Log 2356

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 13, 1992

In reply refer to: A-92-37

Honorable Barry L. Harris
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

About 2:39 p.m. Pacific standard time on March 23, 1992, an Ayres S2R-T34, N59SK, crashed in a cultivated field about 15 miles south of Bakersfield, California. The airplane, operated by Old River Crop Dusting, Inc., for agricultural spraying, sustained substantial damage, and the certified commercial pilot was seriously injured. The flight had originated from a dirt strip 9 minutes prior to the crash. Witnesses to the accident reported that they observed pieces fall from the airplane. The investigation to the accident is continuing.

Examination of the wreckage after the accident revealed that both the upper and the lower steel caps in the front spar of the left wing had completely separated from the aluminum web. The separation occurred through Huckbolt fasteners (P/N NAS1536)[1] that attached the steel caps to the aluminum web sheet. According to an engineering drawing for the spar assembly, the steel spar caps are located on the forward face of the spar extending from wing station (WS) 0 to WS 191. Outboard from this point, the wing spar structure is fabricated entirely from an aluminum alloy.

The portion of the separated left wing spar between WS 37 and WS 66 was examined in the Safety Board's Materials Laboratory. Examination revealed that the mating surfaces of the web and the lower cap were covered with white corrosion deposits. Corrosion deposits were also evident on the surface of the web in areas located well above the upper edge of the spar cap as well as on the fracture surfaces of Huckbolts from the lower spar.

Examination of the fractures from some of the Huckbolts attaching the lower spar cap to the web sheet disclosed features indicative of stress-corrosion cracking. The separations of the Huckbolts occurred in the shank portion of the fasteners, mainly at the interface between the cap and the web.

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[1] P/N NAS1536 Huckbolts, manufactured and marketed by Huck Company, are tension-pull type fasteners that are designed to be used in high-strength structural joints.

At the time of the accident, S2R-T34 (S/N T34-008) was spraying a "Gramoxone Extra" herbicide, which, according to the operator, was one of the primary chemicals applied by this airplane through its service history. A booklet describing directions for use and the conditions of sale and warranty for Gramoxone Extra indicates that Paraquat dichloride, an active ingredient of this herbicide, is corrosive to structures made from aluminum alloys. The booklet states that "aluminum spray equipment and aluminum aircraft structures that are exposed to spray solution should be flushed with water immediately after use." The operator indicated that the outside surface of the accident airplane was rinsed by the pilot at the end of each day when Gramoxone Extra was sprayed.

An Ayres representative indicated that the accident airplane was manufactured on October 31, 1979. At the time of the crash, the airplane had accumulated a total of 10,780 service hours. Maintenance records indicated that on May 14, 1986, at 4,595.1 total hours, a section of the left wing including a 12-foot-long outboard web of the front spar (between wing stations WS 120 and WS 240) and an aluminum sheet metal skin from the leading edge of the wing were replaced because of corrosion. The records further indicated that 71 hours before the crash the airplane had completed a 100-hour inspection, and at that time no evidence of corrosion was reported.

The Huckbolt's components are designed to be fastened together with a tensile preload to produce a permanent, vibration-resistant joint, according to Huck's advertising literature. The specified material for the Huckbolts from the accident airplane is a high strength aluminum alloy 7075-T6. According to technical literature, this alloy is highly susceptible to stress-corrosion when used in the T6 heat-treat condition. According to the literature, water, water vapor, and the presence of halide ions (such as chlorides) are key factors in producing accelerated corrosion.

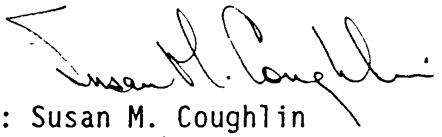
Ayres engineering drawing P/N 20203 indicates that a sealing compound should be applied at the top and bottom interfaces between the spar web and both the upper and the lower spar caps along the full length of the spar. This measure will provide protection from corrosion if there is no damage at the surface of the sealant. However, after some time, the sealant can dry and become brittle, which can result in the development of cracks. Cracks in the sealant can allow electrolytes to penetrate the interface between the spar and the web, causing general corrosion to their surfaces and stress-corrosion cracking of the prestressed Huckbolts.

The section of the maintenance manual on the 100-hour inspection of Ayres S2R series airplanes does not contain detailed requirements for inspection of the wing spars for evidence of corrosion. The Safety Board is concerned that, if undetected, the corrosion of Huckbolt fasteners and other elements of the wing main spar assembly may cause partial or catastrophic failure of the wing structure, resulting in loss of control of the airplane.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive to inspect, immediately and at recurring intervals, all Ayres S2R series airplanes for evidence of corrosion along the front (main) spars. Particular attention should be given to inspecting the condition of the Huckbolts that attach the steel spar caps to the aluminum alloy web sheet, especially along the lower portion of the spar. All spar components containing evidence of corrosion should be repaired or replaced on an expedited basis. (Class I, Urgent Action) (A-92-37)

Acting Chairman COUGHLIN, and Members LAUBER, HART, HAMMERSCHMIDT, and KOLSTAD concurred in this recommendation.



By: Susan M. Coughlin
Acting Chairman

ENCLOSURE 3 (cont')

DATE	LOCATION	OPERATOR	AIRCRAFT	RECORDER	REMARKS
1-10-87	Ilorin Nigeria	Nigerian Airlines	DC-10	573 Collins	Portion of DFDR tape containing final seconds of accident flight destroyed by heat damage. CVR burned. Tape OK.
3-10-89	Dryden, Ont., Canada	Air Ontario	F-28	V557 573	CVR tape destroyed. DFDR tape destroyed. Duration of fire estimated to be more than 2 hrs. at about 850° C. Both tapes destroyed.
11-27-89	Bogota, Colombia	Avianca	B-727	UFDR COLLINS	DFDR tape destroyed by fire/heat. CVR tape OK. Recorders found in separated locations.
5-26-91	Suphan-Buri Thailand	Lauda Air	B-767	UFDR A100	DFDR tape destroyed by fire, CVR burned. Tape OK. CVR and DFDR found in separate locations.
12-29-91	Taipei, Taiwan	China Air	B-747	LAS 209 A100	DFDR tape destroyed by fire when protective case failed at the welds. CVR tape not heat damaged.
1-02-92	Saranac Lake, NY.	Commuter Air	B1900	A100	CVR tape destroyed. Aircraft burned about 2 hrs. Fire fed by jet fuel and forest products.
1-20-92	Monte Sainte Odile, France	Air Inter	A320	F800 A100	DFDR tape destroyed. CVR tape OK. The CVR was found on top of the DFDR. There was a fuel fed fire for about 15 min. and 20 knot wind-whipped pine forest fire for the remaining period. The recorders were removed from the fire after 6 hours 20 min.

COLLINS = Collins Radio 642-C-1, CVR
A100 = Loral Fairchild, CVR
F800 = Loral Fairchild, DFDR
MICRODOT = Microdot, CVR

V557 = Sundstrand Model V557, CVR
AV557 = Sundstrand Model Av557, CVR
UFDR = Sundstrand Model UFDR, DFDR
573 = Sundstrand DFDR

Note: If a flight data recorder was not listed, it was an oscillographic "foil" recorder or a flight data recorder was not installed.