



log 2520

# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

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Date: AUG -- 3 1994

In reply refer to: A-94-146

Mr. Harold Collins  
National Agricultural Aviation Association  
1005 E Street S E.  
Washington, D.C. 20003

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On August 12, 1990, a Piper PA-25, N6358Z, operating under the provisions of Title 14 Code of Federal Regulations (CFR) Part 137, crashed in Minden, Nebraska. The pilot stated that while he was conducting an aerial application during a turnaround maneuver, the airplane's engine partially lost power. The airplane struck the ground, skidded across a highway, struck a sign, and burst into flames. The pilot sustained serious injuries, including burns over 40 percent of his upper body. Although the pilot was able to release his safety belt, he could not quickly exit the burning airplane because of the design of the restraint system.

Because the restraint system was destroyed by fire, the Safety Board examined a similar system on another PA-25 airplane. The 2-point restraint system consisted of shoulder harness straps that were sewn to each strap of the safety belt and a release buckle. The Safety Board found that when the seat occupant released the buckle, the shoulder straps remained in place and restricted quick and unimpeded egress from the restraint system.

There were about 3,927 Cessna 188 and about 5,410 Piper PA-25 airplanes manufactured with the same restraint system as that installed in the accident airplane. Larger agricultural airplanes, such as the Grumman Ag-Cat, the Rockwell Thrush, and the Air Tractor, have either 4-point or 5-point restraint systems, which allow the safety belt and shoulder harness straps to release and fall away simultaneously from the seat occupant.

Timely egress from most agricultural airplanes can be difficult when there is no fire and pilots are not seriously injured. However, the majority of agricultural airplanes do not have sealed cockpit areas to protect pilots from postcrash fires, that is, there are no floors, doors, or secondary firewalls, except the firewall immediately aft of the engine. The Safety Board believes that the use of a restraint system that restricts rapid egress may endanger pilots' lives in the event of an otherwise survivable accident. Furthermore, 4-point restraint systems that have the shoulder harness straps sewn onto the safety belt straps should be replaced with either a 4-point or 5-point

restraint system that allows the safety belt and shoulder harness straps to release and fall away simultaneously from the seat occupant.

Based on this information, the National Transportation Safety Board recommends that the National Agricultural Aviation Association:

Notify members who operate aerial application aircraft of the Safety Board's findings and recommendations regarding the use of a 4-point or 5-point restraint system that allows the safety belt and shoulder harness straps to fall away simultaneously from the seat occupant when released (Class II, Priority Action) (A-94-146)

Acting Chairman HALL, and Members LAUBER, HAMMERSCHMIDT, and VOGT concurred in this recommendation.

  
By: Jim Hall  
Acting Chairman



Log 2505

# National Transportation Safety Board

Washington, D.C. 20594  
**Safety Recommendation**

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Date: AUG - 3 1994  
In reply refer to : A-94-147

Honorable David R. Hinson  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

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On March 21, 1994, a McDonnell Douglas DC-9-32 (Serial Number 47678, Fuselage Number 789), Spanish registration EC-CLE, operated by Aviacion y Comercio (AVIACO), a subsidiary of Iberia Group, was involved in a landing accident at Vigo, Spain, resulting in severe structural damage and a postcrash fire.

The airplane had touched down about 100 feet short of the runway on the upsloping grass runway overrun, resulting in separation of both main landing gear (MLG) from their wing attachment points. The left MLG came to rest on the runway. The right MLG separated from the wing but remained entangled in the airplane structure until the airplane came to rest on the left side of the runway. The left wing fuel tank was intact. However, overloads on the right landing gear wing rear spar attachment fitting installation produced a rupture of the right wing rear spar web when the MLG fitting broke away. The rupture of the spar web opened the integral right wing fuel tank, allowing fuel to escape and feed a postcrash fire. The 116 persons aboard the flight evacuated the airplane; however, 2 persons were injured during the accident or evacuation. The accident is under investigation by the Comision de Investigacion de Accidentes de Aviacion Civil of Spain.

The examination of the wreckage showed that the left MLG had separated from the wing at its rear wing spar attachment point. The attachment fitting had failed such that the lower portion of the fitting and the two lower attachment bolts remained with the airplane. The upper fitting and the two upper attachment bolts remained attached to the landing gear. The remainder of the MLG appeared to be undamaged, except for the torque links that were separated at the apex bolt. The left rear spar web was intact. The tires of the left MLG were still inflated after the accident.

The right wing rear spar web was separated from the wing from approximately the wing root to the attachment point for the auxiliary spar to the wing. A portion of the wing rear spar web, approximately 1 square foot in area, separated from the airplane but remained attached to the separated landing gear fitting. Two other approximately 1 square foot sections, believed to be from the wing rear spar web, were found near the

right MLG. The remainder of the right MLG appeared to be undamaged, except for the fixed brace, which was fractured approximately 12 inches from its attachment to the MLG fitting. The attachment fitting bolts from the left and right MLG measured 1 1/8 inches in diameter.

Douglas Aircraft Company (DAC) records indicate that there have been a total of 11 DC-9 accidents resulting in fuel tank ruptures since October 28, 1971. All of the accidents were reportedly caused by "unpredictable overload from abnormal operations, including runway overruns, running off runway, skidding off runway, taxiing into holes in runway under repair, landing off runway and hard landing."<sup>1</sup> There have been several Service Bulletins (SBs) and revisions thereto issued by DAC, and related Airworthiness Directives (ADs) issued by the Federal Aviation Administration (FAA) that address inspections, replacement, and modifications to the MLG attachment fittings on DC-9 airplanes. One of the modifications requires the replacement of the 1 1/8 inch diameter MLG attachment fitting bolts with bolts of 7/8 inch diameter. This modification is intended to enhance the breakaway characteristic of the MLG to prevent damage to the wing and resultant fuel loss during such accidents. However, the applicability of the SBs and ADs and the related revisions thereto are difficult to interpret. Therefore, the Safety Board was unable to determine the number of DC-9 airplanes that are in service with 1 1/8 inch bolts in the landing gear attachment fitting.

DC-9 SB 57-125 was issued on January, 26, 1979, as a result of 186 cases of cracked MLG attachment fittings reported by 28 operators. The SB recommended that DC-9 MLG attachment fittings previously fabricated from 7079-T6 aluminum alloy forgings be replaced with fittings fabricated from 7075-T73 aluminum alloy forgings. This replacement reduces the possibility of stress corrosion cracks in the MLG attachment fittings. The new issue and Revisions 1 and 2 of this SB did not address the attachment fitting bolts. The attachment fitting replacement provisions of SB 57-125 (equivalent to Revision 2) had been incorporated on the accident airplane during its manufacture. Because the change in the landing gear attachment fittings from 7079-T6 to 7075-T73 aluminum alloy forgings occurred when the accident airplane (S/N 47678) was in production, SB 57-125 did not subsequently apply to that airplane.

Operators of DC-9 airplanes that incorporated MLG attachment fittings with 7075-T73 forgings, according to SB 57-125 New issue, Revision 1, Revision 2, or the production equivalent, were subsequently advised by DAC to accomplish the provisions of SB 57-148, which was issued on October 1, 1982 (and later revised). The effectivity of SB 57-148 to the accident airplane was addressed in the preamble of the SB. According to DAC, SB 57-148 was initially issued because two operators had reported cracks in MLG attachment fittings fabricated from 7075-T73 aluminum alloy forgings. One

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<sup>1</sup> For further information, see DAC All Operator Letter (AOL) 9-2422, issued on May 10, 1994.

crack was discovered during an inspection after a hard landing, and the other was found during a routine inspection. This SB recommends trimming and splicing the auxiliary spar web, as necessary, to facilitate the inspection or rework of MLG attachment fittings. The closing action of SB 57-148 Revision 1, dated June 8, 1983, included increasing the MLG wing attachment fitting counterbore radius, inspecting the counterbore radius for cracks, shotpeening selected areas (to reduce the effects of stress risers), replacing the 1 1/8-inch-diameter lower forward inboard and outboard MLG attachment fitting tension bolts with bushings and bolts of 7/8-inch-diameter, and installing interference fit attachments in the lower flange of the MLG attachment fittings.

Although the reason for the SB 57-148 provision that addresses replacing the MLG attachment fitting tension bolts with smaller diameter bolts was to enhance the breakaway feature of the MLG and minimize the possibility of primary structure damage and fuel tank rupture resulting from unpredictable overloads on the MLG, this benefit was not mentioned in the SB. The diameter of the MLG attachment bolts on the accident airplane indicated that the provisions of SB 57-148, which replaces the 1 1/8-inch bolts with 7/8-inch-diameter bolts, had not been accomplished on that airplane.

SBs 57-125 and 57-148 are addressed in FAA AD 84-26-01, which was effective on January 27, 1985. This AD requires repetitive inspection to detect cracks and prevent failure of the MLG attachment fitting. However, it does not mandate the closing action of either SB 57-125 or 57-148.

AD 90-18-03, which was effective on September 24, 1990, addresses the "DC-9/MD-80 Aging Aircraft Service Action Requirements (ASAR) Document" (McDonnell Douglas Report MDC-K1572). The ASAR document (Tables 2.1 and 2.2), dated June 1, 1990, recommends, and the AD requires incorporation of SB 57-125 for replacement of 7079-T6 aluminum MLG attach fittings with 7075-T73 fittings. The AD currently applies only to those aircraft affected by SB 57-125 (i.e. DC-9 Fuselage Numbers 1 through 675). DC-9 Fuselage Numbers 676 and subsequent were delivered with the production equivalent of SB 57-125 but without the smaller MLG attachment fitting bolts. DC-9 Fuselage Numbers 676 and subsequent are in compliance with AD even though they do not have the small diameter bolts installed.

The ASAR document revision (Table 2.3), dated January 15, 1993, recommends incorporation of SB 57-148, Revision 4, on all airplanes modified by SB 57-125 prior to Revision 3, by January 15, 1997. However, AD 90-18-03, does not address the recommendations noted in Table 2.3 of the ASAR document.

For clarity, all airplanes modified by SB 57-125 Revision 3 or later incorporate the smaller diameter MLG attachment bolts. The only DC-9-10 through -41 Series airplanes that had this modification incorporated during production are Fuselage Numbers 1081 and 1084. These airplanes are not affected by SB 57-148. The airplanes modified by SB 57-125 prior to Revision 3 or the production equivalent are affected by SB 57-148. The

airplanes modified during production, equivalent to SB 57-125 prior to Revision 3, include DC-9-10 through -32 Series, Fuselage Numbers 676 and subsequent (except 1081 and 1084); DC-9-33 through -41 Series, Fuselage Number 743 and subsequent, and DC-9-51 Series Fuselage Numbers 757 and subsequent. DAC records show that 274 DC-9 airplanes that remain in service were manufactured to the production equivalent of the SB 57-125 before Revision 3, and thus did not incorporate the replacement of the 1 1/8-inch-diameter MLG attachment bolts with smaller diameter bolts. DAC records do not show how many of these airplanes were subsequently so-modified by their owner/operators.

Following the AVIACO accident, DAC issued DC-9 All Operator Letter (AOL) 9-2422 on May 10, 1994, and DC-9 SB 57-207 on May 24, 1994, further addressing "Main Landing Gear Attach Fitting Installation." The AOL explained that SB 57-207 was issued "to incorporate modifications on the MLG attach fitting installations to improve breakaway provisions." It further states that the modification requires the incorporation of the (current) provisions of SB 57-148 on all affected airplanes during the earliest practical maintenance period, not to exceed 2 years from the date of the SB, and that this "will reduce the possibility of fuel spillage due to unpredictable overloads on the MLG installation from abnormal landing operations."

The Safety Board found that except for the recently issued SB 57-207, the previously issued SBs and ADs do not specifically address the benefits of replacing the larger DC-9 MLG attachment fitting inboard and outboard lower forward tension bolts and fasteners. Smaller approved hardware would improve important landing gear breakaway provisions in the event of abnormal landings that could cause primary structural damage to the wing rear spar and leakage from the integral wing fuel tanks. In order to minimize such damage and potential postcrash fire, and to improve the likelihood of passenger survivability in the event of such accidents, the Safety Board believes that the provisions of DAC's DC-9 SB 57-207 should be mandated by an appropriate AD. Because of the absence of language in SBs 57-125 and 57-148 stating the purpose of replacing the MLG attachment bolts with smaller diameter bolts, and the undetermined number of DC-9s that may still be using the large diameter MLG attachment fitting bolts, the Safety Board believes issuance of a new AD, mandating the accomplishment of SB 57-207, is preferable to the updating of AD 90-18-03.

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

Issue an Airworthiness Directive to require compliance with Douglas Aircraft Company's DC-9 Service Bulletin 57-207 at the earliest practical maintenance period to ensure, through inspection or replacement as necessary, that the enhanced breakaway features of the main landing gear are incorporated in all applicable DC-9 aircraft. (Class II, Priority Action) (A-94-147)

Acting Chairman HALL, and Members LAUBER, HAMMERSCHMIDT, and VOGT concurred in this recommendation.

By.   
Jim Hall  
Acting Chairman