



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** April 1, 1999

**In reply refer to:** A-99-19

Honorable Jane F. Garvey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

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On February 26, 1998, about 1729 central standard time, a Fokker F.28 Mark 0100 airplane, N867US, operated by US Airways, Inc. as flight 861, lost directional control and skidded off the runway during an emergency landing at Birmingham International Airport, Birmingham, Alabama. The flight crew had declared an emergency because of a dual hydraulic system failure that occurred after the airplane was struck by lightning. None of the 5 crewmembers or the 87 passengers on board were injured, but the airplane sustained substantial damage. Flight 861 was conducted under the provisions of 14 Code of Federal Regulations (CFR) Part 121 as a domestic, scheduled passenger flight from Charlotte, North Carolina to Birmingham.

Although the National Transportation Safety Board's investigation of this accident is ongoing, the investigation has revealed a safety issue regarding the lightning strike protection of the F.28 that the Federal Aviation Administration (FAA) should address.

The pilots of flight 861 stated that the lightning strike occurred as they were deviating to avoid adverse weather while en route to Birmingham. A short time later, both hydraulic system low quantity indicator lights illuminated.<sup>1</sup> During the emergency landing in Birmingham, three main landing gear tires failed,<sup>2</sup> and the airplane departed the runway, slid through the grass, and came to rest on an adjacent taxiway.

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<sup>1</sup> The Fokker F.28 Mark 0100 has two independent hydraulic systems. Low quantity lights indicate that the hydraulic fluid reservoir level has dropped below 20% of capacity. When hydraulic fluid has depleted from both systems, the flight controls revert to manual operation (with much higher control forces), alternate procedures to lower the flaps and landing gear must be used, and thrust reverse and nosewheel steering are inoperative.

<sup>2</sup> It was determined that a misinstalled connector in the alternate brake system caused the brakes to lock when brake pressure was applied. US Airways subsequently inspected its F.28 fleet and found no other instances of this connector being misinstalled.

Examination of the airplane revealed that both hydraulic reservoirs were completely empty and hydraulic fluid was leaking from the vertical tail. Holes (one quarter-inch diameter) were found in a No. 1 hydraulic system pressure line and a No. 2 hydraulic system return line in the vertical tail. In addition, the horizontal stabilizer hinge bonding strap<sup>3</sup> was broken and both ends were melted. Examination of these components in the Safety Board's materials laboratory revealed that the bonding strap melted from the intense heat typical of an electrical overload and that the holes in the hydraulic lines were created by very high intensity electrical arcing. Finally, numerous small lightning burn marks were found along the right-hand side of the fuselage, and a large burn mark was found at the tip of the right-hand horizontal stabilizer.

The FAA's National Resource Specialist (NRS) on Lightning and Electromagnetic Interference participated in the Safety Board's investigation of this accident. He concluded, on the basis of the burn marks, that the airplane was hit by a lightning strike of moderate duration and intensity. Title 14 CFR 25.581, "Lightning Protection," requires transport category airplanes to be protected against the potentially catastrophic effects of lightning. Compliance with this regulation requires either bonding the metallic components properly to the airframe or designing the components so that a lightning strike will not endanger the airplane.

According to Fokker, the horizontal stabilizer hinge does not provide an adequate electrical connection for lightning current; therefore, the bonding strap is designed to provide a current path across the hinge.<sup>4</sup> Fokker design drawings specify a 5-inch MS25083-2CC5 bonding strap<sup>5</sup> at this location. However, the NRS stated that the electrical current contained in a lightning strike could potentially cause this bonding strap to melt. He concluded that, once the bonding strap failed on the accident airplane, the remainder of the electrical current arced across the hydraulic lines in the vertical tail, which led to their failure.

On the basis of the circumstances of this accident, the Safety Board is concerned that the bonding strap installed on the horizontal stabilizer hinge of Fokker F.28 Mark 0100s and Mark 0070s does not provide adequate protection against lightning strikes, making additional dual hydraulic failure emergencies possible. The Safety Board believes that the FAA should review the design of the bonding strap installation at the horizontal stabilizer hinge of the Fokker F.28 Mark 0100 and Mark 0070 and require operators to modify their airplanes to increase the lightning strike protection at that location.

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<sup>3</sup> Bonding straps are intended to provide a low resistance path to allow electrical current to safely discharge. A wide variety of bonding straps are available to conduct the anticipated flow of electrical current through a given location.

<sup>4</sup> Both the Mark 0100 and Mark 0070 use similar bonding strap configurations.

<sup>5</sup> This bonding strap is 1/8 inch in diameter and made of concentric strands of 12-gage copper wire.

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

Review the design of the bonding strap installation at the horizontal stabilizer hinge of the Fokker F.28 Mark 0100 and Mark 0070 and require operators to modify their airplanes to increase the lightning strike protection at that location.  
(A-99-19)

Chairman Hall, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall  
Chairman