, or attached to a parachute, which operates from its own power source on 121.5 MHz and 243.0 MHz emergency frequencies, transmitting a distinctive downward swept audio tone for homing purposes, which may or may not have voice capability, and which is capable of operation by unskilled persons.

4. BACKGROUND.

- a. For many years, the FAA has advocated the voluntary use of aircraft locator beacons in general aviation aircraft. An Advisory Circular, 170-4, entitled "Emergency Signalling Device for Aircraft in Distress," was issued effective January 9, 1964. This was followed by articles in general aviation publications which emphasized and encouraged the purchase or lease of such equipment.
- b. Several tragic accidents in 1966 and 1967, wherein survivors lived for some time but finally died of injuries, starvation, or exposure, resulted in national press coverage, which awakened interest in the use of a rescue beacon to guide search parties to the scene of a crash.
- c. The FAA, Civil Air Patrol, commercial manufacturers and several foreign countries have completed tests which gave us additional technical information on the necessary performance qualities of beacons, as well as established practical search techniques and methods.
- d. A national conference on aircraft locator beacon implementation, sponsored jointly by Aircraft Owners and Pilots Association, National Association of State Aviation Officials and Radio Technical Commission for Aeronautics, was held early in 1968 for the purpose of achieving a coordinated effort in the expansion of a program to enhance the use of locator beacons and necessary search equipment.
- e. Public interest in the use and availability of locator beacons has been increasing. There is also increased interest on the part of manufacturers to develop locator beacons or to refine existing ones. The FAA believes that such interest should be encouraged and that this advisory circular will be of help in that direction.

5. INFORMATION.

- a. Basically, a locator beacon is a radio transmitter designed to emit a distress signal. The locator beacon transmits a modulated tone on the international emergency frequencies, 121.5 MHz and 243.0 MHz.

A downward swept tone audio signal should be used that sweeps in pitch from approximately 1,000 Hz to 300 Hz about two to three times a second.

- b. Locator beacons operate from self-contained batteries. Some are available with batteries rechargeable from the aircraft's electrical system. Special batteries are available that provide for relatively long periods of operation, including operation at low temperatures; however, some beacons use batteries that have reduced power output characteristics at the lower temperatures.
- c. The most common types of beacons for aircraft are activated either manually or by "G" force switches. The "G" force switch automatically places the beacon in operation when it is subjected to a sudden shock.
- d. When a locator beacon is turned on, its distinctive warbling tone will alert any listener that an emergency exists. Military aircraft guard 243 MHz during all enroute operations and air carrier aircraft customarily guard 121.5 MHz during oceanic flight. In addition, any of the thousands of general aviation and air carrier aircraft will, upon request, monitor the emergency frequency in order to locate a missing aircraft.
- e. All FAA flight inspection aircraft now monitor the emergency frequencies of 121.5 MHz and 243.0 MHz during enroute operations. These aircraft are equipped with a device that measures signal strength, and extensive tests by the FAA using the signal measuring techniques have shown that even under IFR conditions, the location of a downed aircraft equipped with an operating beacon can be determined in the time period of approximately one hour after the search aircraft is within the reception range of the beacon. Tests by the Civil Air Patrol members whose aircraft carried no special equipment and using only the normal VHF receivers have shown that they can determine the location of a downed aircraft equipped with an operating beacon; however, not quite as quickly or accurately as aircraft equipped with signal strength meters. These tests have been made with beacons placed in many different types of terrain, including blind canyons, mountain ravines, marsh lands, and open desert. The FAA plans, in the near future, to install new DF equipment in flight inspection aircraft which will enable pinpointing the location in a much shorter time period. The U.S. Coast Guard and U.S. Air Force Search and Rescue aircraft, of course, already have this capability.
- f. The Department of Agriculture is seriously considering installing radio equipment in selected fire watch towers for monitoring 121.5 MHz. They are equipping the aircraft which the Department owns or leases in a like manner in addition to carrying a locator beacon.

These actions will substantially increase the number of monitoring stations and reduce the time necessary to locate a downed aircraft.

- g. Members of the CAP and others have expressed interest in the installation of simple AGC meters which are somewhat more effective in search operations than the audio build and fade method. The latter method should not be discounted, however, as it is highly effective when used with the simple search procedure known as the $180^{\circ}/90^{\circ}$ search pattern. This pattern is used either with or without the aid of an AGC meter, and is graphically and procedurally explained in Appendix 1.
- h. It should be noted that the beacons discussed herein would have to comply with applicable Federal Communications Commission requirements along with the following performance standards which should be considered minimal.
- (1) Simultaneous transmission on 121.5 and 243.0 MHz, A₂ emission.
 - (2) Has a power output to the antenna of at least 100 milliwatts, with antenna losses not exceeding 3db, to achieve a usable range of 25 miles (line of sight) from the beacon.
 - (3) Swept tone modulation - downward swept at least 700 Hz from 1,000 to 1,600 Hz with lowest frequency including 300 Hz. Sweep rate two to four sweeps per second.
 - (4) The capacity of the power supply should be sufficient to provide continuous operation for at least 24 hours at -40°F .
 - (5) It is highly desirable that the equipment operate within the temperature range of -40°F to 130°F . However, satisfactory operation could depend on geographical area and use, season of the year, or a combination of both which may require a less stringent temperature range.
- i. The FAA advises against the use of obsolete military locator beacons which do not meet the performance standards set forth above. Normally, they have only a steady tone modulation and may not operate on both 121.5 MHz and 243.0 MHz simultaneously.

6. RECOMMENDATIONS.

- a. We recommend the installation of crash locator beacons since this type device will afford the best assurance of being located in case of an accident, including those in which the occupants are incapacitated; however, should a crash locator beacon not be installed: carry a personnel locator beacon.

- b. We recommend that the pilot indicate on his flight plan the class of radio beacon that is aboard the aircraft.
- c. We recommend that pilots become knowledgeable regarding other conspicuity actions such as clearing of sites, fires, signals, etc., which could assist in providing an early rescue.
- d. We recommend the carriage of survival radio equipment, and the emergency equipment specified in FAR 135.163 during all extended overwater operations. This emergency equipment can generally be rented at an airport prior to departure for an overwater flight.

NOTE: Extended overwater operation is defined as an operation over water at a horizontal distance of more than 50 nautical miles from the nearest shore line.


Director
Flight Standards Service

SEARCH PATTERN PROCEDURE (180° - 90° PATTERN).

AURALLY AND/OR VISUALLY IDENTIFY EMERGENCY BEACON SIGNAL:

NOTE AGC METER READING. (METER MAY FLUCTUATE RAPIDLY WITH A LOW SIGNAL LEVEL.)

HOLD CONSTANT HEADING AND ALTITUDE WHILE RECORDING LOCATION AND AGC VALUES AT PERIODIC INTERVALS ON ANY APPROPRIATE CHART.

AIRCRAFT WILL PASS THROUGH AREA OF MAXIMUM SIGNAL LEVEL AND CONTINUE TO THE POINT OF SIGNAL FADE OUT.

CONDUCT 180° TURN AND RETURN TO POINT OF HIGHEST SIGNAL LEVEL.

CONDUCT 90° TURN EITHER LEFT OR RIGHT.

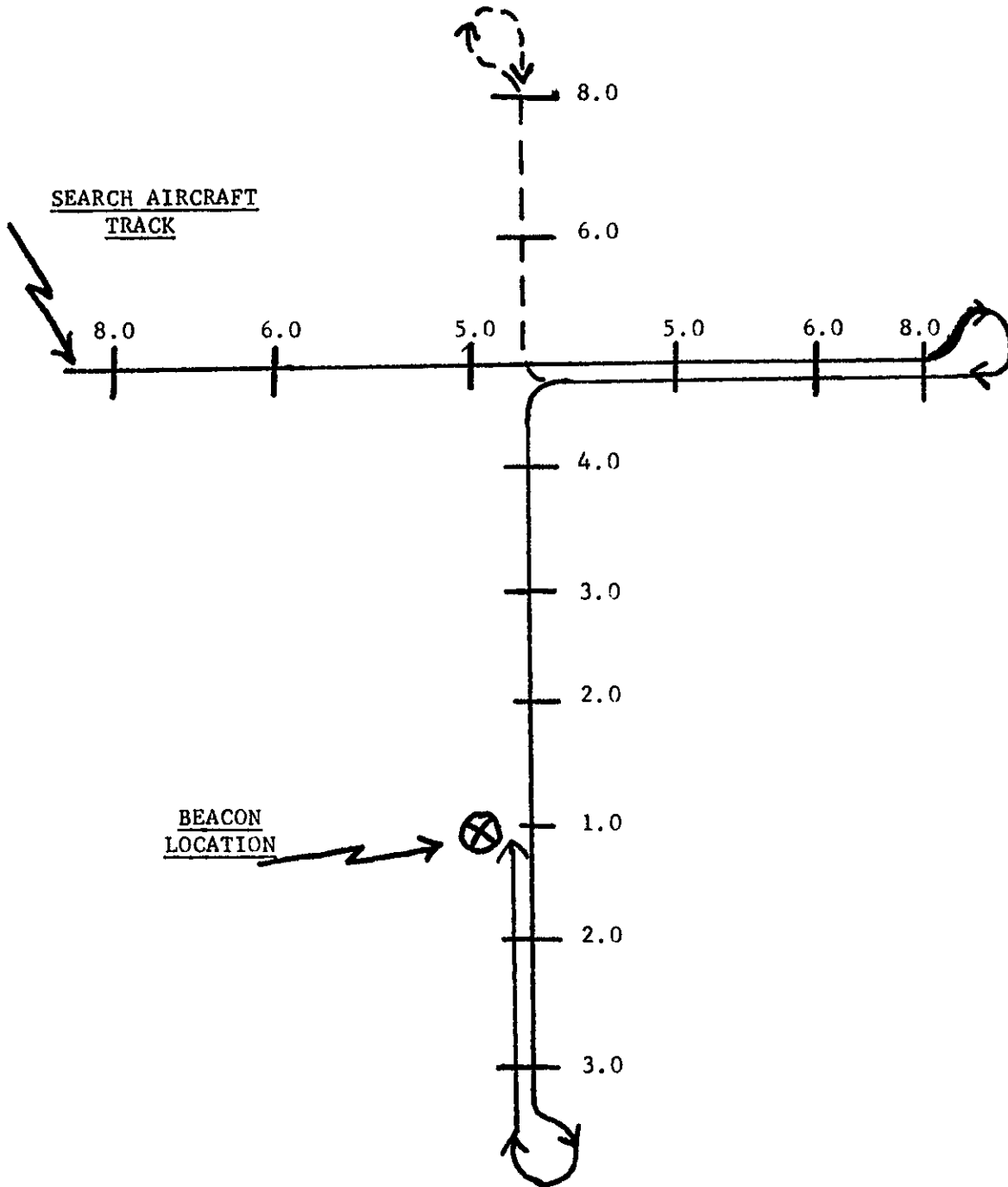
IF SIGNAL LEVEL DIMINISHES, CONDUCT A 180° TURN AND RETURN TOWARD BEACON.

AFTER PASSING OVER AREA OF HIGHEST SIGNAL LEVEL, CONTINUE PAST APPROXIMATE BEACON LOCATION TO DEFINITELY OBTAIN A DECREASE IN SIGNAL LEVEL.

CONDUCT 180° TURN AND RETURN TO POINT OF HIGHEST SIGNAL LEVEL FOR APPROPRIATE SEARCH LOCATION.

IN MOUNTAINOUS TERRAIN OR AREAS OF CONFINED BEACON LOCATION WHERE SIGNAL LEVEL FLUCTUATES CONSIDERABLY IT MAY BE NECESSARY TO REPEAT THE 180° - 90° PATTERN FOR ADEQUATELY LOCATING BEACON POSITION.

180° - 90° SEARCH PATTERN WITH AGC METER



NUMBERS REPRESENT SIGNAL STRENGTH VALUES ON AGC METER.
THE LOWER THE NUMBER THE STRONGER THE SIGNAL.