



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

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In reply refer to: A-91-51

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On November 4, 1988, an Aerospatiale AS-355F-1 helicopter, N355EH, owned and operated by ERA Helicopters, Inc., crashed into the waters of the Gulf of Mexico. The aircraft was destroyed, and the pilot and three of the five passengers were killed.

The aircraft, which sank in about 360 feet of water, was equipped with a Dukane Corporation underwater acoustic beacon (UAB), model N15F210B, mounted to the aircraft's frame inside the left electronics compartment. A search was conducted for the helicopter using appropriate underwater search equipment. The search was unsuccessful in locating the UAB's acoustic signal. Based on the aircraft's last reported position, underwater divers eventually located and recovered the wreckage.

The beacon was found to contain a battery that was almost completely discharged, even though the battery had been recently replaced by the operator. With a fresh battery, a beacon should have an operating lifetime of about 30-45 days, depending on the environment. The reason for the discharged state of the battery was not initially known.

During further examinations at the Dukane manufacturing facility and at the laboratory of the National Transportation Safety Board, small metal filings were found between the water switch post and the metal case. These metal filings were suspected of causing an intermittent short of the water switch, causing an undesired activation of the beacon. The filings were identified as residue from the mechanical scraping of excess potting material on the water switch post during the manufacturing process.

This mechanical scraping of the water switch post was a standard procedure in the manufacturing of thousands of beacons by Dukane until 1989. Dukane states it has experienced a very low failure rate of in-service beacons, and it has had only one other UAB returned because of traces of metal filings shorting the water switch. The Safety Board's experience has been similar. Safety Board staff test all UABs that come into the lab installed on cockpit voice recorders (CVR) and flight data recorders (FDR).

Over 800 beacons have been tested by the Safety Board's staff. About 10 of these UABs were completely destroyed by impact or fire. Of the remainder, only two failed to operate correctly.

To aid in the maintenance and testing of the beacons, Dukane provides a technical manual that recommends certain maintenance procedures. These recommended procedures include testing the installed beacons every 90 days and every 2 years concurrent with battery replacement.

The 90-day testing procedures state that the beacon's water switch should be cleaned of any foreign material and that the unit should be operationally tested by activating the beacon and monitoring the output signal on a test set.

The procedures for the 2-year testing, conducted concurrently with battery replacement, state that the beacon should be functionally tested prior to removing the old battery to determine if the beacon still operates correctly. A completely discharged battery would be an indication of a possible problem with the beacon and of the need for the beacon to be further tested. A new battery should then be installed and the beacon should be again functionally tested. In addition to the functional test, an off-current test should be performed. The beacon must have a non-operating current drain of less than 2 microamps because, if the off-current is greater than 2 microamps, the battery could be depleted prior to the next change cycle.

Both the 90-day operational testing and the battery replacement intervals are recommended by Dukane to provide very high confidence that the beacon will function properly while it is in service.

The UAB in the accident aircraft was not tested in accordance with the Dukane recommended procedures. Even though the battery had been recently replaced in the accident beacon, it still failed to operate when submerged in water at the time of the accident. According to the maintenance records reviewed during the course of the investigation, it was discovered that the operator, ERA Helicopters, had no program to routinely test in-service UAB's, nor did the operator perform any functional or off-current tests when the batteries were replaced. Postaccident testing indicated that the accident beacon's battery was discharged, probably from inadvertent activation induced by metal filings. If the off-current and functional tests had been performed on this UAB as recommended, the defect in the beacon probably would have been identified and corrected.

There are no Federal regulations requiring that UABs be installed on offshore helicopters. This beacon was voluntarily installed by the operator, to aid in the location of the aircraft in the event of a water ditching. However, to aid in the underwater recovery of FDRs and CVRs, both the Federal Aviation Administration (FAA) and the International Civil Aviation Organization (ICAO) require that an approved UAB be installed on either, or both, of the flight recorders. To meet this requirement, most operators of aircraft required to be equipped with CVRs and FDRs use the same type of Dukane UAB that was installed on the accident aircraft.

The manufacturers of CVRs and FDRs incorporate Dukane's recommended procedures in their installation and operations manuals. These manuals are then used by the aircraft operators as the basis for their FAA-approved CVR and FDR maintenance programs. However, the only FAA requirement for UAB maintenance is that the battery be replaced every 2 years. None of the tests recommended by Dukane are required. Consequently, according to Dukane, air carriers do not routinely test installed beacons, although some do perform the off-current test when the battery is replaced. The Safety Board believes that the functional battery and off-current tests recommended by Dukane should be performed when the battery is changed.

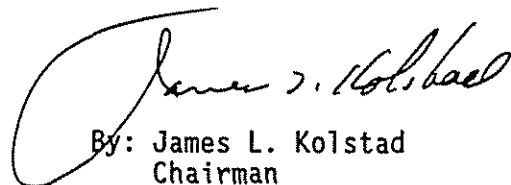
According to the information provided by Dukane, its UABs have been extremely reliable devices, even when neglected for long periods of time. The Safety Board realizes that conducting operational tests of the beacons every 90 days would impose an increased maintenance burden on the operators. Further, the Safety Board believes that Dukane has been extremely conservative in establishing its recommended 90-day testing interval. However, the Board also believes that the FAA, with the assistance of industry, could establish a more reasonable interval that would still help to identify even the infrequent beacon problems, including any remaining beacons with metal filings around their water switch posts.

Therefore, the National Transportation Safety Board recommends that the Dukane Corporation:

Issue a notice to all branches of the military service and to all foreign airworthiness authorities stating the importance of following Dukane Corporation's recommended procedures concerning periodic operational tests of model N15F210B underwater acoustic beacons, the performance of functional tests of the old and new batteries, and the performance of an off-current test when a new battery is installed. (Class II, Priority Action) (A-91-51)

The Safety Board is also issuing two recommendations to the Federal Aviation Administration, urging the agency to require that air carriers operating under Federal regulations (a) follow Dukane's recommended test procedures; and (b) test, at a reasonable interval, acoustic beacons installed on cockpit voice recorders and flight data recorders.

Chairman KOLSTAD, Vice Chairman COUGHLIN, and Members LAUBER and HART concurred in this recommendation. Member HAMMERSCHMIDT did not participate.



By: James L. Kolstad
Chairman