

2303



# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

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Date: August 14, 1991  
In reply refer to: A-91-70  
through A-91-72

Honorable James B. Busey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

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On March 17, 1991, at 1618 Atlantic Standard Time, Delta Air Lines flight 15, a Lockheed L-1011-385-3, N753DA, was en route from Frankfurt, Germany to Atlanta, Georgia, at flight level (FL) 330 when it experienced a fire below the aft cabin floor and in the cabin. The flight was conducted under the operating rules of Part 121 of Title 14 Code of Federal Regulations (CFR) and carried 218 passengers, 10 flight attendants, 2 pilots, and 1 flight engineer.

Flight 15 had been en route for about 7.5 hours, when about 180 miles east of Goose Bay, Labrador, Canada, a flight attendant noticed flames rising from the base of the left cabin sidewall panel to the height of the seatback tray at the next to last row of passenger seats (Seat 41A). The flight attendant promptly discharged a Halon fire extinguisher into an opening in the base of the sidewall from which the flames appeared to originate. The fire was extinguished and a precautionary landing was made at Goose Bay.

The Canadian Transportation Safety Board (CTSB) initiated an investigation of the incident at Goose Bay. The National Transportation Safety Board is participating in the CTSB investigation. The investigation revealed that the fire originated below deck in a "cheek" area outboard of the C2 cargo compartment left wall. This area extends from the main wheel well to the aft pressure bulkhead. Fire damage was limited longitudinally to the area between fuselage stations (FS) 1645 and 1665. The fire damaged the main generator cables from the No. 2 engine and auxiliary power unit; the air return ventilator was melted; and soot was deposited on various components. The ignition source for this fire has not been determined. However, a possible source of ignition in the cheek area appears to be electrical power. A bundle of 15 electrical wires, which was present in the

fire area, provided electrical power for the cargo compartment lights and potable water pressurization system. Some wires in this bundle exhibited evidence of arcing, and the insulation was extensively damaged. The wires in this bundle are insulated with Kapton.<sup>1</sup> Arc tracking of this insulation is a well-known phenomenon that can result in short circuiting and ignition, although it has not been determined that there was an insulation breakdown in this incident. Various circuit breakers related to these circuits had tripped.

During the investigation, two conditions relevant to fire safety were noted: (1) the fire-damaged wire bundle and other wire bundles in this aircraft were bent at relatively small radii of curvature, and (2) debris, which included extensive accumulations of lint, dust, and other items from the passenger compartment, had accumulated on the wire bundles, insulation blankets, structure, hydraulic lines, and other surfaces in the cheek area.

Advisory Circular (AC) 65-15 states that, "Bends in wire groups or bundles should not be less than 10 times the outside diameter of the wire group or bundle." Boeing and McDonnell Douglas have similar instructions for aircraft manufacture and repair. The fire-damaged wire bundle on N753DA and a similar bundle in the next bay aft had a bend radius of approximately one bundle in diameter. Other airplanes examined during the investigation, including a B-767-232 and an MD-88, had bundles that turned 180 degrees with radii of less than two bundles in diameter and exhibited wiring chafes. This situation, which is not in accordance with the provisions of AC 65-15, could result in damaged insulation, creating a fire hazard, regardless of the type of wire insulation.

The Safety Board believes the Federal Aviation Administration (FAA) should ensure that effective quality control inspection procedures for wire bundle installation are carried out at manufacturing and operator facilities. Such action would ensure the proper installation and inspection of wire bundle bend radii, chafe protection, and routing. To reduce the potential for in-flight electrical fires, all transport category airplanes should receive an inspection for incorrect wire installations whenever planned inspections allow the observation of such wires.

The Safety Board is also concerned about the degree to which dust, lint, and other debris had been allowed to accumulate on the aircraft wiring. Flammability tests on items taken from the aircraft, such as the insulation blankets and the air diffusers, showed that they were resistant to ignition. However, the lint and dust were easily ignited and burned. In addition to flammable lint and dust accumulation in the cheek area, the edge of an unused 5-inch-diameter metal hose clamp was found supported by a wire bundle. Other debris in the burned and adjacent bays included metal nut clips, fingernail clippers, a disposable paper face mask, disposable towlettes, a clean No. 10 screw, a burned No. 10 screw, and cabin trash, including torn peanut bags. The dust and lint accumulation averaged more

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<sup>1</sup>Kapton is a duPont trade name for aromatic polyimide.

than 3/8 inch deep and in some areas was more than 2 inches deep. An undamaged wire bundle with routing similar to the burned bundle was near the surface of the outer skin insulation blankets. Flammable lint, dust, and debris had accumulated sufficiently to cover the top of the undamaged wire bundle and to form a bridge to the lint on the outer skin insulation.

Postincident random inspections of six other transport category airplanes revealed lint accumulations and debris in an older L-1011, a 2-year-old MD-88, and a 4-year-old B-767. Regulations governing aircraft maintenance and cleanliness are contained in 14 CFR Part 43. Air carriers operating under 14 CFR Part 121 are required to adhere to the maintenance planning requirements of 14 CFR Part 43. However, the investigation has revealed that areas that are difficult to access may not be receiving the attention intended by the regulation.

The Safety Board believes that the FAA should inform principal maintenance inspectors about the potential fire hazards associated with lint accumulation and other debris and to focus attention on proper cleaning practices. Further, the FAA should require airframe manufacturers and airlines to amend the appropriate maintenance manual provisions to require periodic cleaning of areas in which debris may accumulate.

As a result of this investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require specific quality control and inspection procedures for wire bundle installations on transport category aircraft to verify proper bend radii, chafe protection, and routing practices by aircraft manufacturers during fabrication and by airlines during maintenance operations that expose wire bundles. (Class II, Priority Action) (A-91-70)

Notify principal maintenance inspectors and operators of transport category aircraft of the fire hazard posed by accumulations of lint and other debris on wire bundles. (Class II, Priority Action) (A-91-71)

Require that transport category aircraft manufacturers and airlines amend maintenance manuals as necessary to ensure thorough inspection and cleaning of areas where lint and other debris may accumulate and pose a potential fire hazard. (Class II, Priority Action) (A-91-72)

Chairman KOLSTAD, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.

By:  James L. Kolstad  
Chairman