



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

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log 2518

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In reply refer to: A-94-133 through -136

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

On October 16, 1993, heavy smoke started coming out of the overhead electrical panel of a Swissair McDonnell Douglas MD-81, registration HB-INH, shortly after the airplane departed Munich, Germany. The flight was a regularly scheduled passenger flight from Munich, Germany, to Zurich, Switzerland. On board the airplane were 88 passengers and 7 crewmembers. Fourteen passengers and one crewmember were slightly injured in the subsequent emergency evacuation. The airplane was substantially damaged by smoke and overheated electrical components. The accident is under investigation by the Accidents Investigation Bureau of Germany. The Safety Board has been assisting in the investigation per the provisions of Annex 13 to the Convention on International Civil Aviation.

The flightcrew reported that they had smelled something abnormal in the cockpit approximately 10 minutes after takeoff while the airplane was at an altitude of 18,000 feet above sea level. A few moments later, increasingly dense smoke became noticeable in the area of the overhead panel. The flightcrew declared an emergency and decided to return to Munich. In accordance with the checklist, the flightcrew donned their oxygen masks and smoke goggles.

The "Electrical Smoke in Cockpit" checklist did not provide guidance on how to identify the origin of the smoke or how to isolate the source of the fire. Because the smoke was rapidly thickening, the crew was unable to read and complete the checklist. After declaring an emergency, the aircraft received radar guidance by

approach control to land at Munich. The flightcrew reported that crew coordination became difficult and that the captain's flight instruments began to fail sporadically.

The flightcrew further reported that visibility in the cockpit became extremely limited. The investigation found that the flightcrew did not take timely or appropriate actions to eliminate smoke from the cockpit. Initially, the flightcrew did not depressurize the cabin which prevented the opening of the cockpit window. After switching the cabin pressurization system to "manual," the flightcrew reported that they were too preoccupied with flying and preparing to land the airplane to open the window.

The investigation of the incident found indications of a smoldering fire in the overhead electrical panel. Electrical wires, terminal blocks, and the emergency power switch, Part Number (P/N) 103-200, were charred or burnt. The direction of the propagation of the smoke and fire indicated that the fire had originated in the area of the emergency power switch.

The switch was disassembled and analyzed at the facilities of the Mason Electric Company, the manufacturer of the switch, in the United States. The examination found that the fire had originated in the emergency power switch. The examination found mechanical damage to the internal contacts and moveable parts, due to wear, along with traces of melting, which could have developed only under very high temperatures. The findings indicate that the switch had failed mechanically due to wear or overstress. This internal damage resulted in one or more short circuits that caused the high temperatures and subsequent fire.

The melting point of the different materials indicates exposure to extremely high temperatures. The investigation has not determined the power source that could have supplied the intensity of electrical current necessary to cause such damage.

Examination of the engineering documents at Swissair showed a relatively high failure rate for the emergency power switch over the past few years. On several occasions, the Swissair Engineering Department had contacted McDonnell Douglas regarding the following problems:

1. Malfunction of the switch due to burnt electrical contacts No. 10-20.

2. Increase of the current from 19.5 amperes to 30 amperes in airplanes equipped with a 600 volt-ampere inverter. The incident airplane had a 400 volt-ampere inverter.
3. Malfunction of the switch due to burnt electrical contacts IA-IB-IC and 2A-28-2C.
4. Loose screw connections at the wire terminals of the emergency power switch as described in the Douglas All Operators Letter (AOL) 9-2160.

Following the incident, precautionary inspections of the switch were conducted at several European air carrier fleets. Those inspections found several instances of burnt contacts as well as loose screw connections.

According to the manufacturer, a service life limit is not specified for the switch. The Accidents Investigation Bureau's investigation has determined that the same model switch was used in the Boeing Model B-707. In that application it was provided with a service life limitation of 10,000 switching operations. The switch from the incident airplane had approximately 30,000 switching operations. The investigation found that current operational practices require the switch to be operated prior to each flight.

As a result of the accident, the German Accidents Investigation Bureau developed safety recommendations that they requested be transmitted to the Federal Aviation Administration (FAA) by the Safety Board. Therefore, to prevent additional incidents or a serious accident, the Safety Board recommends that the FAA:

Issue an airworthiness directive to require that the emergency power switch, Part Number (P/N) 103-2200, used on the McDonnell Douglas DC-9 and MD-80 series airplanes, be limited to a maximum service life of 10,000 switching operations. (Class II, Priority Action) (A-94-133)

Determine the feasibility of replacing the emergency power switch, Part Number (P/N) 103-2200, with a relay type circuit, or developing a design that would remove all nonessential high

current electric relays and wires from aircraft overhead panels and the cockpit area. (Class II, Priority Action) (A-94-134)

Modify the operations procedures for the DC-9 and MD-80 series airplanes to reduce the operating cycles on the emergency power switch. (Class II, Priority Action) (A-94-135)

In coordination with McDonnell Douglas, determine the source of the high electrical current that damaged the emergency power switch, and the reason for the sporadic failure of the captain's flight instruments after application of the "Electrical Smoke in Cockpit" checklist. (Class II, Priority Action) (A-94-136)

Acting Chairman HALL, and Members LAUBER, HAMMERSCHMIDT and VOGT concurred in these recommendations.

By: 
Jim Hall
Acting Chairman