ANALYTICAL ENGINEERING REPORT

AIRPLANE 17

Note: Photos attached as pages 3 through 13 were not reproducible
R Thomas

ITEM NO.: Chem 6743

DATE: March 26, 1998

MODEL: BCA

GROUP INDEX: 9-5576 - Analytical Engineering, Chemical/Physical

SUBJECT: Analysis of Contaminants on BACC45FT Connectors

Four connectors (P/N BACC45FT20-25S8, 22-32SW, 22-55P and 20-25S) were submitted for analysis of contaminants as part of aging aircraft hardware investigation 747-100 N[redacted], [redacted]. (AIRPLANE #17 R Thomas) Identification numbers and the contaminants of interest were as follows:

DB9001E (22-55P) - some dirt/dust on wiring/tape

D1990P (20-25S8) - oily material on buildup tape and clamp saddles

D1608P (22-32SW) - dirt/particulate on wire, tape and heat shrink tubing

D1769P (20-28S7) - stuff on tape and wiring exiting connector.

CONCLUSIONS

All four connectors were contaminated with a mixture of organic and inorganic environmental debris, which can be generally categorized as dust and dirt. In addition, the D1990P, D1608P and D1769P connectors were found to be contaminated with ester oil, azelaic acid and mixtures of oil and acid. Engine turbine oils (such as MIL-L 23699 or MIL-L-7808) and ester greases are known to degrade to form azelaic acid. Although the presence of azelaic acid was identified on all three connectors, the extent of degradation varied among the connectors with the D1990P having the lowest amount of acid and D1769 having the largest amount of acid.

EXPERIMENTATION AND RESULTS

The connectors and higher magnification views of the areas of interest are presented in Figures 1 through 11. The contaminants were analyzed using infrared microspectroscopy and electron microprobe elemental analysis. Results for each connector are discussed individually.

The contaminants on DB9001E connector, shown in Figure 2, were found to be consistent with environmental debris (i.e., dust and dirt). Specifically, the presence of cellulose fibers was identified by infrared spectroscopy (see Figure 12). Electron microprobe elemental analysis detected the presence

of the following elements: carbon, silicon, aluminum, oxygen, calcium, chlorine, sodium, magnesium, sulfur, potassium, phosphorus, iron and titanium (see Figure 13).

Oily contaminant on the saddle clamp of D1990 connector (see Figure 4) was separable into an MEK-soluble fraction and an MEK-insoluble fraction. The MEK-soluble fraction was identified as an ester oil, based on the infrared spectrum (refer to Figure 14 for the sample spectrum and a reference spectrum). The MEK-insoluble fraction was found to contain cellulosic debris, similar to that discussed above. Small crystals were found on the surface of the buildup tape. The infrared spectra of these crystals shows good spectral agreement to a reference spectrum of azelaic acid, as shown in Figure 15. In addition to the separate samples of ester oil and azelaic acid, mixtures of oil and acid were also observed (see spectrum of this type of mixture in Figure 16). The oil is identified by the presence of the ester carbonyl peak at 1740 wavenumbers and comparison to reference spectra of engine oils. The acid is identified by the presence of the acid carbonyl relaxation at 1700 wavenumbers. Electron microprobe analysis results were similar to those of the DB9001E connector.

Contaminants on D1608P connector were similar to those found on connector D1900. Specifically, the presence of ester oil was verified on the yellow tape in addition to cellulosic debris (refer to Figure 6 for a photograph). A mixture of ester and acid was identified on the buildup tape (see acid crystals in oil in Figure 7). Based on both the electron microprobe analysis and the infrared spectroscopy results a mixture of dust/dirt with the oil and acid were identified on the wires beneath the clamp. Although the contaminants were the same, the quantity of contamination was considerably higher on the D1608P connector compared to the D1990 connector.

The D1769P connector was also found to have environmental debris (cellulosic debris and dust/dirt on the wires above the buildup tape, as shown in Figure 9). A mixture of ester oil and acid was identified on the wires exiting the connector. The contaminant on the buildup tape, shown in Figures 10 and 11, was identified as primarily azelaic acid. This connector had the largest quantity of contamination of the four connectors analyzed.

Engine turbine oils (such as MIL-L 23699 or MIL-L-7808) and ester greases are known to degrade to form azelaic acid and an alcohol. The alcohol generally evaporates leaving the azelaic acid behind to form crystals. A sample of the crystals from connector D1769P was dissolved in hot water to allow separation from any remaining oil, and then recrystallized upon cooling of the water. The water/crystal mixture was allowed to dry overnight and then the melting point of the crystals was measured using differential scanning calorimetry (DSC). Pure azelaic acid has a melting point of 106 °C (reference: Merck Index, Twelfth Edition. Merck & Co., Inc., 1996). The measured melting point of the crystals from the connector was 102 °C (see DSC scan in Figure 17. The similarity in the melting point of the sample compared to pure azelaic acid (102 °C compared to 106 °C) confirms the identity of the contaminant as azelaic acid. It is expected that the sample from the connector would have a slightly lowered melting point since it was not a pure sample.

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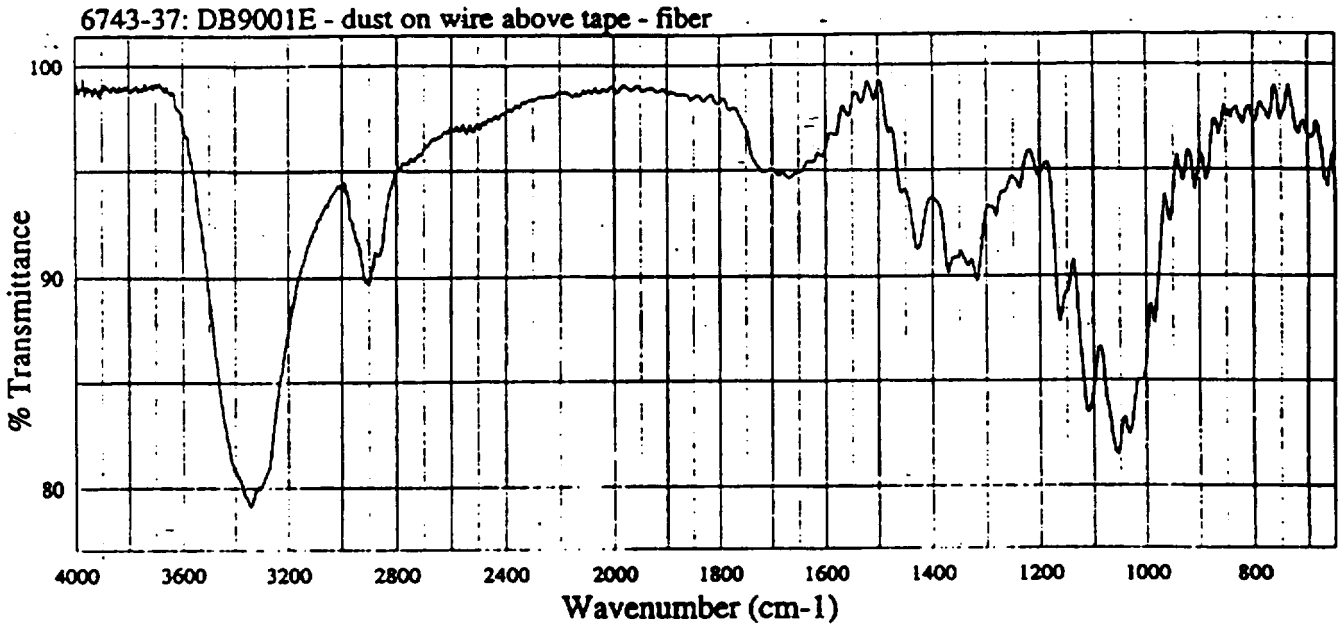
Photography by J. Brewer.
Electron microprobe analysis by J. Wessel.



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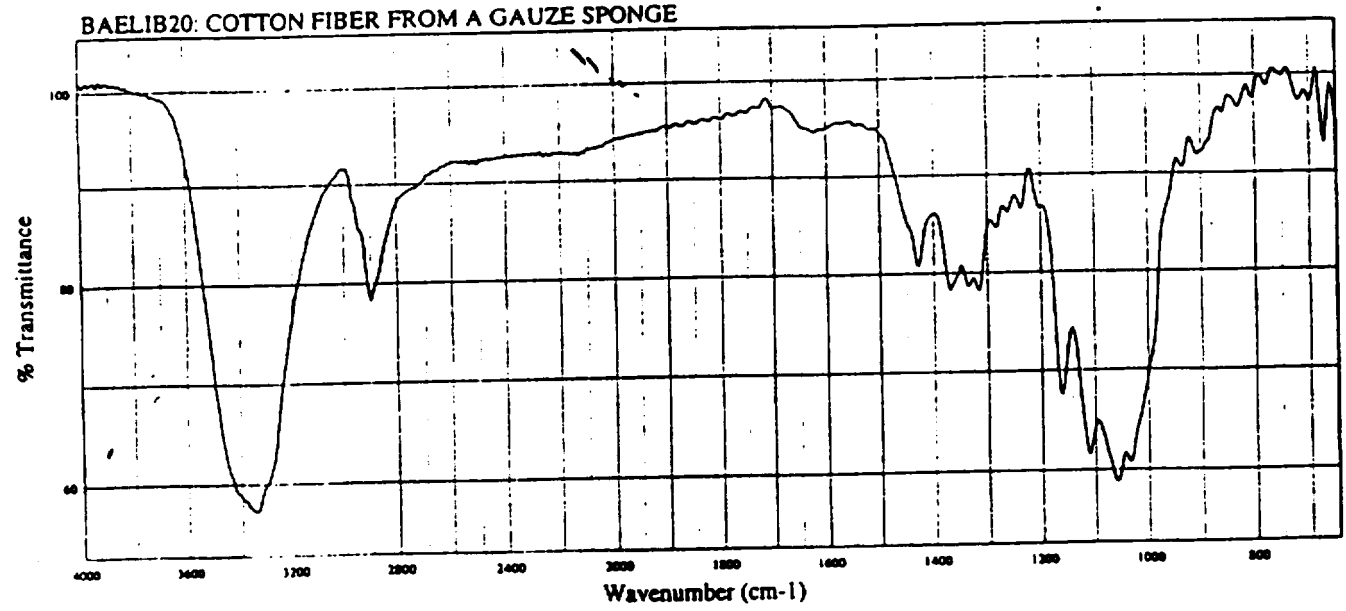


(B)

Figure 12. Infrared transmission spectra: (A) contaminant on DB9001E connector and (B) reference spectrum of cellulose, specifically a cotton fiber.

17

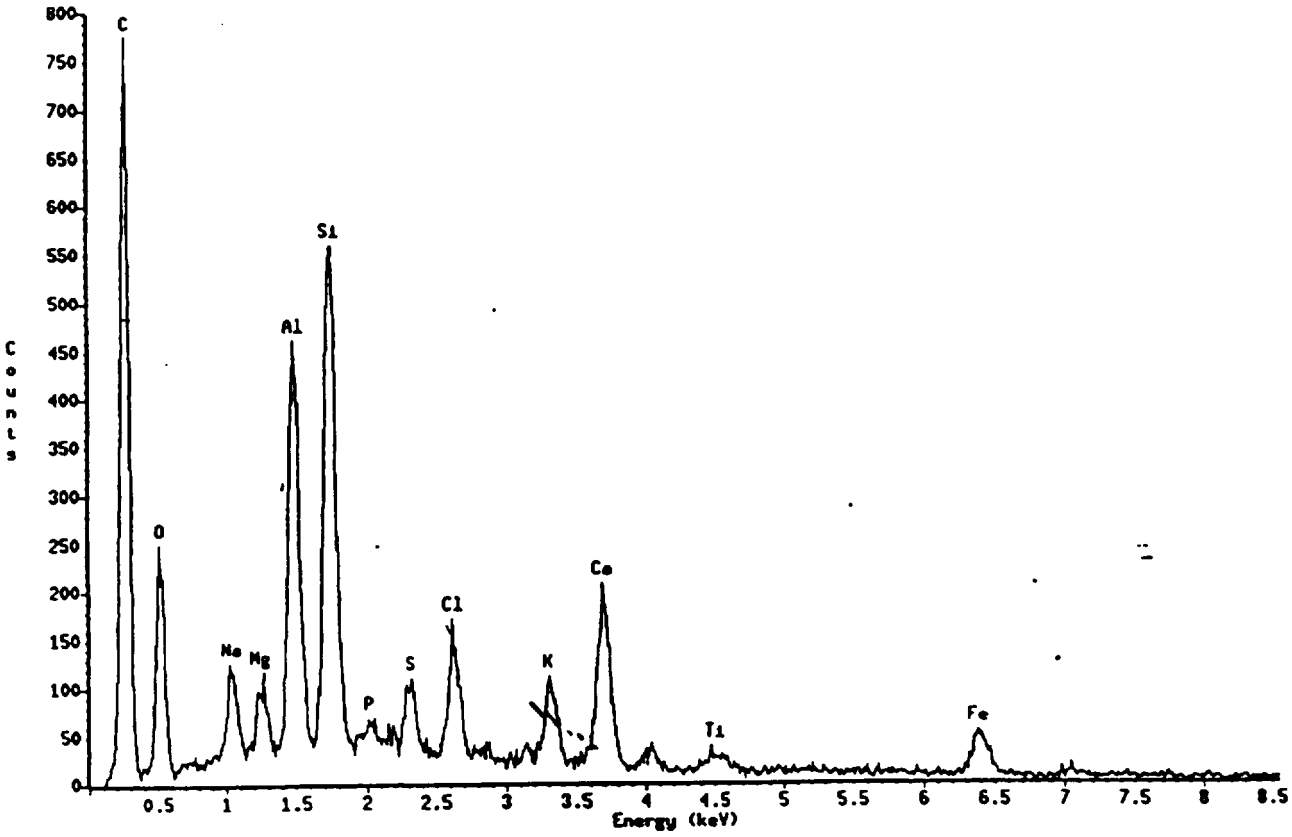
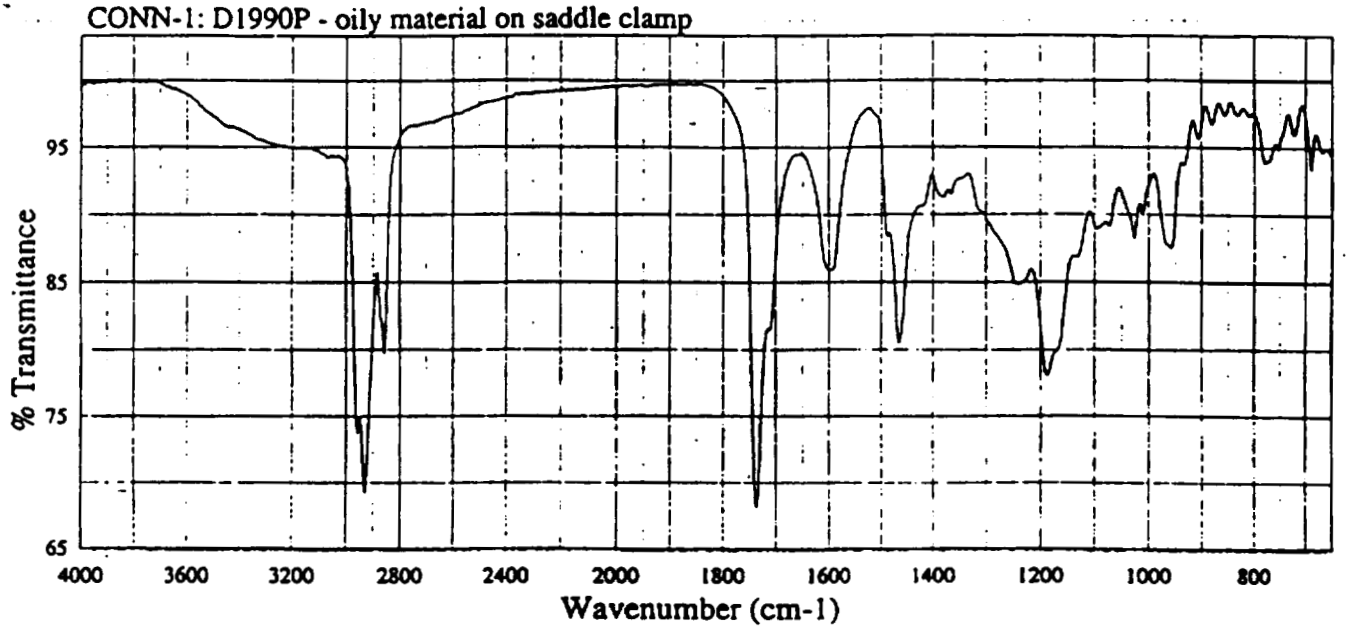


Figure 13. Electron microprobe elemental survey of contaminant on buildup tape beneath clamp on DB9001E connector.



(A)

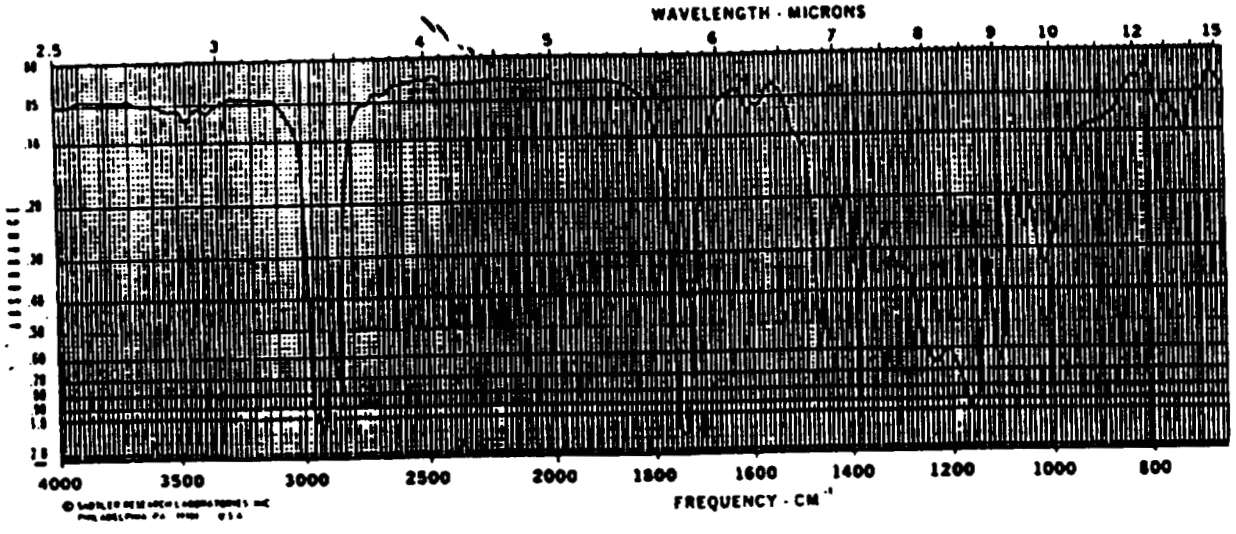


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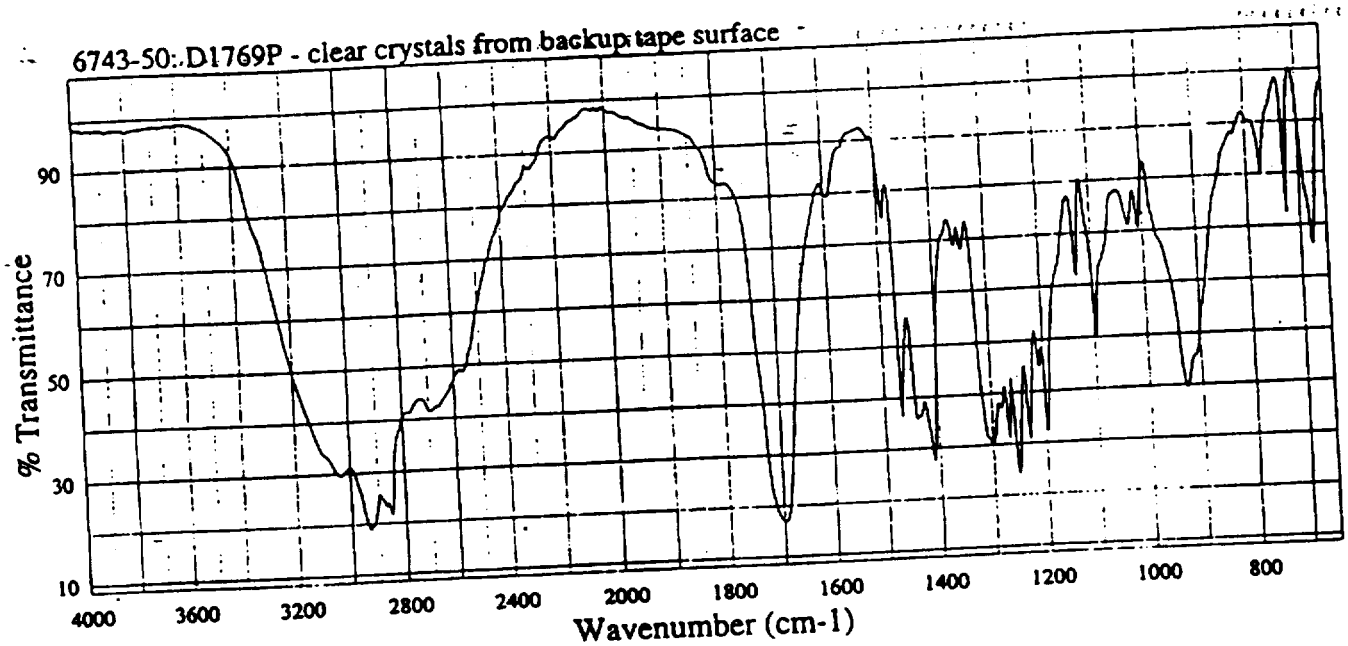
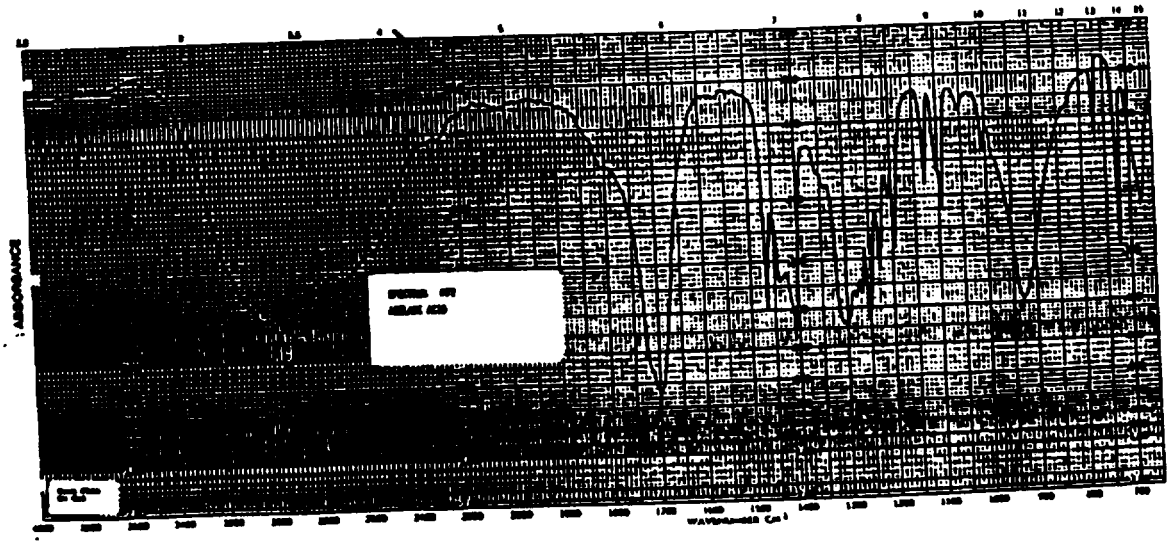
Figure 14. Infrared transmittance spectra: (A) oily contaminant on saddle clamp of D1990P connector and (B) reference spectrum of an ester oil, specifically MIL-L-23699 (Sadtler Research Laboratories, Inc.).



(A)



(B)

Figure 15. Infrared transmittance spectra: (A) clear crystals from buildup tape surface and (B) reference spectrum of azelaic acid (Federation of Societies for Coatings Technology).

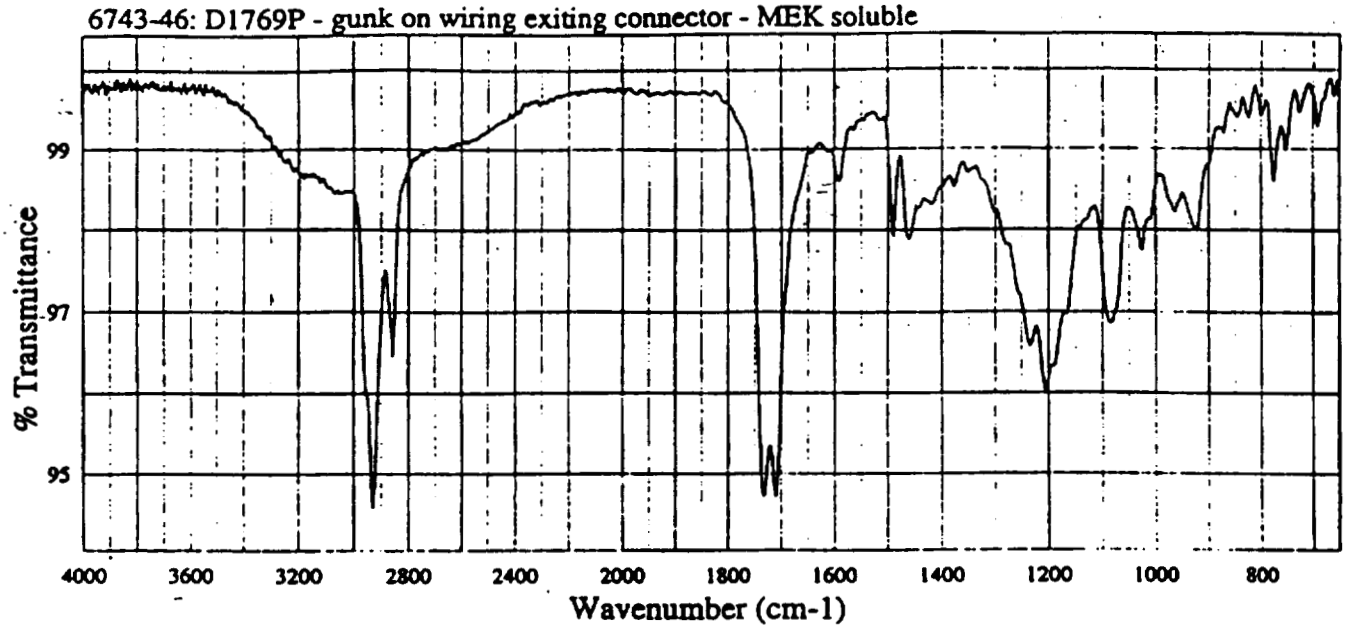


Figure 16. Infrared transmittance spectra of contaminant on wiring exiting a connector showing a mixture of ester oil and acid.

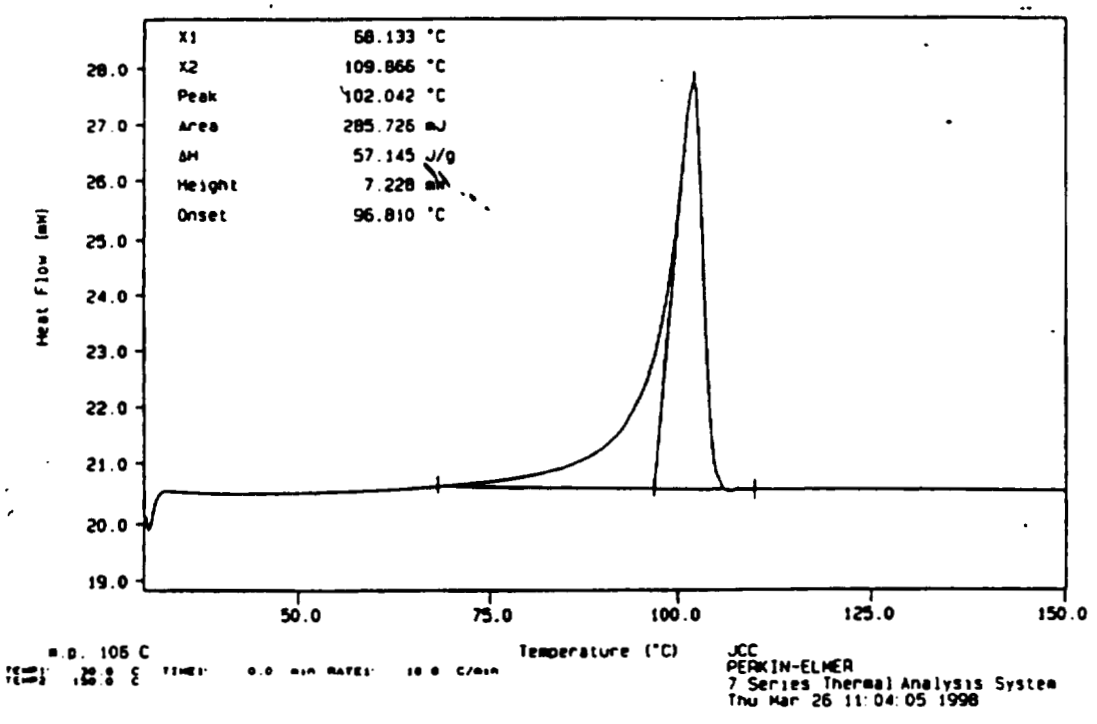


Figure 17. DSC scan of crystals from D1769P connector.

AIRPLANE 18

ANALYTICAL ENGINEERING REPORT

TO: D.M. Haselman M.S. 96-03
L.S. Ghoreishi M.S. 02-AK
CC:

NO.: 9-5576-WP-97-394-R1
ITEM NO.: Chem 6304
DATE: October 31, 1997
MODEL: EQA

GROUP INDEX: 9-5576 - Analytical Engineering, Chemical/Physical

SUBJECT: Identification of Deposits on Wire Bundle.

BACKGROUND

A wire bundle (No. W118, connector number D1947J) removed from a P14 panel of 747 airplane RA[redacted] (S/N [redacted]) was submitted for analysis of deposits observed on the surface of the wire insulation near the connector.

CONCLUSIONS

The deposits were identified as a complex mixture of organic and inorganic environmental debris. Based on the peaks observed in the 1200-1000 wavenumbers range of the infrared transmittance spectra and elements detected with the electron microprobe, the mixture likely contains silicates, sulfates and phosphates. Many sulfate and some phosphate compounds have an infrared peak or series of peaks in this wavenumber range. Dark-colored deposits on the wire insulation had a higher organic fraction compared to the light-colored deposits on the surface of the connector. The deposits contain water-soluble elements, suggesting that the material may have been deposited from water. The source of the water is unknown. No evidence of arcing or overheating on the wires or connector were observed.

EXPERIMENTATION AND RESULTS

The connector submitted for analysis is shown in Figure 1. A region with dark deposits on the wires is shown in Figure 2. Lighter colored deposits on the connector have the appearance of being deposited from a liquid, as shown in Figure 3. The dark deposits on the wires and the light deposits on the connector were analyzed using infrared microspectroscopy and electron microprobe.

The dark deposit lifted from the surface of one of the wires was found to be separable into an MEK-soluble fraction and an MEK-insoluble fraction. Infrared transmittance spectra of these materials are shown in Figure 4. The peaks in the 3000 to 2800 wavenumber range are associated with -C-H stretching, suggesting the presence of an organic material, possibly lubricant or corrosion inhibiting

compound. A representative infrared spectrum of the light deposit lifted from the surface of the connector is shown in Figure 5.

Representative electron microprobe elemental surveys of the deposits are shown in Figure 6. The following elements were detected in the dark deposit from the wires: carbon, silicon, sulfur, oxygen, potassium, with smaller quantities of calcium, aluminum, sodium, magnesium, titanium, magnesium and iron. The light deposit on the connector was found to contain carbon, sodium, silicon, phosphorus, sulfur, oxygen and smaller quantities of aluminum, calcium, cadmium, potassium and iron.

The infrared spectra of the two deposits are similar, suggesting that the deposits contain some of the same compounds with the exception of the components giving rise to color, which are different. Based on the peaks observed in the 1200-1000 wavenumbers range of the infrared transmittance spectrum and elements detected with the electron microprobe, the mixture likely contains silicates, sulfates and phosphates. Many sulfates and some phosphate compounds have an infrared peak or series of peaks in this wavenumber range. The dark deposit contains more organic material compared to the light deposit based on the relative quantity of carbon detected and the size of the organic infrared peaks. Most of the elements detected are water-soluble. The suggests that at least some portion of these contaminants were deposited from a liquid phase. The source of water is unknown.

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Electron microprobe by J. Wessel.

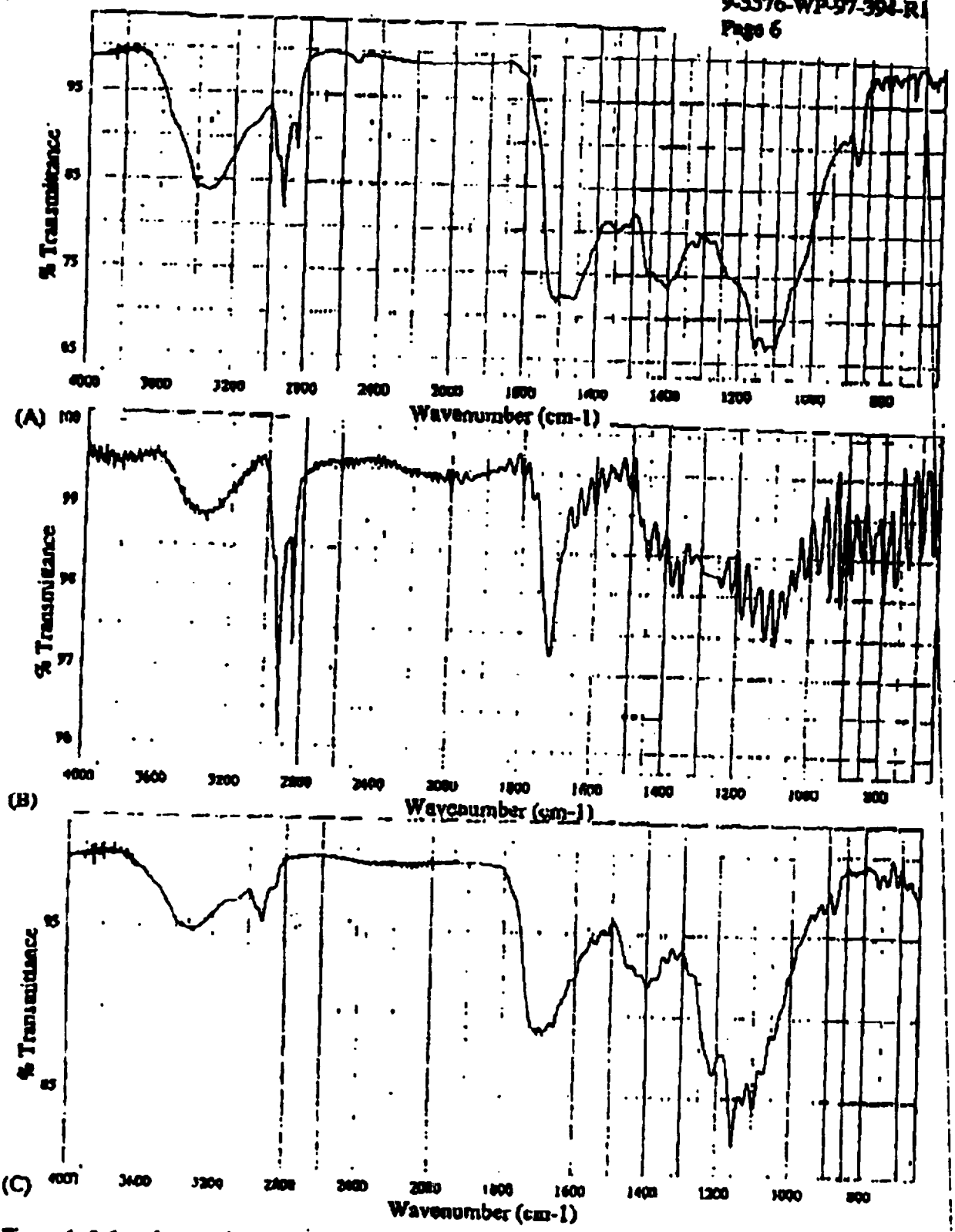


Figure 4. Infrared transmittance spectra: (A) dark deposit on wire above tape, (B) MEK-soluble fraction and (C) MEK-insoluble fraction.

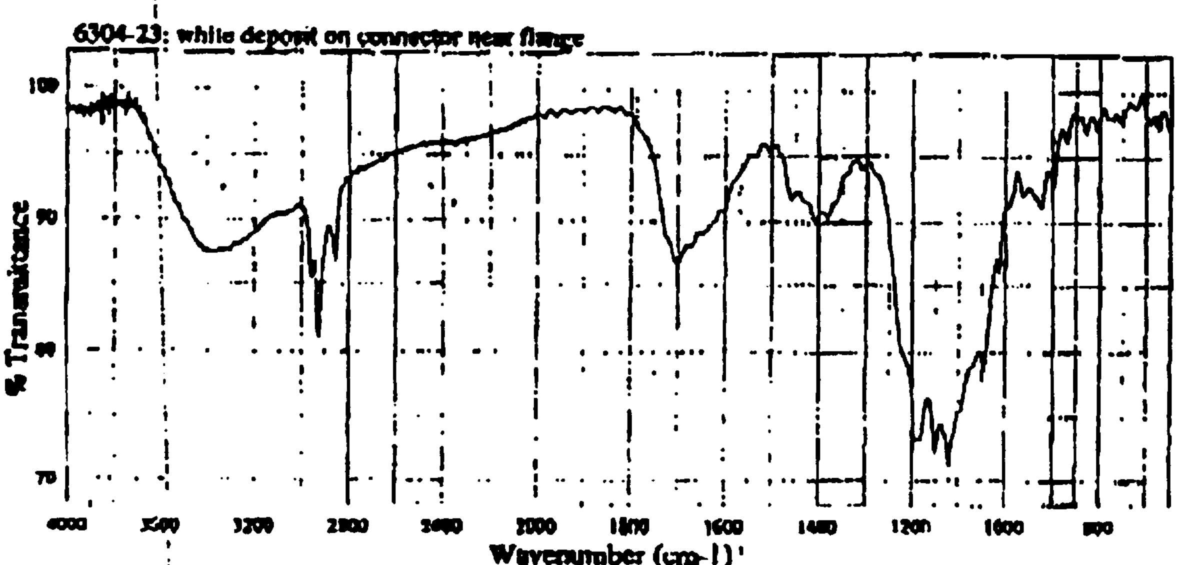
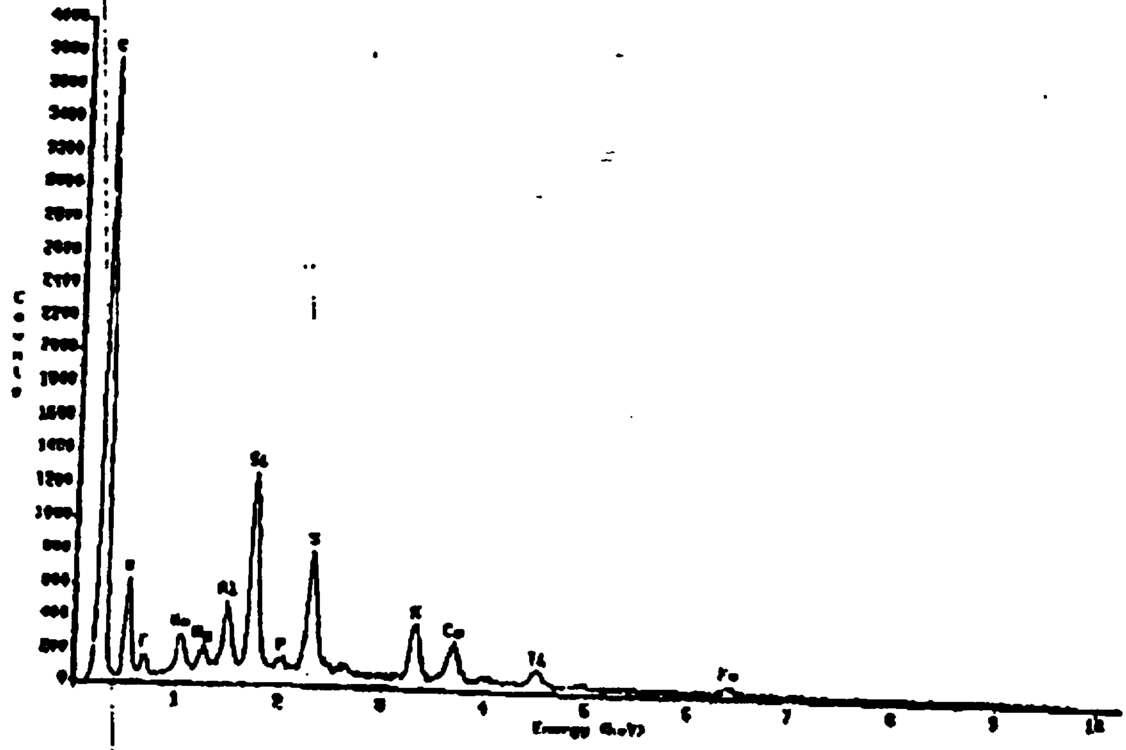
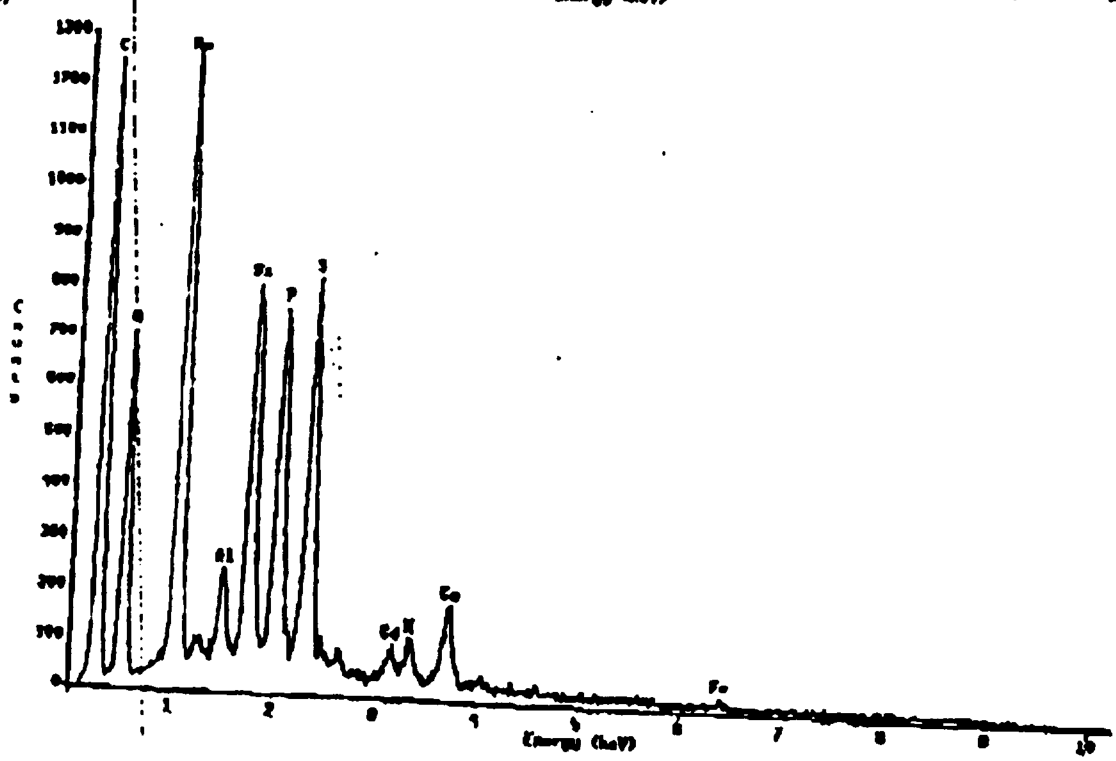


Figure 5. Infrared transmitance spectrum of light deposit on connector.



(A)



(B)

Figure 6. Electron microprobe elemental surveys : (A) dark deposit on wire and (B) light deposit on connector.

AIRPLANE 21

Honeywell 757 Fuel Tank Compensator (Failure Analysis)

26 January 1999

Evaluation Report (43499TMO/NTSB)

Report No. AFRL/MLSA 99-10

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REQUESTER(S)

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EXECUTIVE SUMMARY

AFRL/MLSA received a Boeing 757 fuel probe from the National Transportation Safety Board (NTSB) for evaluation of terminal block and wiring film residues. All electrical measurements were normal. The observed film residues were unremarkable. However, during close internal visual inspection, a small rectangular hole was found in the outer insulation of a length of coaxial hookup wire. This damage extended through the wire, breaking through the braided shield and cutting into the insulation of the primary conductor. It is concluded that a rectangular object was forced through the wire leaving an entry and exit hole in the outer insulation and shield braid. Damage to the inner insulation was limited to a minor cut that did not expose the primary conductor. This puncture may have occurred during assembly of the probe or during aircraft maintenance operations. Had the primary conductor been exposed, fuel contacting the silver-plated copper wire (both shield braid and primary conductor) would result in semiconductive film residues. Such residues can sustain leakage currents high enough to cause inaccurate fuel quantity measurements. Residues deposited in the close spacing between the primary conductor and braiding of shielded hookup wire presents the risk of electrical breakdown and arcing. It is recommended that possible sources of this type of damage be identified and appropriate preventive actions implemented.

Analysis of a Honeywell 757 Fuel Tank Compensator

PURPOSE

Evaluate a Boeing 757 center wing tank (CWT) fuel quantity indicator system (FQIS) compensator assembly for electrical or physical anomalies.

BACKGROUND

As part of an ongoing study of possible aircraft fuel tank ignition sources, the National Transportation Safety Board (NTSB) submitted a Boeing 757 FQIS compensator (figure 1) to MLSA for evaluation. This compensator (MFG No. FG1007 AA04, Serial No. M0069) was reported to have been removed from Boeing 757 aircraft number N557NA for cause during normal maintenance operations to correct inaccurate FQIS measurements.

FACTUAL DATA

Honeywell Corporation manufactured the compensator. An identification tag was attached to the top section of the compensator. The information on this tag is presented in appendix A. Visual inspection of the terminal block and attached wiring revealed no anomalies.

Electrical resistance measurements were made to assess the condition of the compensator assembly. A Hewlett Packard HP4329 high resistance meter was used to measure the insulation resistance between pairs of terminals on the compensator. The measurements were made at 500 VDC. The metering circuit was allowed to stabilize for one minute before measurements were taken. Measurements indicated insulation resistance between all terminal pairs was greater than $3X10^{12}$ ohms. The insulation resistance values are presented in appendix B.

A detailed internal visual inspection revealed a small rectangular hole in the transparent outer jacket insulation of the shielded wire (figures 2 and 3). This shielded wire was attached to the compensator terminal block in two places (figure 4). A wire with black-colored insulation was soldered to the shield braid and used to connect the shield to a grounding point on the compensator assembly. The white-colored center conductor was attached to terminal H with a screw.

A mounting screw was removed to disconnect one end of the shielded wire. The other end was separated from the terminal block by cutting the black ground wire and the center conductor at the crimp-on connector (figure 4). The detached wire was pulled through a grommet to the inside of the inner concentric tube and out the bottom of the compensator assembly. Care was taken in the removal process to prevent further damage to the insulation. The damaged section of the removed coaxial cable is shown in figure 5.

Close examination revealed two small rectangular shaped punctures in the outer insulation jacket. These holes were in alignment. The holes in the outer insulation were approximately 0.25mm across the long rectangular side. Beneath the outer insulation damage

sites, the braiding was separated with some strands having been cut. Braid strands were pushed inward, toward the center of the conductor, below the outer insulation hole that was visible when looking into the end of the compensator assembly. The braid strands had been pushed outward at the opposite end of the hole, on the side originally hidden from view when looking at the wire through the end of the compensator. This damage to the braided shielding can be seen in figure 6.

Discoloration was observed on the surface of the outer insulation in the vicinity of the two holes. A close-up of one of the holes is shown in figure 7. Radiographs revealed the displaced and broken wires in the braided shield in these two locations (figure 8). The radiographs did not reveal damage to the inner conductor stranded wire.

The outer jacket insulation was removed and a sample submitted to the Analytical Laboratory for identification. Chemical analysis by Fourier transform infrared spectrometry (FTIR) suggested the insulation is a polytetrafluoroethylene-hexafluoropropylene copolymer (appendix C). The braided shield under the outer jacket was also removed and analyzed. X-ray fluorescence (XRF) indicated it consisted of silver-plated copper wire (appendix C). Also observed was discoloration of the braided shield in the vicinity of the damage site (figure 9). One of the holes and associated braided shield is shown in figure 10. Note the broken and pushed out wire braid.

The braided shield was removed from the insulated center conductor for inspection and analysis in a scanning electron microscope (SEM) with energy dispersive spectroscopy (EDS). Analysis results were identical to the XRF except for the additional detection of sulfur and carbon (appendix C). Inspection of the shield in the SEM revealed broken wires with necked-down ends (figures 11 and 12). Analysis by EDS of the discoloration on the surface of a terminal lug (Figure 16) and crimped wiring indicated the presence of sulfur, silver, copper and carbon (appendix C).

Optical examination of the center conductor insulation revealed a small nick on its surface (figure 13). It did not appear to expose the primary conductor wire. Chemical analysis by FTIR (appendix C) identified the insulation as polytetrafluoroethylene (Teflon®). Analysis by XRF indicated the center conductor to be silver-plated copper wire (appendix C).

An attempt was made to duplicate the damage to determine if a foreign object puncturing the wire could have caused damage similar to what was observed. A small jeweler's screwdriver blade was pushed through a piece of the shielded wire at an angle so as to nick, but not completely penetrate, the center conductor insulation. The resultant artifact (figure 14) was compared to the existing damage (figure 15) under an optical microscope. They were very similar in appearance.

DISCUSSION(S)

Damage to the wire was located predominately in the outer jacket insulation and the braided shield underneath. The shape and disposition of the two holes in the outer insulation jacket and surrounding braided shield suggest entrance and exit perforations. The hole with the

braiding pushed in believed to be the entrance and the hole with the braiding pushed out the exit. The damage indicates a foreign object pierced the cable. The scrape on the center conductor insulation was essentially duplicated with a small chisel-shaped screwdriver blade. This suggests a similarly shaped object may have caused the damage. The necked-down ends of the broken shield strands indicate they failed in tension (figures 10, 11 and 12). This is compatible with the braid being punctured by a foreign object. Although the center conductor insulation was damaged, the conductor itself was not exposed.

The discoloration on the shield braid and contamination residues on the solderless connectors had the same appearance as film residues previously analyzed and reported by MLSA evaluation report AFRAL/MLS 97-102, dated 30 October 1997. These residues have been found to be rich in sliver, copper and sulfur.

CONCLUSION(S)

The wire damage consisted of a rectangular-shaped hole (0.25 mm long side) puncturing the outer insulation jacket and shielding and nicking the center conductor insulation. A chisel-shaped object, such as a small screwdriver blade, may have caused the damage. The hole did not touch the center conductor or cause any degradation in insulation resistance between the shield and the center conductor. No other physical damage to the compensator or its internal wiring was discovered that might have affected the proper operation of this assembly.

RECOMMENDATION(S)

If the damage seen in this evaluation had exposed the center conductor, a current leakage path could have developed as a result of previously described silver and copper-rich films. Such a leakage path could cause inaccurate fuel quantity measurements and increase the risk of an electrical breakdown event. Before fuel tank compensator assembly, connecting cables should be inspected for defects in the insulation. During assembly, care should be taken when handling the internal cabling. The processes and procedures used during aircraft installation and testing, as well as fuel tank and FQIS maintenance procedures, should be evaluated for tools or test equipment that could cause the kind of damage seen in this evaluation. Any process or procedure that calls for penetrating wire insulation inside fuel tanks should be evaluated and modified to eliminate the risk associated with the development current leakage and electrical breakdown paths.

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PUBLICATION REVIEW: This report has been reviewed and approved.

MICHAEL F. HITCHCOCK, Branch Chief
Materials Integrity Branch
Systems Support Division
Materials and Manufacturing Directorate

Figure 5. Removed coaxial cable showing insulation damage and discolored braided shield.

Mag. 2.8X

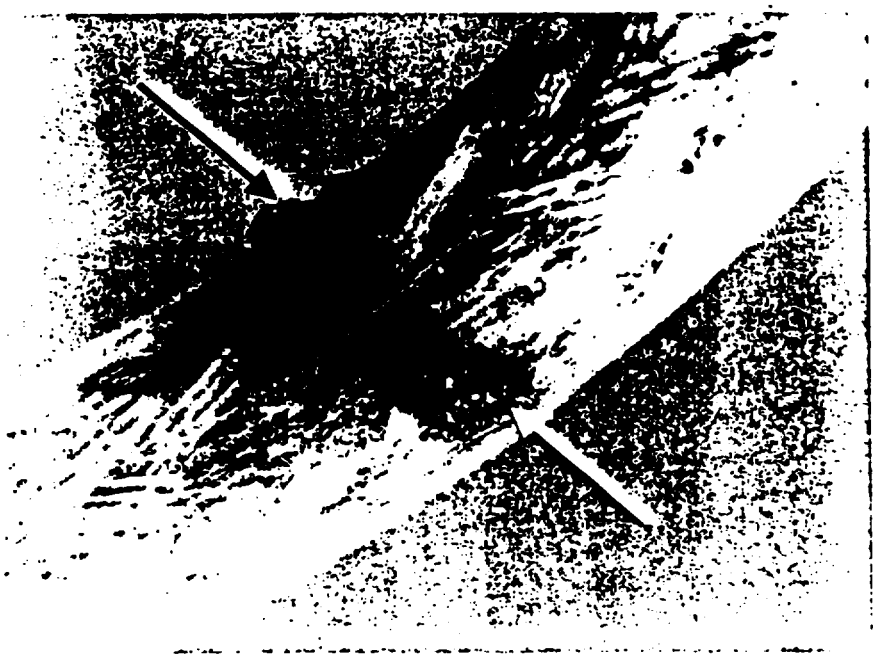

Figure 6. Holes in jacket insulation with discoloration. The white arrow highlights the hole with the pushed-in braiding. The blue arrow highlights the hole with the pushed-out braiding.

Mag. 16X

AIRPLANE 2

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

June 15, 1999

AIRWORTHINESS GROUP FACTUAL REPORT

DCA99SA043

A. INCIDENT

Location:	San Francisco, California
Date:	November 9, 1998
Time:	0615 Pacific Standard Time (PST)
Aircraft:	Lockheed L1011-385; N740DA

B. AIRWORTHINESS GROUP

Jeffrey B. Guzzetti	Chairman National Transportation Safety Board Washington, D.C.
John R. Potthast	Member Delta Air Lines, Inc. Atlanta, Georgia
Daniel Head	Member Delta Air Lines, Inc. Atlanta, Georgia
Keith Noles	Member Delta Air Lines, Inc. Atlanta, Georgia
James Kirkman	Member Federal Aviation Administration Atlanta, Georgia

C. SUMMARY

On November 9, 1998, at 0615 Pacific Standard Time, Delta Air Lines flight 225, registration N740DA, a Lockheed L-1011-385, experienced electrical arcing and smoke in the cockpit while cruising over the Pacific Ocean near San Francisco International Airport, San Francisco, California. An emergency was declared and the airplane landed safely in San Francisco with no damage. Instrument meteorological conditions prevailed at the time of the incident. The captain, first officer, flight engineer, 8 cabin crewmembers, and 53 passengers were not injured. The scheduled domestic passenger flight had departed from Honolulu, Hawaii, at 0154 PST and was conducted under 14 CFR Part 121.

According to written statements from the flight crew (attached), the airplane was about 140 nautical miles west of San Francisco while cruising at 36,000 feet over the Pacific Ocean when the flight engineer observed smoke and sparks emanating from inside the circuit breaker panel above and to the right of his station. He also observed a small flame inside the panel and extinguished it with a fire extinguisher. The crew donned their oxygen masks, declared an emergency, and began a descent through clouds.

After breaking out of the clouds at 5,000 feet, the crew was vectored for a visual approach to runway 28R. During the descent and landing, multiple system failures occurred with the autopilot, cabin pressurization, auto spoilers, and thrust reversers. After a safe landing and taxi to the gate, the crew determined that the engines were still running at flight idle instead of ground idle. Additionally, the cabin doors could not be opened because the cabin pressurization outflow valves remained in the closed position despite attempts to override them. The crew then attempted to shut down the engines with normal procedures, but were required to pull the emergency "T" handles to accomplish the shut down. The airplane was subsequently depressurized and the cabin doors opened. The occupants deplaned normally through the main cabin door and jetway.

This factual report summarizes the findings for all on-site activities and follow-up research. Supporting documentation, including flightcrew statements (appendix A), excerpts of pertinent maintenance records (appendix B), interview summary of Delta Air Lines maintenance/engineering personnel (appendix C), parts diagram of affected areas (appendix D), and Lockheed operation information letters addressing the effects of electrical bus welding (appendix E), are attached.

D. DETAILS OF THE INVESTIGATION

1.0 On-Scene Examination

After the airplane was deplaned, airline maintenance personnel were called to inspect it. According to statements and records (attached) provided by Delta Air Lines maintenance personnel, the inspection revealed no evidence of a fire on any aircraft

structure, including the circuit breaker panel. An adel clamp and a circuit breaker exhibited evidence of external thermal damage (blackening). A single circuit breaker was found popped and its post exhibited evidence that it had arced to an adel wiring clamp that held a bundle of wires. The circuit breaker was identified as "CB 3F1" and was associated with the "Direct Current (DC) Essential Bus Standby Power." Delta maintenance personnel further stated that the wire stand-off that was associated with the adel clamp was only about 1/8-inch in length. They stated that the wire bundle worked its way in close proximity to the circuit breaker lug until the adel clamp contacted the lug and shorted. They also indicated that the wire stand-off assembly appeared to have been a factory installation, and that it should not have been installed in that location.

The maintenance personnel also reported that an undetermined amount of dust covered the back side of the circuit breaker panel. Additionally, they stated that a corner of a piece of paper with flight crew handwriting on it exhibited evidence that it had been partially consumed by a flame. They stated that this paper was placed in one of the slotted edges in the circuit breaker panel prior to the incident, and they indicated that the flame reported by the flight crew probably came from the paper. They reiterated that there was no other evidence of a fire.

3.0 Additional Research and Follow-up Action.

3.1 Pertinent Maintenance History.

According to maintenance personnel and maintenance records (attached) the DC standby bus circuit breaker had popped on the incident airplane on a flight from Dallas, Texas, to Honolulu, Hawaii, one day before the incident, on November 8, 1998. The breaker was replaced, but popped again on a subsequent flight from Honolulu to Atlanta. Maintenance personnel then replaced the 2432-3K11 control relay. The airplane flew for an additional eight flights without incident, until the incident occurred on the flight to San Francisco from Honolulu.

3.2 Lockheed Information Regarding DC Bus Welding Problems.

On September 17, 1976, Lockheed issued an L1011 Operating Information Letter (attached) entitled "Bus Transfer Relay Contact Welding." The letter addresses, in part, the anomalous events that can occur should a main electrical contact of the DC standby bus transfer relay become welded. The letter also discusses an improved relay that is not subject to welding. Although this relay was not found to be welded in the incident airplane, the effects of a short-circuited DC standby bus could cause similar anomalies. The letter states: "If the DC standby bus relay welds, gradual loss of the DC standby bus will result, and the following events can be expected to occur while the battery is being discharged, though not necessarily in the order shown.

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- Loss of automatic pressurization control.
- Loss of automatic and manual control of RAT deployment
- Loss of engine and APU fire detection and extinguishing capability
- Loss of automatic and manual control of passenger oxygen systems
- Loss of standby galley, lavatory, and aisle lights.
- Loss of instrument panel standby floodlights and the ability to reset the CAWP annunciators
- Inability to operate the engine driven hydraulic pump depressurization or suction shutoff valves.
- Loss of landing gear and gear door position annunciation.
- Inability to operate the engine thrust reversers on landing."

3.3 Fleet Inspection Results of Delta Air Lines L1011 Cockpit Wire Stand-offs

As a result of the incident, Delta Air Lines immediately inspected their entire fleet of L1011 airplanes for inadequate lengths on cockpit wire stand-offs. They reported that the inspections revealed no other stand-offs that exhibited the same problem as the incident airplane.

3.4 Delta Air Lines Guidance Regarding Pilot Checklists/Papers Placement.

As a result of the incident, Delta Air Lines immediately issued a Crew Information Letter to instruct flight crews to refrain from placing paper checklists and other items into the slotted edges of electrical panels for fire prevention purposes.

Jeffrey B. Guzzetti 6/15/99
Aerospace Engineer
6/17/99

AIRPLANE 23

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

June 11, 1999

AIRWORTHINESS FACTUAL REPORT

DCA99SA044

A. INCIDENT

Location:	Atlanta, Georgia
Date:	December 22, 1998
Time:	1140 Eastern Standard Time (EST)
Aircraft:	Lockheed L1011-385; N766DA

B. AIRWORTHINESS GROUP

Jeffrey B. Guzzetti	Chairman National Transportation Safety Board Washington, D.C.
John R. Potthast	Member Delta Air Lines, Inc. Atlanta, Georgia
Daniel Head	Member Delta Air Lines, Inc. Atlanta, Georgia
Keith Noles	Member Delta Air Lines, Inc. Atlanta, Georgia
James Kirkman	Member Federal Aviation Administration Atlanta, Georgia

C. SUMMARY

On December 22, 1998, about 1140 Eastern Standard Time, Delta Air Lines flight 566, registration N766DA, a Lockheed L-1011-385, experienced electrical wire arcing inside an avionics compartment while the airplane was standing at the gate at the Hartsfield International Airport in Atlanta, Georgia. The airplane was deplaned normally and the captain, first officer, flight engineer, 6 flight attendants, and 198 passengers were not injured. Visual meteorological conditions prevailed at the time of the incident. The scheduled domestic passenger flight was destined for Boston, Massachusetts, and conducted under 14 CFR Part 121.

According to a representative of Delta Air Lines, the incident occurred just before pushback from the gate. A passenger seated immediately aft of the L2 door, located on the left side of the airplane behind the lavatory, observed sparks and smoke emanating from a vent below the adjacent sidewall panel. Flight attendants were informed, and the smoke ceased shortly thereafter.. The captain was advised of the situation and subsequently ordered that everyone deplane the aircraft through the forward exit. The flight was subsequently cancelled.

This factual report summarizes the findings for all on-site activities (conducted by FAA and Delta) and follow-up research. Supporting documentation, including excerpts of pertinent maintenance records (appendix A), an interview summary of Delta maintenance/engineering personnel, and a Delta Special Inspection (appendix C) are attached.

D. DETAILS OF THE INVESTIGATION

1.0 On-Scene Examination

After the airplane was deplaned, airline maintenance personnel were called to inspect it. According to statements and records (attached) provided by Delta Air Lines, maintenance personnel gained access to the airplane's Mid Electrical Service Center (MESC), which is an avionics compartment located below the main cabin floor near the middle portion of the fuselage. Maintenance personnel noticed that two wire bundles, measuring about 3 inches in diameter, exhibited evidence that they had burned. The sections of the wire bundles that were damaged were located just forward of the station 963 floor beam, directly below the 2L lavatory, and led to a disconnect panel in the subfloor structure. The airplane was placed out of service and additional maintenance and inspection actions were taken.

2.0 Follow-up Examination and Maintenance Actions.

According to representatives from Delta Air Lines, a detailed inspection of the area surrounding the burned sections of the wire bundles revealed no evidence of any fire damage or soot to adjacent structure. Examination of the wire bundles revealed that wire-to-wire arcing had occurred, with no other collateral damage noted. The wire bundles

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were also saturated with fluid that was blue in color. An undetermined amount of dust build-up was found in the area, but was not excessive or unusual in the opinion of Delta personnel. Delta then issued two "Engineering Repair Authorization" actions (attached) to replace the wire bundle sections and install a wire disconnect bracket. The airplane was returned to service six days after the incident occurred.

3.0 Additional Research and Follow-up Action.

3.1 Previous Problems Associated with Lavatory Fluid Replenishment.

According to representatives from Delta Air Lines, there have been three or four previous occurrences involving exposure of wire bundles to blue lavatory fluid below the mid lavatories on their L1011 airplanes. These lavatories have a "low charge level" and thus have an increased potential of becoming overcharged by personnel who service the lavatories. If the lavatories are overcharged with fluid, then the fluid can spill out of its receptacles and onto wire bundles and electrical equipment located beneath them. Delta has taken corrective action by verifying the integrity of the drip pans and disseminating information about the problem to others.

3.2 Special Inspection Conducted by Delta Air Lines.

On January 15, 1999, Delta Air Lines issued a "Special Inspection" (attached) entitled "MESC General Wire and Drip Pan Inspection" for L1011 airplanes as a result of the Atlanta occurrence on December 22, 1998. The inspection called for the examination of drip pans and wiring located near the left and right mid lavatories. The inspection procedures included examining the integrity of the drip pans and drain tubes. The procedures also included performing a general inspection of the wires installed in the MESC, for evidence of blue fluid soaking, loose debris, arcing damage, deteriorated wiring, wire chaffing, and numerous other items.

3.3 Results of Reactive Inspection.

According to a report (attached) provided by Delta Air Lines, 35 L1011 airplanes operated by Delta underwent a "reactive" inspection that was ordered by the Delta L1011 Product Team Manager. The following results were reported:

- 5 airplanes exhibited evidence of lavatory fluid contamination of wires in the inspection area.
- 11 airplanes exhibited "some signs of feeder to bundle rubbing" in the inspection area.
- 17 airplanes "demonstrated excessive dirt and dust" in the inspection area.
- 13 airplanes had "metal shavings or paper debris" in the inspection area.

Jeffrey B. Guzzetti · 6/11/99
Jeffrey B. Guzzetti
Aerospace Engineer

6/10/99

AIRPLANE 24

NTSB Identification: **DCA99SA037**

Scheduled 14 CFR 121 operation of AMERICAN AIRLINES, INC.
Incident occurred JAN-31-99 at SEATTLE, WA
Aircraft: McDonnell Douglas MD-11, registration: N1765B
Injuries: 80 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On January 31, 1999, about 1500 PST, American Airlines Flight 27, N1765B, a McDonnell Douglas MD-11, experienced smoke in the cabin and performed an emergency landing at the Seattle-Tacoma International Airport. The captain, first officer, 14 crewmembers, and 64 passengers were not injured. Instrument meteorological conditions prevailed and a company flight plan had been filed. The 14 CFR Part 121 scheduled international passenger flight had departed Seattle about 1350 and was en route to Narita, Japan. According to representatives of American Airlines, the airplane was airborne for about 1 hour and 10 minutes while cruising over north Vancouver Island, British Columbia, Canada, when the event occurred. A "buzz" was first heard over the public address system, so the flightcrew reset the circuit breaker for it. Smoke was then observed in the first class cabin area. The crew immediately declared an emergency and turned back to Seattle. A crewmember located the source of the smoke and opened up an overhead bin just forward of the R2 door located near the right rear section of the first class cabin. A halon fire extinguisher was discharged onto a video system control unit (VSCU) and the smoke dissipated with no further incident. No reports of fire were made, and no fire damage was found. Examination of the VSCU by representatives of the Federal Aviation Administration (FAA) revealed that part of a circuit board was charred. Further examination of the entire video system revealed internal damage to several video distribution units (VDUs) downstream of the VSCU. A "cannon plug" power connector that linked the damaged components exhibited evidence of moisture damage and a short circuit between two pins. All video system wiring was intact and undamaged. The video system was manufactured by Rockwell Collins Passenger Systems and certified by the FAA Long Beach Aircraft Certification Office. It was installed in the incident airplane by McDonnell Douglas prior to the aircraft's delivery from the factory. According to manufacturer records from Rockwell Collins, the connector failure was the first of its kind.

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AIRPLANE 25

NTSB Identification: **DCA99SA051**

Incident occurred MAR-29-99 at SAN BERNARDINO, CA
Aircraft: McDonnell Douglas MD-11, registration: N274WA
Injuries: 1 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On March 29, 1999, maintenance personnel in San Bernardino, California, discovered evidence of a fire on board a McDonnell Douglas MD-11, N274WA, operated by World Airways. The time and circumstances of the fire went unreported and are unknown. The airplane received minor damage, and no injuries associated with the event were reported. Maintenance personnel at Santa Barbara Aerospace in San Bernardino contacted the Safety Board when they noted evidence of the fire while opening up the aft cargo bay floorboards during a scheduled "4 C" maintenance check. The airplane, a freighter, was manufactured in 1992 and accumulated about 18,300 hours since delivery. A deferred maintenance item dated February 22, 1999, was noted in the aircraft logbook that reported a inoperative electric cargo loading system. A routine task card was scheduled to remove the floorboards, so the operator opted to defer this item until the 4C check (the floorboards had never been removed). Upon removal of the floorboards, the insulation blanket between stations 1661 and 1681 was found burned. An detailed inspection of the area revealed that a wiring harness, containing 20-guage wires insulated with Kapton, was routed across and onto frame 1681. One wire was separated, and the insulation of seven other wires were damaged and chaffed where they contacted the frame. The bundle emanated from the aft cargo loading system control box, which routes 115 volt 3-phase power to electric floor rollers when the aft cargo door is in the fully open position. Evidence of wire chaffing and arcing was present on the wire bundle and the frame where the bundle was contacted it. The metalized mylar that covered the entire insulation blanket (measuring about 60 inches feet by 20 inches) that fit into the bay between frame 1661 and 1681 had completely burned away, exposing partially burned insulation material beneath it. A 1.25-inch hole in the blanket was found underneath the chaffed portion of the wire bundle. The mating edge of the adjoining insulation blanket (forward of frame 1681) was also burned. The metalized mylar is DMS 2072K, type 2, class 1, grade A, lot no.2024. The tape that held the mylar in place is DMS 1984 tape. Two wire bundle "stand-offs" were installed on either side of the arced area of the wires. The wire run was 14 inches between the stand-offs. The outboard stand-off was 1 inch high, and the inboard stand-off was 1.5 inches high, with an effective stand-off clearance of 3/4-inch from the frame.

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AIRPLANE 26

Air 2000 — AIR SAFETY REPORT — REFERENCE B98/67

1. TYPE OF EVENT	ASR	AIRPROX	BIRD STRIKE	GPWS	TCAS RA	CAA OCCURRENCE Nr.

2. CAPTAIN: CORCORAN

3. DATE OF OCCURRENCE D / M / Y	4. TIME LOCAL/UTC / DAY/NIGHT/TWILIGHT	5. FLIGHT Nr	6. ROUTE	7. SQUAWK
22 / 06 / 98	0005Z	DP63	LCA/MAN	5546

8. A/C TYPE	9. REGISTRATION	10. PASSENGERS/CREW	DIVERSION (IF APPLIC)	11. ETOPS
B757	G-OOOX	206/9	DIV TOLCA	NO

12. ALTITUDE ON GROUND.	13. SPEED/MACH NO.	14. A/C WEIGHT	15. TECH LOG REF.
FL 270 / FT	300KTS IAS	96000 KG	194108

16. FLIGHT PHASE

TOWING ➡ PARKED | 17. AIRPORT ➡ STAND | ➡ PUSH BACK ➡ TAXI OUT ➡ TAKE OFF ➡ INITIAL CLIMB ➡

CLIMB ➡ CRUISE | 18. GEOG. POSITION DASNI | ➡ DESCENT ➡ HOLDING ➡ APPROACH LANDING ➡➡ TAXI IN

19. MET DMC / VMC 20km	20. WX ACTUAL WIND	VIS	CLOUD	TEMP	QNH	21. SIGNIFICANT WX ~~nil MODERATE / SEVERE RAIN / SNOW / ICING / FOG / TURBULENCE HAIL / STANDING WATER / WINDSHEAR~~
		km	5/1000	22 °C	1018	

22. RUNWAY	23. RUNWAY STATE	24. CONFIGURATION
22	DRY / WET / ICE / SNOW / SLUSH / RVR	~~A.PILOT/~~ A.THRUST/ GEAR/ FLAP/ SLAT/SPOILERS clean

25. SUMMARY (CONCISE DESCRIPTION OF THE EVENT)

LOUD BANG AND SPARKS IN FLIGHT DECK - FOLLOWED BY INSTRUMENT FAILURES AND MULTIPLE EICAS MESSAGES. A/C RETURNED TOLCA

26. EVENT AND CAUSE (DETAILED DESCRIPTION OF THE EVENT AND ITS IMMEDIATE CAUSE). (ACTIONS TAKEN, THEIR RESULT AND ANY SUBSEQUENT EVENTS).

In the climb out of LCA, passing FL255, loud bang and shower of sparks from overhead panel (P11). Some sparks landed on Captains lap. Simultaneously Capt's ASI fell to zero - altimeter off flag and RDMI multiple off flags. The FO was PF - no instrument problems on co-pilots side. Aircraft levelled at FL270. Multiple EICAS messages now appeared. ALT ADC selected on Capt's side, which restored Capt's ASI and altimeter. Centre ILS failed and Capt's VOR/DME control blank. Multiple off flags appeared on s/by ADI and instrument eventually toppled. Pan declared. DIV to LCA requested. QRH drills for the following EICAS messages were carried out. "Spoilers" "s/by Bus off" "left yaw damper" status message - "s/by inverter". Following QRH drill unable to restore s/by bus power. Main and APU batteries now discharging (more EICAS messages) - returned s/by power switch to auto to conserve battery power. During descent Capt's F/DIR failed. Auto throttle failed. During approach at 5000' "RT IRS D.C. Fail" on EICAS. Overweight landing (96 tonnes) in CAVOK conditions at LCA. Started APU on taxi-in status message "APU Batt to s/by"

FTO

AIRPLANE 26

24 June 1998

Air 2000 Limited
Commonwealth House
Chicago Avenue
Manchester International Airport
Manchester M90 3DP

Engineering Department
Direct Telephone: 0161 489 0401
Direct Fax: 0161 908 2285
EMAIL: MRHODES@
fchmail.mhs.compuserve.com

Paul Price
Quality Assurance Manager
AIR 2000 LTD

C.C. G.Evans, M.Thatcher, G.Lovell, R.Challis

Dear Paul

AIR 2000 B757 FLEET INSPECTION.

We have now carried out a fleetwide inspection of the looms behind the P11 panel. The inspection was called up due to the in flight incident to NB 329. The area concentrated on was the fwd end of disconnect bracket AP0011. There is a loom that runs in close proximity to this bracket in addition the routing of wires W2016-0001-12 and W2016-0002-16 were investigated. The results are listed below:

G-OOOX NB329: (see attached drawings). Wires W2016-0001-12 and W2016-0002-16 were routed over the top of disconnect bracket AP0011 in close proximity of the bracket bonding stud. At this point the wires chafed through and shorted to earth. These two wire were repaired and rerouted. The disconnect bracket was also moved aft as it is mounted on elongated mounting holes.

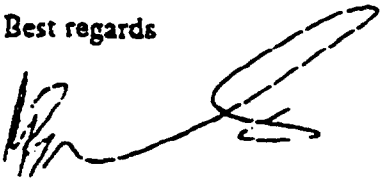
G-OOOA NA441: (see attached drawing). There was evidence of slight damage to one wire in the main loom caused by chaffing against the disconnect bracket. The damaged wire was protected and the disconnect bracket was moved aft.

G-OOOI NB131: The main loom was found to be in contact with a securing bolt of the disconnect bracket AP0011. There was no sign of chafing but the loom was repositioned as a precaution.

C-FOOG NB134: Wires W2016-0001-12 and W2016-0002-16 were found routed in a similar manor to G-OOOX NB329. At present no chafing was found and the wires were rerouted as best that could be in the ground time available.

The remainder of the fleet did not show any problems. I will raise an E.R. calling for the protection of the loom that runs adjacent to disconnect bracket AP0011. This will be carried out during "A" checks. I have informed BOEING of the results and suggested to BOEING that a fleet check of all B757 aircraft be carried out world wide.

Best regards



- Mick Rhodes.

AIRPLANE 28

AAIB Bulletin No: 10/97 **Ref: EW/C97/4/3** **Category: 1.1**

INCIDENT

Aircraft Type and Registration:	Boeing 747-243B, G-VGIN	
No & Type of Engines:	4 Pratt & Whitney JT9D-7J turbofan engines	
Year of Manufacture:	1971	
Date & Time (UTC):	28 April 1997 at 0018 hrs	
Location:	En-route Washington DC - London Heathrow	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 20	Passengers - 140
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Overheating damage to wiring loom and furnishing behind overhead panels in forward cabin	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	57 years	
Commander's Flying Experience:	16,800 hours (of which 11,800 were on type) Last 90 days - 155 Last 28 days - 51	
Information Source:	AAIB Field Investigation	

The aircraft had taken off from Washington Dulles Airport en-route for Heathrow. As it approached Halifax, Nova Scotia, the cabin crew in the first class section saw smoke and sparks coming from an overhead panel above the beautician's table, which was fitted as part of this operator's interior layout. No passengers were in the area at the time, which was curtained-off, and they remained unaware of the occurrence. The Flight Crew were informed and the appropriate drills were executed.

The Flight Engineer investigated by dropping the two Passenger Service Unit panels nearest to where the cabin crew had seen the smoke and sparks. Initially he could not see any problem, however, upon removing a lamp fitting and shining a torch into the aperture, he could see evidence of blackened wires and paint discoloration. There were by now no further signs of smoke or fire but he left the opening available for the introduction of extinguishant if required. He also examined the circuit-breaker panels and found that two had tripped - P14 'Ceiling control' and P15 'Light window right'. The flight was continued and completed without further problems.

After landing, the aircraft was removed from service and inspected by the operator and the AAIB. Severe overheat damage was found to wiring loom W1144 which was located in the central ceiling panel in Zone B (Station 655) and contained wires for the ceiling and sidewall lights in this zone, both 115V ac and 28V dc. The loom comprised about 50 wires, the majority of which had melted at the same location, associated with a 'P' clip which had also partially melted. Secondary damage to a gasper air pipe and sooting/heat damage to adjacent structure and trim panels was also noted. It was evident that the fire had self-extinguished but the loom in the area of the overheat was too badly burned to identify which individual wire had initiated the sequence.

The airline uses third-party maintenance for major checks and modification and G-VGIN had just undergone such a check at the maintenance facility of another UK operator. Whilst undergoing this work a modification had been embodied to the lighting in the affected section which involved introducing new wires into loom W1144, which consequently ran through the 'P' clip mentioned above. Examination of some of the new wires in an area away from the overheating showed damage to the insulation typical of it having been pulled through a clip, possibly in the presence of sharp metallic debris such as swarf, causing tearing of the insulation. A considerable amount of 'fresh' debris such as swarf, a solid fastener, a stiffnut and a drill bit was found in the area which had been subject to modification. The operator's Quality Assurance is of the opinion that the overheat was due to the new wires being pulled through the 'P' clip with a piece of swarf trapped within the clip, causing damage to the insulation. Unfortunately, the overheat damage in the immediate area had destroyed any direct evidence of this.

The airline has drawn the attention of their maintenance contractor to these findings who had stated that they will in future ensure that such a situation should not arise again, both with respect to 'pulling' wires through clips and the amount of debris not cleaned-up after modification work. The operator also inspected another aircraft which had undergone the same modification work by the same contractor and, as a precaution, changed all four circuit breakers associated with the wiring loom. It is understood that, although some quantity of debris was recovered from the other aircraft, there was no evidence of a potential short-circuit in the loom as had been postulated for the incident to G-VGIN.

Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

AIRPLANE 29

DEC 16 1996

B-T113-96-4178

RECEIVED
DEC 17 1996
ANM-100S
FAA SACO

Mr. D. L. Riggin
Manager, ANM-100S
Department of Transportation
Federal Aviation Administration
Seattle Aircraft Certification Office
1601 Lind Avenue Southwest
Renton, WA 98055-4056

BOEING

Dear Mr. Riggin:

Subject: **FAR 21.3 Report 96-1989, Wire Bundle Fire in Forward Lower Lobe - Model 747-200 - Status Report**

References: (a) Telecon, October 22, 1996, Mr Forrest Keller (FAA) with I. Ghoreishi and D. Hartnell (Boeing)

(b) Boeing letter BT113-96-3435, dated October 24, 1996

Please forward the following information to Mr: Forrest Keller and Mr. Chris Hartonas of your office.

BACKGROUND:

In the subject FAR 21.3 report, a 747 foreign operator reported an arcing wire bundle resulted in a fire, on October 12, 1996, at the aft bulkhead of the forward lower lobe cargo compartment at STA 1000. This incident occurred on Model 747-200 Freighter serial number 24177, during post C-check functional testing on the ground.

The resultant damage was to wire bundles W834, W846, W1524, and W370, to the insulation blanket and to the bulkhead itself. In addition, the operator postulated that there may be damage to the center fuel tank sealant.

The airline operator removed the burned wire bundles and the separated wires, W1524-C1760/59/58/57, and W1524-C2137 (all identified as "A") and W1524-C1767/68/69/73 and W1524-C2136 (all identified as 'B") and the following circuit breakers, relays and relay sockets from the airplane, and sent them to Boeing for evaluation and determination of the possible cause of this incident:

"L.E. FLAP CONTROL A" circuit breaker P/N BACC18Z7R
"ENG 2 CCMA" circuit breaker P/N BACC18Z2R,
Relay 10 Amps 4PDT plug-in P/N 10-60450-2
Relay, Sub miniature, 115VAC, 400Hz Coil, P/N JA-D9F-007
Socket, Relay, 8 Contact, Removable Crimp Type, P/N BACS16X3A
Relay, 2PDT, 10 Ampere, Hermetically Sealed, P/N BACR13CF-2A (2 off)
Socket, Relay, 8 Contact,Removable Crimp Type, P/N BACS16XIA (2 off)

The following is the summary of the activities associated with this investigation and the results of the Boeing evaluation on the parts forwarded by the operator for Boeing evaluation.

ACTIVITIES:

In the reference (a) telecon, the FAA requested copies of the maintenance job cards covering the tasks performed in the forward cargo compartment during the recent C-check on the subject airplane. In addition, the FAA requested any special maintenance actions which affected the wire bundles in the area where the fire occurred.

BOEING

The copies of the airline operator job cards addressing the airline operator's maintenance actions in the aft end of the forward lower lobe cargo compartment during the airplane C-check (just prior to the reported event) were provided to the FAA as enclosures to the reference (b) Boeing letter. Maintenance records for any repairs which involved wire bundle W1524, and adjacent bundles were not available.

The FAA also requested copies of the wire installation drawing and all associated wiring, schematic, and systems and the power source for the four wire bundles which were involved in this incident (W1524, W846, W834, and W370).

A meeting was held on October 18, 1996, at the Boeing Everett Facilities between Mr. Chris Hartonas of the FAA and Boeing engineers F. A. Jaques, R. J. Lidicker, and I. S. Ghoreishi. At the conclusion of this meeting copies of the requested drawings and related information were given to Mr. Hartonas. Enclosure 4 is the list of these drawings.

The FAA also requested an inspection at the Boeing Everett facilities of a 747-400 forward lower lobe (STA 1000) cargo compartment.

Mr. Chris Hartonas and DER Issa Ghoreishi performed an inspection of the wire routing of the 747-400 lower lobe (STA 1000) cargo compartment on October 21, 1996. No anomalies were observed. Wire routing was photographed. Copies of the photograph taken in this area were given to Mr. Hartonas. In addition, copies of the photographs provided by the airline operator of the damaged wire bundles on the subject airplane were also given to Mr. Hartonas.

The FAA also requested Boeing to provide copies of the wiring installation drawing, wire diagram, the power source, of all affected systems of all wire bundles installed on the lower lobe (STA 1000) bulkhead of the subject the airline operator 747-200 airplane (RR566).

Copies of these requested drawings are provided with this letter as enclosure 5.

Discussion & Analysis:

The airline operator removed three relays and their associated relay sockets, two circuit breakers and the damaged wires from the subject airplane. Portions of the damaged wire bundles identified by the airline operator as "A" and "B" were transmitted to Boeing for evaluation to determine the possible cause of the damage.

An EQA was conducted on each of the parts received from the operator.

The EQA test on the relays and relay sockets consisted of visual inspection and a functional test in accordance with the applicable Boeing specification or Specification Control Drawing (SCD). No anomalies were noted. Copies of the EQA test on the relays and relay sockets are provided with this letter as Enclosure 1.

BOEING

The EQA test on each of two circuit breakers, BACC18Z2 (S/N D/C8651) and BACC18Z7 (S/N D/C8613), consisted of visual inspection, functional test and overload calibration at 200% rated current in accordance with section 3.1 of BACC18Z Boeing Specification. Both circuit breakers met the specification, with no anomalies observed. Copies of the EQA test on these circuit breakers are provided with this letter as Enclosure 2.

Portions of the damaged wire bundle W1524 and four conductors unshielded and unjacketed wires identified by the airline operator as "A" and "B" were provided to the EQA for analysis. The EQA test on these wire samples consisted of visual inspection and photographs of the samples "as received".

Some of the wire samples were identified as BMS13-48 "Wire, Electric, Extruded Cross-Linked Ethylentetrafluoroethylene (ETFE) 600V (RMS) 150C. Four unshielded and unjacketed wire conductors identified as "A" and "B" did not have any part number identification or marking.

Following visual examination, the wire samples were provided to Boeing Analytical Engineering for evaluation. The results of the evaluation indicated that the insulation on the wires was charred adjacent to the melting. However, there was little damage, if any, beyond approximately 0.35 inches from the melted regions. Since the melting temperature of copper is 1084.5°C and the adjacent insulating materials are relatively unaffected, the source of the heating could not have been external. X-ray microanalysis and chemical identification of the damaged wire suggest that the insulation of the wire was damaged and that arcing had occurred between the damaged wires or that arcing between the damaged wires and ground had occurred. A copy of the EQA test report is provided with this letter as Enclosure 3. The Analytical Engineering metallurgical analysis is part of the EQA report.

We have reviewed and found no production drawing related to wire bundles W370, W834, W846, and W1524 where unshielded multi conductor cables (four conductor wires) were used on the subject 747-200 airplane. In addition, no production drawing or Boeing Process Specification requires approximately twelve inches of shield of the multiconductors shielded wire to be removed for exposure of the primary wire (shield is continuous in all cases). Copies of the revision history of the section of the Boeing BAC 5157 "Fabrication of Wire Bundle Assembly" that refer to shield termination and the maximum allowable unshielded distance between the shield termination and the splice are provided with this letter as Enclosure 6.

The following types of wires were used on the above wire bundles of the subject airplane:

BUNDLE	EDP CODE	WIRE MFG	TYPE	CLASS	SHIELD
W370-045	UA	BMS13-48	VIII	1	NO
	PA	BMS13-48	X	1	NO
	UB	BMS13-48	VIII	2	NO
	VF	BMS13-48	XII	1	YES
	VG	BMS13-48	XII	2	YES
W834-011	PK	BMS13-48	XI	I	NO
	UA	BMS13-48	VIII	I	NO
W846-008	UA	BMS13-48	VIII	1	NO
W1524-057	UA	BMS13-48	VIII	1	NO
	U4	BMS13-48	XII	4	YES
	VF	BMS13-48	XII	1	YES
W1524-067	UA	BMS13-48	VII	1	NO
	U4	BMS13-48	XII	4	YES
	VF	BMS13-48	XII	1	YES

BOEING

CONCLUSION:

It is postulated that mechanical or thermal damage was sustained by the primary wire conductor(s), which resulted in arcing after electrical power was applied (post 'C' check and during the functional test). Electrical arcing at shield termination on wire bundle W1524 is the likely source of the initial ignition.

Wire samples "A" and "B" received from the airline operator for evaluation were either four conductors unshielded or the shield has been removed and does not conform to the production configuration drawings or process.

We have reviewed and found no Boeing service bulletin which requires any modification to wire bundles W1524, W846, W834, and W370 on the subject airplane.

The information being forwarded to the FAA by or with this correspondence is for the exclusive purpose of support of applications for or amendments to Type Certificates, is considered proprietary to The Boeing Company, and is provided on a confidential basis.

The data provided should be returned to Boeing immediately following use by the FAA, including any copies thereof which the FAA may be required to make in the course of its review. Boeing does not authorize the FAA to retain any portion of the materials being supplied.

Very truly yours,

BOEING

K. B. Buchanan
Manager, Certification
Delivery & Fleet Support, B-T113
Everett: M/S 02-79, (206) 342-3810
Renton: M/S 9U-RL, (206) 237-0300

DH

Enclosures

AIRPLANE 30

- - Figure 1
- - Figure 2
- - Figure 3
- - Figure 4

- **Appendix 4 - Photographs of deposits on connector D295 and YDC cover plate**

- - Figure 1
- - Figures 2 and 3

- **Appendix 5 - Initial M-Cab plots**

- - Figure 1
- - Figure 2

- **Appendix 6 - Construction of connector D295**

- - Figure 1a and Figure 1b
- - Figure 2
- - Figure 3

- **Appendix 7 - Connector D295 pin to pin shunt analysis**

- **Appendix 8 - Final M-Cab plots**

- - Figure 1
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- - Figure 6
- - Figure 7

- **Appendix 9 - Aircraft manufacturer's Operational Bulletin**

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Registered Owner:	British Airways PLC
Operator:	British Airways PLC
Aircraft Type:	Boeing 737-236 Advanced
Nationality:	British
Registration:	G-BGJI
Place of Incident:	15 nm north-west of Bournemouth International Airport Latitude: 50° 55.72' North Longitude: 002° 12.55' East
Date and Time:	22 October 1995 at 1609 hrs All times in this report are UTC

Synopsis

The incident was notified promptly to the Air Accidents Investigation Branch (AAIB) by the operator and the investigation began that evening. The AAIB team comprised Mr D F King (Investigator-in-Charge), Mr P D Gilmartin (Operations), Mr C G Pollard (Engineering), Mr S W Moss (Engineering), Mr A N Cable (Engineering) Ms A Evans (Flight Recorders).

The crew reported at 1330 hrs at Gatwick to carry out a post-heavy maintenance check, test flight on the aircraft. The first officer (F/O) completed the external check, while the commander completed the 'Flight Deck Preparation' items of the aircraft checklist. A Standby (STBY) Rudder system check was carried out with no abnormalities noted and during taxi before take-off, the Yaw Damper indicator showed normal response to turns.

When the aircraft was in straight and level flight at FL200 with an indicated airspeed of 290 kt, Autopilot and Autothrottle engaged and Yaw Damper ON, the aircraft experienced roll/yaw oscillations. The Flight Data Recorder (FDR) showed that the Autopilot and Autothrottle were disengaged, and the commander reported that the Yaw Damper was switched OFF but the crew were unable to stop the oscillations. A MAYDAY call was broadcast at 1609 hrs. The crew had the impression that the bank angle would have continued to increase had opposite roll control inputs not been applied.

A descent was made to around FL75 and as the airspeed was allowed to reduce towards 250 kt the oscillations began to decay rapidly and stopped. The total duration of the roll/yaw event was about seven minutes.

A low speed handling check was carried out, and it was found that the aircraft handled well at a speed 150 kt, with Flap 15° selected and with the landing gear down. It was decided to return to London Gatwick Airport in this configuration, and the MAYDAY was downgraded to a PAN. The crew recovered the aircraft to Gatwick without further incident.

The investigation identified the following causal factors:

(i) Contamination of the connector on the Yaw Damper Coupler, in the Electronic and Equipment Bay, by an unidentified fluid had occurred at some time prior to the incident flight and compromised the function of its pin to pin insulation.

(ii) Sufficiently conductive contaminant paths between certain adjacent pins had affected the phase and magnitude of the signals transmitted to the Yaw Damper Actuator, thereby stimulating a forced Dutch Roll mode of the aircraft.

(iii) The location of the Electronic and Equipment (E&E) Bay, beneath the cabin floor in the area of the aircraft doors, galleys and toilets made it vulnerable to fluid ingress from a variety of sources.

(iv) The crew actions immediately following the onset of the Dutch Roll oscillations did not result in the disengagement of the malfunctioning Yaw Damper system.

Four safety recommendations were made.

1 Factual information

1.1 History of the flight

1.1.1 Pre-flight checks

The current carrying capacity of those paths and the voltages which had to be sustained at the pins were specific to the units of the system which were installed at the time of the incident. The tests done on the aircraft system to prove which stray connections were needed had shown that actuator solenoids, in particular, could vary considerably in their voltage and current demands for the 'held on' condition. The tests to see if it was possible to reproduce any 'hold on' condition were, therefore, conducted using the components fitted to the aircraft at the time of the incident.

When looking at the attempts to introduce the necessary stray connections into a representatively wired up connector, it was seen that none could be classified as successful, in the sense that the Yaw Damper system did not remain solidly engaged after being selected OFF, although some type of stray connection had clearly formed.

In summary, the experiments demonstrated that it might be possible to generate stray current paths capable of sustaining engagement of the Yaw Damper system when selected to OFF, but only in the presence of a high resistance in the engage switch earth path . Although the evidence was tenuous, the possibility that such a resistance was present during the incident flight cannot be discounted.

CLICK HERE TO RETURN TO INDEX

2.4 Possible sources of connector contamination

The nature of the deposits observed on the Yaw Damper Coupler connector pins appeared to be relatively long term, almost certainly pre-dating the P6 check activity. As such, it was highly unlikely that the investigation and testing would reveal a contamination source from that period and indeed none was found. The only evidence indicating a fluid path into the connector was the whitish dried deposit on the connector shell, suggesting a very particular localised drip (as opposed to a more general soaking of the unit). The tray in which the Yaw Damper Coupler was located bore no signs of any contamination although its mating connector did have some of the dried residue similar to that found on the Yaw Damper Coupler connector, indicating that the two were joined at the time of the contamination. The Technical Log entry in March 1995 indicating a leak in the toilet handbasin drain may be relevant, but for the same reasons discussed below, moisture should still have been prevented from contaminating the E1 rack.

Attempts to analytically determine the origin of the deposits were unsuccessful. The conclusion in §1.16.6 that electrolysis of a solution containing sodium chloride had definitely occurred, whilst demonstrating the passage of current, did not assist in identifying the contaminant since this is obviously such a common substance and could have come from almost any source.

The scenario connecting the incident to the connector contamination requires a further source of moisture nearer to the time of the incident to activate the electrical 'bridge' between the pins. Chemical analysis of the dried deposits did not point towards any particular source of fluid and, although some defects were found in the wet systems of the aircraft, these systems were essentially non-functional and drained during the incident flight. The weather was dry whilst the aircraft was outside the hangar preparing for the flight.

It would appear that for any fluid leak to drip onto the subject connector, it is necessary to penetrate the rubberised fabric shroud which is fitted above it. Once through this, it may drip onto the cooling plenum, whose forward lip coincides with the array of connectors at the back of each unit on the E1 rack, particularly the Yaw Damper Coupler which is at the top. The evidence of a dried fluid run on the upper and lower surfaces of the plenum was of interest because it did indeed correspond to the centreline of the Yaw Damper Coupler but there was no indication of a leak in the shroud at the location from where the run appeared to originate. Notwithstanding this, G-BGJI's operator has developed a modification which puts an aluminium tray between the plenum and the shroud which completely covers the forward face of the E1 rack thus preventing any fluid which penetrates the

shroud from dripping onto the connectors. A Boeing modification to achieve a similar standard of protection already existed but was not applicable to aircraft fitted with airstairs.

The E&E Bay Assessment Team were not specifically tasked with finding the cause of contamination which caused this incident but it formed part of their statistics and the operator of G-BGJI was one of the airlines whose procedures and aircraft were examined, after the operator had conducted their own internal checks. As mentioned in §1.16.8, the team generally found that occasional E&E Bay contamination was an accepted fact-of-life by many airlines This appeared to be the case at the operator's Gatwick facility, where the condition of aircraft after a few years service following a P6 check, both by physical examination and discussion with the technicians, was expected to show signs of the characteristic blue staining of toilet sanitising fluid under the floor area. G-BGJI's operator did not necessarily regard water/waste system components as 'on-condition' as they were generally overhauled or renewed at each P6 check, but this represents 5 years service of systems which are often troublesome and prone to abuse. This incident led the operator to review all aspects of E&E Bay protection and maintenance practices and it might be speculated that other airlines would be well advised to do the same rather than wait until they, too, have an in-flight incident. By its nature, a contamination event is unpredictable as is demonstrated by this incident. It is unlikely that anyone could have foreseen the dramatic effect that contamination of the connector had on the behaviour of the aircraft.

The following recommendations were made in January 1996:

It is recommended that the FAA :

1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

It is also recommended that the FAA and Boeing :

3) Conduct an urgent review of the measures incorporated into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary require modifications to ensure that the equipment, connectors and wiring are provided with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is accepted that the findings of the E&E Bay review team identified differing maintenance practices as being highly significant in determining the in-service condition of the E&E Bay and its associated avionics components, their connectors and wiring. However, the location of the bay, below the cabin floor in areas susceptible to fluid leaks from toilets, galleys and aircraft doors does make the bay unnecessarily vulnerable. Although the chances of fluid contamination directly affecting aircraft handling, as in this case, would appear to be a most unlikely outcome, the wetting of sensitive avionics equipment will undoubtedly lead to unserviceabilities. This will become of more significance as aircraft continue to develop an increased dependence on electronic equipment. The location of the E&E Bay was undoubtedly arrived at following a variety of design considerations but in modern aircraft is possibly based on historic precedent as much as current design constraints.

It is therefore further recommended that:

The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

The CAA with the FAA review FARs and JARs with a view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant on maintenance practices.

(Recommendation 97-61)

3 Conclusions

(a) Findings

1	The crew members were properly licensed, medically fit, adequately rested and technically qualified to conduct the test flight.
2	The aircraft was on a test flight before being returned to line service following a scheduled major (P6) service and was operating within the normal limits of weight and centre of gravity.
3	The aircraft was being operated within the normal flight envelope at the time of the incident, using the Autopilot and Autothrottle systems and with the Yaw Damper system engaged.
4	The aircraft entered a cyclic oscillation in roll and yaw which was consistent with a critically damped Dutch Roll motion and persisted for seven minutes. The aircraft type has natural positive damping of the Dutch Roll mode.
5	The crew's initial actions, as they recalled them, of disconnecting the Autopilot and Autothrottle, and switching OFF the Yaw Damper were in accordance with the manufacturer's recommended procedure.
6	The commander's decision to issue a MAYDAY call in response to the incident was appropriate.
7	The ATC response to the MAYDAY call was timely, helpful and appropriate.
	The crew's decision to conduct a low speed handling check to

8 determine a suitable configuration in which to carry out a landing demonstrated good airmanship.

9 The decision to maintain the Flap 15°, landing gear down configuration for the return to London Gatwick was judicious.

10 The decision to re-engage the Yaw Damper system during the final approach sequence was unwise, but the system was switched OFF once again prior to landing.

11 The main rudder PCU had been replaced but in all other respects the rudder/Yaw Damper system components were the same as those fitted prior to the check.

12 After the incident, all components (mechanical, electrical and electronic) capable of affecting rudder movement were tested and none was found to be significantly out of specification.

13 From the M-Cab simulator testing it was possible to conclude that shunt resistances, simulating the effect of fluid ingress, between combinations of pins in the Yaw Damper Coupler connector could cause an aircraft response similar to that experienced during the incident.

14 The Yaw Damper Coupler had not been overhauled during its life and had run 17 years and about 34,000 hours without any recorded defects.

15 Examination of the aircraft's Technical Log did not reveal entries related to Yaw Damper defects during the last two years.

16 No component defects were found in the Yaw Damper Coupler apart from those on the connector D295.

17 The portion of the connector D295 on the outside of the Yaw Damper Coupler enclosure had evidence of liquid spillage onto it.

18 Despite various attempts it was not possible to analyse the contaminant and hence identify its origin.

19 There was a considerable build up of products of corrosion and electrolysis between pins of the connector D295, within the Yaw Damper Coupler enclosure.

20 The nature of the deposits observed on the Yaw Damper Coupler connector pins appeared similar to those produced when attempting to create stray electrical paths.

21 The pins most affected by these deposits were related to the 28V dc power supply and the circuits involved in activation of the Yaw Damper system.

22 The scenario connecting the incident to the connector contamination, requires a further source of moisture nearer to the time of the incident to activate the electrical 'bridge' between the pins but no such source of moisture was identified.

23 The airframe wiring affecting the Yaw Damper circuits was found not to have any deficiencies.

24 Tests using a 'breakout fly-lead' confirmed theoretical analysis that it was possible to maintain engagement of the Yaw Damper system after it had been switched OFF by introducing stray connections between pins within the Yaw Damper Coupler connector (D295) but only if the engage switch OFF earth was high resistance or open circuit.

25 Experimentation demonstrated that possibilities existed to build the necessary stray connections to achieve continued Yaw Damper engagement after it had been selected OFF.

The experimentation demonstrated that it was very difficult to generate

26 robust stray connections between pins of connector D295 without causing more severe damage to the pins than had been observed on the unit involved in the incident.

27 None of the experimentally produced stray connections with appropriately damaged pins was sufficiently robust to sustain continuing Yaw Damper engagement after it had been selected OFF.

28 There was little chance of finding evidence that a source of moisture existed in the past, as the electronic units in the E&E Bay (including the Yaw Damper Coupler) were removed and the E&E Bay and structure immediately above it were cleaned or replaced during the P6 check.

29 Visual inspection of the structure was carried out and evidence from the technical records along with the recollections of the individuals involved indicated that the degree of corrosion found and rectified was typical of any aircraft on such a check and there were no indications of any abnormalities which may have indicated heavy fluid contamination.

30 The E&E Bay was vulnerable to fluid leaks because it housed the forward airstairs, was located immediately below the main entry vestibule and forward galley and just aft of the forward toilet.

31 Examination of the aircraft technical documents only revealed one entry relating to a fluid leak capable of affecting the E&E Bay, dated 5 March 1995, when a leak was traced to the forward toilet sink drain.

32 The E&E Bay Assessment Team's findings and recommendations were extensive and identified detailed improvements both to hardware and maintenance practices to maintain a desirable environment in the bay.

(b) Causal factors

The investigation identified the following causal factors:

1 Contamination of the connector on the Yaw Damper Coupler, in the E&E Bay, by an unidentified fluid had occurred at some time prior to the incident flight and compromised the function of its pin to pin insulation.

2 Sufficiently conductive contaminant paths between certain adjacent pins had affected the phase and magnitude of the signals transmitted to the Yaw Damper Actuator, thereby stimulating a forced Dutch Roll mode of the aircraft.

3 The location of the E&E Bay, beneath the cabin floor in the area of the aircraft doors, galleys and toilets made it vulnerable to fluid ingress from a variety of sources.

4 The crew actions immediately following the onset of the Dutch Roll oscillations did not result in the disengagement of the malfunctioning Yaw Damper system.

4 Safety recommendations

4.1 It is recommended that the FAA :

1) Require as soon as practical a visual inspection of all Boeing 737 aircraft Electrical and Equipment (E&E) Bays to check for fluid ingress into avionics components, their connectors and associated wiring. Such inspection should involve the minimum disturbance of equipment and connectors

commensurate with a thorough examination for contamination. Where such contamination is found, the component should be removed and despatched to workshops for examination.

2) Require as soon as practical an inspection of the area in and around the E&E Bay for evidence on the structure and fittings of recent fluid leakage such as wet corrosion, staining and crystallised deposits. Such evidence should be investigated to ensure that, where the source of the leak is not apparent or readily rectifiable, no potential exists for it to impinge upon the avionics components, their connectors or wiring.

(Recommendation 96-3)

4.2 It is recommended that the FAA and Boeing :

3) Conduct an urgent review of the measures incorporated into the Boeing 737 to prevent fluid ingress into the E&E Bay, its equipment, connectors and wiring and as necessary require modifications to ensure that the equipment, connectors and wiring are provided with protection consistent with reliable operation.

4) Conduct a review of the Aircraft Maintenance Manual to ensure that clear and specific instructions are contained therein to enable evidence of fluid ingress, even if not apparently directly impinging on electrical equipment, to be identified during routine maintenance. It should also be ascertained that any routine testing for leaks in the toilet, galley and airstairs systems should be done with the systems functioning fully throughout their normal operational cycle to ensure that any leaks which only occur during, for example, draining or replenishment cycles are detected.

(Recommendation 96-4)

It is further recommended that:

4.3 The Boeing Airplane Company promulgate the findings of the E&E Bay Assessment Team to all operators and that the recommendations be actioned through Service Bulletins to maximise the protection from fluid ingress of bay housed electronic components in current aircraft.

(Recommendation 97-60)

4.4 The CAA with the FAA review FARs and JARs with a view to requiring that the location of electronic equipment be arranged during the aircraft design so as to minimise the potential for contamination by fluid ingress, with the intention of ensuring that the equipment, connectors and wiring are provided with protection consistent with reliable operation less heavily dependant on maintenance practices.

(Recommendation 97-61)

D F King

Inspector of Air Accidents

Air Accidents Investigation Branch

Department of the Environment, Transport and the Regions

AIRPLANES 31&33

题目: Investigation Report of B-737

Title : and MD-11 on Fire

技术报告
TECHNICAL REPORT

编号: AMD FA 960003
No :

页数: 7
Page:

日期: 1996.05.24
Date:

项目负责人: Ma Xiaoming
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AIRCRAFT AIRWORTHINESS CENTRE

31,33

Investigation Report of B-737 and MD-11 on Fire

There were three times E/E bay or lower cargo on fire happening to the B-737 and MD-11 of China during 1994-1995. For these incidents, the Airworthiness Department, Maintenance Department and Airlines gave emphasis to them. In order to analyze the cause of fire, the Airworthiness Department required the personnel of the Aeronautical Materials Failure Analysis to investigate these incidents. the following is our results and recommendations.

The Courses of The Incidents

1. On October 10, 1994, Flight No. [redacted] (Boeing 737-300) landed in the Beijing. After the landing, the ground crews went aboard for maintenance and smelt that something must have been scorched in the cabin. After opened the E/E bay, they found the insulation blanket under the rack E2 in the E/E bay on fire.

The airplane's dilivered date: January 29, 1993. The dilivered serial number: [redacted]. It had counted total 4661 FH, 2287 cycles. In this period, there were no major repair and rebuilt in the E/E bay, they didn't replace the insulation blanket.

According to the analysis of the AMECO, the cause of fire is the inproper installation of the W2132 wire bundle clamp. It made the contact of the metal clamp and wires. Because of the long-time vibration, the wires were worn out and happened the short circuit. this shorted circuit sparkles and its heat made the insulation blanket on fire.

It is estimated that the loss of this incident was approximately 500,000 US$. (Detailed in the report of the AMECO 94.10.21 2-94-87)

2.On the November 13, 1995, during the "C" inspection on the 737-300 B-[redacted] [redacted] Airlines, performed at the AMECO, the personnel of maintenance found that the floor nut bolt of the left-rear access cargo door was separated. When they removed the nut bolt by air drill, the film on the

insulation blanket under the floor was on fire, resulted in a scorched hole 18X40 inches.

The airplane's dilivered date: June 1, 1992. The dilivered serial number: [redacted]

According to the analysis of the AMECO, the cause of fire on the film was the chips caused by the air drill.
(Detailed in the table GA02, AMECO. 9602)

3. On the September 6,1995, Flight No. [redacted], MD-11[redacted] when the flight crews were ready to start the engine at the Capital Airport, they found a large amount of fog within the E/E bay. After inspection, they noticed the E/E bay on fire.

According to the analysis of the [redacted] Airlines, the cause of this incident was as follows: Because the wire bundles under the front rack didn't lay in the wire clamp, with the long-time vibration, the wires were worn out and led to the short circuit, consequently the 11 wires of the bundles were separated by fire and the melted metal dropping made it on fire the insulation blanket at the outboard of the fuselage skin under the E/E bay. The burning areas of the insulation blanket were as follows:

From right to left: The burning areas from the area under the rack to the area under the auxiliary rack and the nearby bottle of oxygen for the flight crews.

From front to back: The burning areas from the back edge of the E/E bay door under the fuselage to the ahead of the main rack.

The airplane's dilivered date: May 1,1992. Dilivered serial number[redacted]

The Research of the Fire Retardant for the Insulation Blanket

Because the cause of fire during all these incidents was led by the insulation blanket ignited, it was much necessary for us to carry out the research for its fire retardant. The equipment for test was the model HVFAA-Horizontal FAA Flame Chamber, and the tests were performed at the Test Centre of CAAC and the Test Centre of the AMECO. The Boeing's insulation blanket part number : 65-45241-1455.

When we placed a piece of the centre material of the insulation blanket on the ground, and ignited a corner by a igniter, the material was consumed by the flame rapidly. Figure 1. 2. 3. was respectively showed the burning course of the same sample at one time.

According to the covering side character of the insulation blanket manufacturer, the covering side was consisted of four-layer-film and was sewed by the thread, as showed in figure 4. To perform the vertical burning test, we placed the covering side in the centre area of the flame, it was evidenced that the covering side was not fire retardant. Because the thread was held the film at its position, the flame would spread rapidly once the thread was ignited, as figure 5. 6. 7..

The sample was cut from the centre area of the insulation blanket for the horizontal burning test. Sometimes the film below the blanket was continued to be burned till all the film was burned up. Detailed in the test report and the on-site video of the test.

As stated above, it was considered that the film of the insulation blanket was fire flammable and didn't meet the requirements of the section 853(b) FAR -25 with that kind of sewing.

The Requirements of FAR -25

The sections in the FAR -25 for the cargo and passenger compartment are 25.853, 25.855, 25.857.

It is specified in the section I of the appendix F, FAR -25 :" The materials for the insulation blanket (including covering materials) in the each cargo and passenger baggage compartment of the no passenger or flight crews must at least meet the requirements of 25.853 (b)."

According to the section (b) in the part I of the appendix F, it is specified: " The sample can be cut from the any area of the item."

Conclusion

The covering material of Boeing 737-300 airplane's insulation blanket was fire flammable. After the insulation blanket was made by sewing, the covering at

the edge of the blanket consists of four layers and made steadly by thread, this kind of sewing was easy to be burned. In the meanwhile, the edges of these insulation blanket were mainly located at the frame of the fuselage, and made its ignited possibility by the sparkles of the short circuit and the heat generated during the maintenance work to be increased. It was a potential danger for the safety of the aircraft.

Recommendation

Because it requires that the material of the passenger compartment and cargo would be self-extinguishing in the amendment 25-15 of the FAR-25 (valified from the October 24, 1967). We advise as follows:

1. The Boeing. MD Company should be noted that the insulation blanket installed in the Boeing 737-300, MD-11 airplanes is fire flammable. They should make a prompt and positive response.

2. Submit this report to the FAA and wait for the FAA's explanation.

3. For the new purchased airplanes, we should add the burning test inspection for the insulation blanket and determine its fire retardant.

AIRPLANE 32

Accident to RAF Nimrod XW 666 in the Moray Firth, Scotland, on 16 May 1995

On 16 May 1995, Nimrod R1 XW666 of 51 Squadron took off from RAF Kinloss to conduct a post major inspection air test. The crew of seven, comprised of two pilots, one air engineer (Air Eng), a navigator, who occupied their normal seats on the flight deck, and three sensor operators, Aux. A, B and C. The crew brief, pre-start and start procedures were all reported as being unremarkable and the aircraft commenced the test schedule with a rated full power take-off, during which all engine parameters were reported as normal. The aircraft proceeded through the briefed flight profile until, when level at FL150, an instrument comparison check was carried out followed by initiation of the engine and airframe anti-icing system checks. At about this time the flight crew noticed the Air Start Valve (ASV) warning light flash, then illuminate steadily. At the captain's request, the Air Eng. read the advice contained in the Air Crew Manual (ACM) on ASV illumination in flight but, later, could not recall if first he turned off the engine anti-ice valve switches. In accordance with the advice in the ACM, the Air Eng was about to remove the ASV light fuse when the No 4 engine zone 1 fire warning initiated. A short time later the flight crew reported feeling a shudder through the controls and hearing an explosion. The co-pilot and Air Eng. immediately actioned from memory the appropriate drill, including firing the first extinguisher shot and shutting down the engine; and whilst the subsequent actions were being carried out from the FRCS, the fire warning for engine No 4 zone 2 initiated. The first extinguisher shot for this zone was fired. A short while later, the fire warning for engine No 3 zone 2 initiated and a further fire drill was carried out.

After subsequent actions were completed the fire was on-going, so the second shot was fired into both zones in accordance with the FRCS, although by this time all available fire extinguishers had been used. Over this period, both these engines were shut down. When the first fire warning occurred the Captain positioned the aircraft for an immediate recovery to Kinloss and commenced a descent as quickly as practicable but, on realising that the fire warnings were real and not spurious, elected to head for Lossiemouth which, at a range of 3.5 miles, was closer. The Aux A crew member, having heard the fire warning, unstrapped and temporarily moved to the right overwing escape hatch position in order to pass reports to the crew on the condition of the wing. His detailed and graphic reports on the extent and severity of the fire, and the fact that the crew had felt and heard what they

interpreted to be at least one loud explosion, led the Captain to decide to carry out a pre-meditated ditching. Ditching drills were performed and, at low level with the speed reducing to 130 kts, he called for 20° of flap to be lowered. This was not obtained, due to a failure of the Green hydraulic system, but mindful that the integrity of the aircraft structure would probably not exist for much longer he continued with the ditching in the clean configuration. The aircraft touched the water in a controlled wings level attitude, but it skipped before slewing to the left and coming to rest. At the time the wind was light and the sea surface calm. Despite a major failure of the fuselage towards the rear of the wing, which was largely undamaged in the ditching, the aircraft remained afloat for approximately 15 minutes. During this time the crew, who received relatively minor injuries, were able to make their escape into a dingy deployed from the port forward overwing hatch and from which they were rescued by helicopter. Elapsed time from ASV light illumination to ditching was estimated at 5.5 minutes.

The investigation into this accident concluded that the fire resulted from a breach of a wing fuel tank adjacent to the No 4 engine, which allowed fuel to spill into the engine bay. It was determined that this breach had been caused by the impact of the turbine wheel, rotating at high speed, from the ASM after an uncommanded electrical signal to the ASV had caused it to run to an overspeed. A latent defect within the ASM under these circumstances allowed the release of the wheel, which then machined its way through the firewall and into the sidewall of the tank.

A high proportion of the time spent inspecting the wreckage was expended on the No 4 engine starting control system. Essentially, it was necessary for a 28v DC supply to have been connected to the input side of the solenoid in the ASV for it to open, although the solenoid was capable of operating at lower voltages. Reports from the flight deck crew, the correct post-accident positions of the air assist/windmill and standby engine start switches, and their assessed pre-accident serviceable condition, precluded the possibility that a supply to the ASV solenoid occurred through normal routes. Additionally, from the cockpit to the No 4 engine bay the examination of all available wires and their terminations (outside of the fire affected areas), diodes, relays, fuses and circuit breakers failed to produce any evidence of pre-existing shorting, heat damage or mechanical defects. Aftwards, from the forward firewall in No 4 engine bay, all wires, plugs and sockets had been damaged to a greater or lesser extent by the airborne fire, and impact with the water had torn away sections of the wiring looms. Thus a complete examination of the ASV control system could not be carried out. However, the most significant missing section was the forward part of the No 1 DC loom on the engine, which

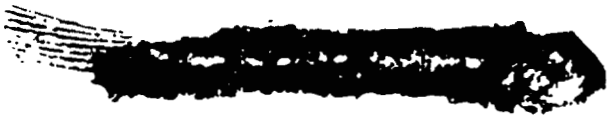
on some other engines, exhibited evidence of loom chafing. This loom was comprised of some 16 wires tied together at regular intervals and clipped to the engine caseing. They did not not run in a conduit and were not wrapped. Throughout the examination of this system on XW666 the only area which gave rise for concern was at the damaged end of the aft section of the loom, where the characteristics of some of the wire ends indicated that an electrical arcing/heating event had taken place. The fact that the particular wires affected were only associated with the ASV solenoid supply and earth, and the anti-icing valve supply and earth wires, lent weight to this concern.

At the time the ASV light came on there were thought to be, at least, three wires carrying 28v DC in the loom: two to the anti-ice valves and one to the pressure switch in the ASV. The fact that the ASV light came on steadily in the cockpit for a period of time, and the condition of this wire at the loom failure position, suggested that this wire was probably unaffected by the high temperature event in the loom, at least initially. The fuse supplying power to this light was found blown. Two of the three wires associated with the anti-ice valves terminated in solidified globules of copper, strongly indicative that they had both been live at the time of failure. The third wire termination was not globular, its surface finish and shape indicating that it had been contained within its core insulation at the time it re-solidified, suggesting perhaps it had not arced but that it had been close to a high temperature event. It was considered possible that this wire was a more extreme example of the earth wire from the ASV solenoid. Several of these wire ends, which had retained sections of their core insulation close to the molten copper areas, were uncharacteristic of other sections of the same loom which had been exposed to the fire and the effects of water pressure. The whole localised nature of the 'high temperature' area of this loom, together with other wires in the loom at this location having retained their outer insulation very close to the affected area, suggested that the 'high temperature' event had not been precipitated by insulation degradation resulting from the fire. Also, the condition of the adjacent engine casing, and the loom immediately aft of the failure section, suggested that the fire in this region had not been particularly intense. One wire had not failed, but contained a melted, and re-solidified section approximately 1 inch in length, indicative that an arc had tracked along this wire from one adjacent. Photographs of these wires are attached to this report.

The investigation into this accident concluded that " the prime cause of the loss of this aircraft was the uncommanded opening of the No 4 engine ASV whilst in flight. compounded by a latent defect within the ASM. This resulted in the release

of the ASM turbine whilst rotating at high speed and the subsequent puncture of the No 2 fuel tank, a large unstoppable fuel leak and serious fire. The balance of evidence suggested that a defect existed within the No 1 DC loom on the No 4 engine, which resulted in shorting and/or arcing between conductors, which in turn allowed stray voltage onto the supply wire to the ASV solenoid".

1



2

3 These wires associated with the Anti-ice valves

Note molten ends, fused strands and core insulation upto molten areas

4

Earth wire from ASV solenoid

Wire End Details from No 1 DC Loom

AIRPLANE 34

No	Occ	Phs	Subj	Mod	Pers	
1	171	520	Fire		Takeoff	
		C	14400	1224		Exhaust system <> Fractured
		C	12013	1121		Electrical system,electric wiring <> Deteriorated

****

Type Make/ Status	Date	NTSB ID No. / Reg. No. / Docket No.	City, State: / Airport Proximity / Airport Name (Ident.)	Aircraft
Model/Damage	of Operation	Operator/	Injuries D. B. A.	F S M N
Public	08/13/94	LAX94FA323	PEARBLOSSOM ,CA:	LOCKHEED
C-130A	137 Public	JAMES A.	3 0 0 0	
ACC		N135FF/		

Destroyed use VENABLE / HEMET
2073

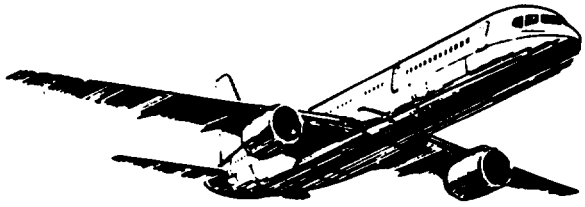
VALLEY FLYING

SERVICE

WITNESSES SAW THE AIRCRAFT IN LEVEL FLIGHT AND OBSERVED A BRIGHT ORANGE FLASH NEAR THE WING ROOT. THE FIRST FLASH WAS FOLLOWED ABOUT 1 SECOND LATER BY A MUCH LARGER DARK ORANGE FIREBALL AND BLACK SMOKE. THE RIGHT MAIN WING THEN SEPARATED FROM THE AIRCRAFT. THE WRECKAGE WAS DISTRIBUTED OVER 1 MILE IN MOUNTAINOUS TERRAIN. UNBURNED CENTER WING BOX SKIN, FOAM INSULATION PIECES, AND AUX TANK FRAGMENTS (ALL FROM THE AREA WHERE THE FIRST FLASH WAS OBSERVED BY THE WITNESSES) WERE THE FIRST DEBRIS FOUND IN THE WRECKAGE DISTRIBUTION PATH. THE DRY BAY AREA OF THE RIGHT WING CONTAINS HIGH PRESSURE FUEL LINES, UNSHIELDED AND EXPOSED ELECTRICAL WIRING, AND IS IN CLOSE PROXIMITY TO THE NO. 3 ENGINE. THE MAIN FUEL TANK IS LOCATED OUTBOARD OF THE DRY BAY. NO LIGHTNING ACTIVITY WAS REPORTED IN THE VICINITY OF THE AIRCRAFT. C-130 AIRCRAFT HAVE A HISTORY OF FUEL LEAKS IN THE DRY BAY. THE SOURCE OF THE LEAKS, FLATTENED OR PINCHED O-RINGS, ARE ON-CONDITION REPLACEMENT ITEMS. THE AIRCRAFT WAS IN LONG TERM STORAGE IN THE DESERT FOR 2 YEARS PRIOR TO ACQUISITION BY THE OPERATOR FOR FIRE TANKER DUTIES. U.S. AIR FORCE EMERGENCY PROCEDURES WARN OF FUEL LEAKS IN THIS AREA AND REQUIRE INSPECTIONS PRIOR TO EACH FLIGHT.

No	Occ	Phs	Subj	Mod	Pers	
1	170	540	Fire/explosion		Cruise	
		C	15100	1154		Fuel system <> Leak
		C	12013	1101		Electrical system,electric wiring <> Arcing
		C	16902	1169		Powerplant <> Other
		C	17001	1132		Fluid,fuel <> Exploded
2	130	540	Airframe/component/system failure/malfunction		Cruise	
			15101	1132		Fuel system,tank <> Exploded
			19100	1180		Wing <> Separation

AIRPLANE 35



BOEING 757

ALERT

SERVICE BULLETIN

SUMMARY

BOEING COMMERCIAL AIRPLANE COMPANY P.O. BOX 3707 SEATTLE, WASHINGTON 98124

SUBJECT: ELECTRICAL POWER - GENERAL - WIRE BUNDLE ROUTING MODIFICATION

ATA: 2400 **NO:** 757-24A0025

DATE: May 10, 1985

BACKGROUND

The modification described in this service bulletin eliminates a wire bundle routing/wire insulation problem in the forward lavatory drain area that poses a potential fire hazard.

One 757 operator reported an in-flight loss of electrical power on one airplane when both engine generators tripped off. The right-hand generator was successfully reset; but the left-hand generator tripped again after a reset attempt and smoke temporarily appeared in the passenger cabin. The flight was diverted to an alternate airport.

Subsequent investigations have shown that the following conditions led to the loss of electrical power:

1. A coupling on the forward lavatory drain line leaked fluid.

2. The fluid dripped onto wire bundles routed beneath the drain line.

3. One of the fluid contaminated wire bundles contained wires that had damaged insulation.

The presence of fluid on the wires with damaged insulation created a conductive path between two of these wires in wire bundle W4508 that resulted in phase-to-phase arcing. The two wires are powered from the three-phase 115V AC left main bus. Arcing between these two wires resulted in burn damage to eight of the nine wires in bundles W4508 and W2608 routed in the drain coupling area, and also caused the left-hand generator to trip. A bus tie switch was cycled to allow the right-hand generator to provide power to the left bus, but this action also caused the right-hand generator to trip.

Boeing has determined that wire insulation damage, which was limited to BMS 13-51 AWG 10 wires installed on airplanes prior to line number 46, occurred when the wires were passed through a misaligned wire stamping machine to receive their code numbers.

Accomplishment of this service bulletin reroutes all wire bundles away from the forward lavatory drain line and, in addition, replaces all potentially damaged BMS 13-51 AWG 10 wiring routed in areas where conductive fluids may be present.

ACTION

In the main equipment center, reroute wire bundles W2604, W2608, W4508, and, for Group 2 airplanes only, wire bundle W4242. In addition, on Group 1 and 2 airplanes NA002-NA021, NA191, NA401-NA403, NA501-NA504 and NB001-NB002 only, replace three wires in wire bundle W4508.

EFFECTIVITY

Group 1 Airplanes:

BAB (BRITISH AIRWAYS)
NA201-NA204, NA206-NA213, NA215-NA217
EAL (EASTERN AIR LINES)
NA002-NA021
INT (AIR EUROPE)
NA205, NA214
LTS (LUFTTRANSPORT SUED)
NA191-NA192
MON (MONARCH)
NA401-NA403

Group 2 Airplanes:

DAL (DELTA AIR LINES)
NA501-NA506
NWA (NORTHWEST)
NC001-NC002
SIA (SINGAPORE AIRLINES)
NB001-NB004

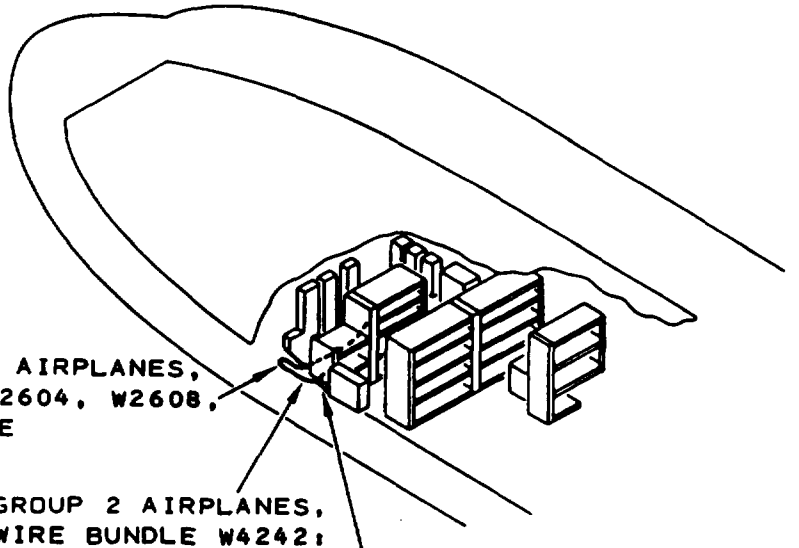
MANPOWER

	Total Man-Hours	Elapsed Time (Hours)
Group 1 Airplanes: Wire Bundle Reroute	20	10
Group 2 Airplanes: Wire Bundle Reroute	24	12
Replacement of AWG 10 Wire (a)	6	3

(a) Applicable to airplanes NA002-NA021, NA191, NA401-NA403, NA501-NA504, NB001-NB002

MATERIAL INFORMATION

Operator-furnished parts



Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

NOT ATTRIBUTED TO A SINGLE AIRPLANE

19 May 1998
B-B600-16409-ASI

Mr. R. Swaim, AS-40
National Transportation Safety Board
490 L'Enfant Plaza East, SW
Washington DC 20594-2000

BOEING

Subject: Scrapped Airplane Wire Bundle Clamp Analysis, TWA 747-100 N93119 Accident off Long Island, NY - 17 July 1996

Reference: (a) Analytical Engineering Report, Item No Chem 6883, dated 1 May 1998
(b) Letter B-B600-16399-ASI, dated 28 April 1998

Dear Mr. Swaim:

During a visit to Marana, Arizona to inspect scrapped 747 airplane wiring, several connectors and clamps were removed and taken to Boeing for laboratory analysis. The reference (b) letter forwarded the laboratory report of our analysis of the connectors and advised that examination results of the clamps would be provided later.

Examination of the wire bundle clamps is now complete. Enclosed is the reference (a) report detailing the laboratory findings following examination of the clamps. The clamps are also enclosed with this letter.

If you have any questions, please do not hesitate to call.

Very truly yours,

5 photographs were not of sufficient quality for copying. R Swaim

for John W. Purvis
Director, Air Safety Investigation
Org. B-B600, M/S 67-PR
Telex 32-9430, STA DIR PURVIS
Phone (425) 237-8525
Fax (425) 237-8188

Enclosure: As Noted

cc: Mr. A. Dickinson, IIC (w/o enclosure)

NO SINGLE AIRPLANE

ANALYTICAL ENGINEERING REPORT

[redacted]

NO.: 9-5576-WP-98-124

ITEM NO.: Chem 6883

DATE: May 1, 1998

MODEL: BCAG

GROUP INDEX: 9-5576 - Analytical Engineering, Chemical/Physical

SUBJECT: Analysis of BACC10DS Wire Bundle Raceway Clamps

BACKGROUND

Three wire bundle raceway clamps that had been removed from an older 747-100 were submitted for analysis of their foam pads. The foam pads on two of the clamps had deteriorated, while the pad on the third had not. The pad which did not exhibit deterioration was yellow in color, and the part was stamped "UMP CO S296-10." The same part marking was present on the part with the most extensively degraded foam pad, which was black in color. The pad on the third clamp, orange in color, had also experienced a good deal of deterioration. That clamp was marked "H K WILSON CO, SEATTLE WASH P/N 6004-1." Exposure to fluid or overheating were suspected possible causes of the damage to the foam, which is specified in BACC10DS to be a modified closed-cell silicone foam rubber per BMS 1-68. Determination of the cause of deterioration of the foam was requested.

EXPERIMENTATION AND RESULTS

Optical inspection revealed that the non-degraded yellow pad consisted of an open-cell foam material. The remains of the degraded black and yellow pads appeared to have originally consisted of solid blocks of material rather than open-cell foam. Both degraded pads were partially liquid in character.

Samplings of the foam pads were analyzed by infrared microspectroscopy, yielding the spectra in Figure 1. Figure 1A reveals that the yellow foam consists of a urethane polymer that was synthesized from a polyether pre-polymer. Urethane foams of this type are known to exhibit good chemical stability and resistance to hydrolysis under humid conditions. The spectra of the degraded black and orange pads (1B and 1C) are typical of urethane foams synthesized from polyester pre-polymer. Urethanes of this type have poor resistance to environment in that the ester linkage is subject to hydrolysis. The hydrolysis process is often termed "reversion" due to the fact that such products eventually return to a liquid state. The rate of hydrolysis is a function of the temperature and humidity to which the material is exposed. No liquid contaminants were indicated by the spectra. Reference spectra are included in Figure 2 for comparison. The polyether urethane foam is recommended for this application rather than the polyester urethane, but consideration should be given to the requirement of BACC10DS that calls for a silicone product.

Prepared by D. Bruce Skoropinski

D. B. Skoropinski
M/S 73-09, 234-2666

Approved by D. Bruce Skoropinski
for

W. L. Plagemann
M/S 73-09, 234-3025

NO SINGLE AIRPLANE

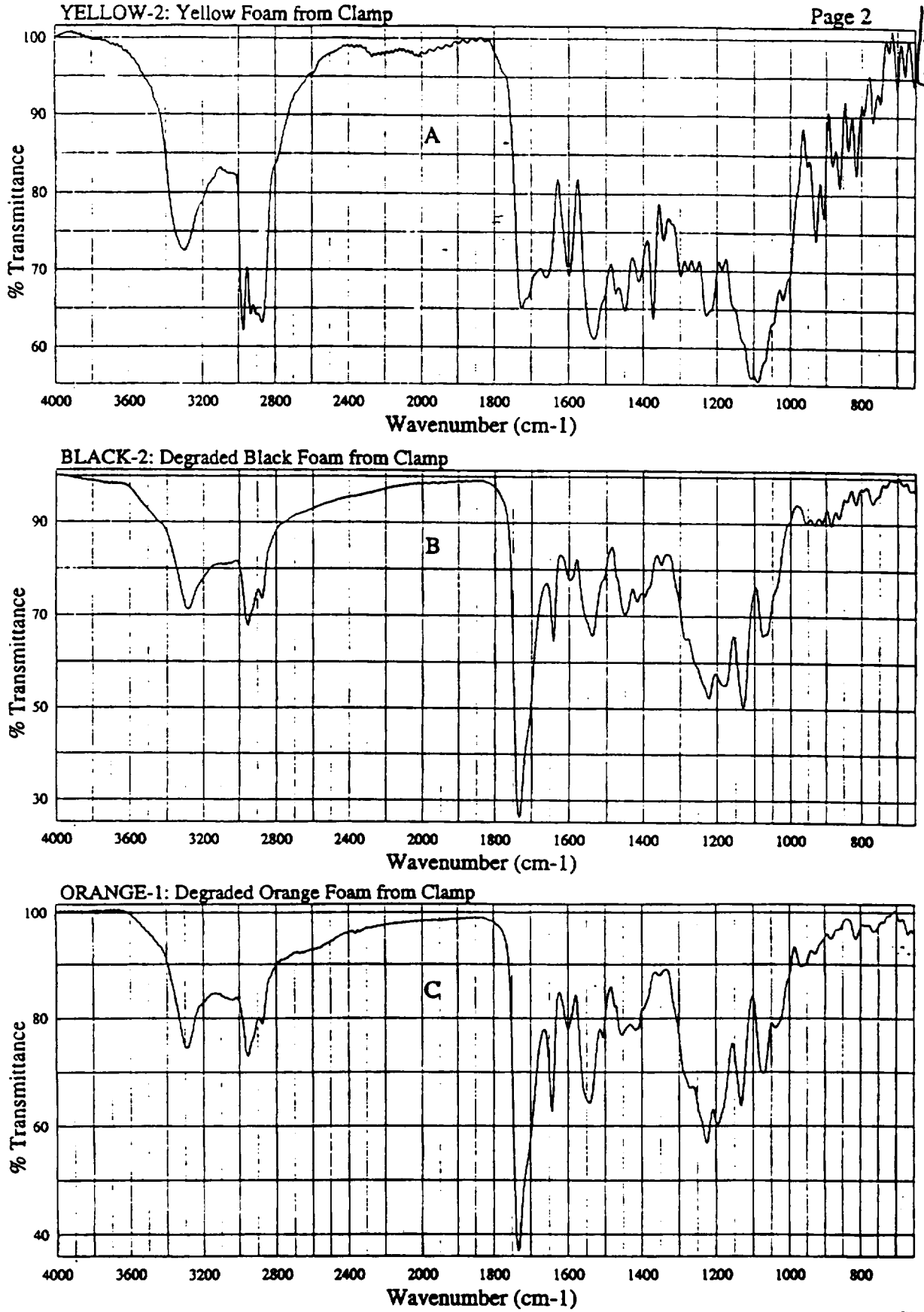


Figure 1. Infrared spectra of (A) the non-deteriorated yellow foam, (B) the degraded black pad and (C) the degraded orange pad. The absorption near 1540 wavenumbers in each of the three spectra is characteristic of polyurethane. The strong band near 1100 wavenumbers in (A), which is absent in (B) and (C), is due to the ether linkage in the yellow foam.

NO SINGLE AIRPLANE

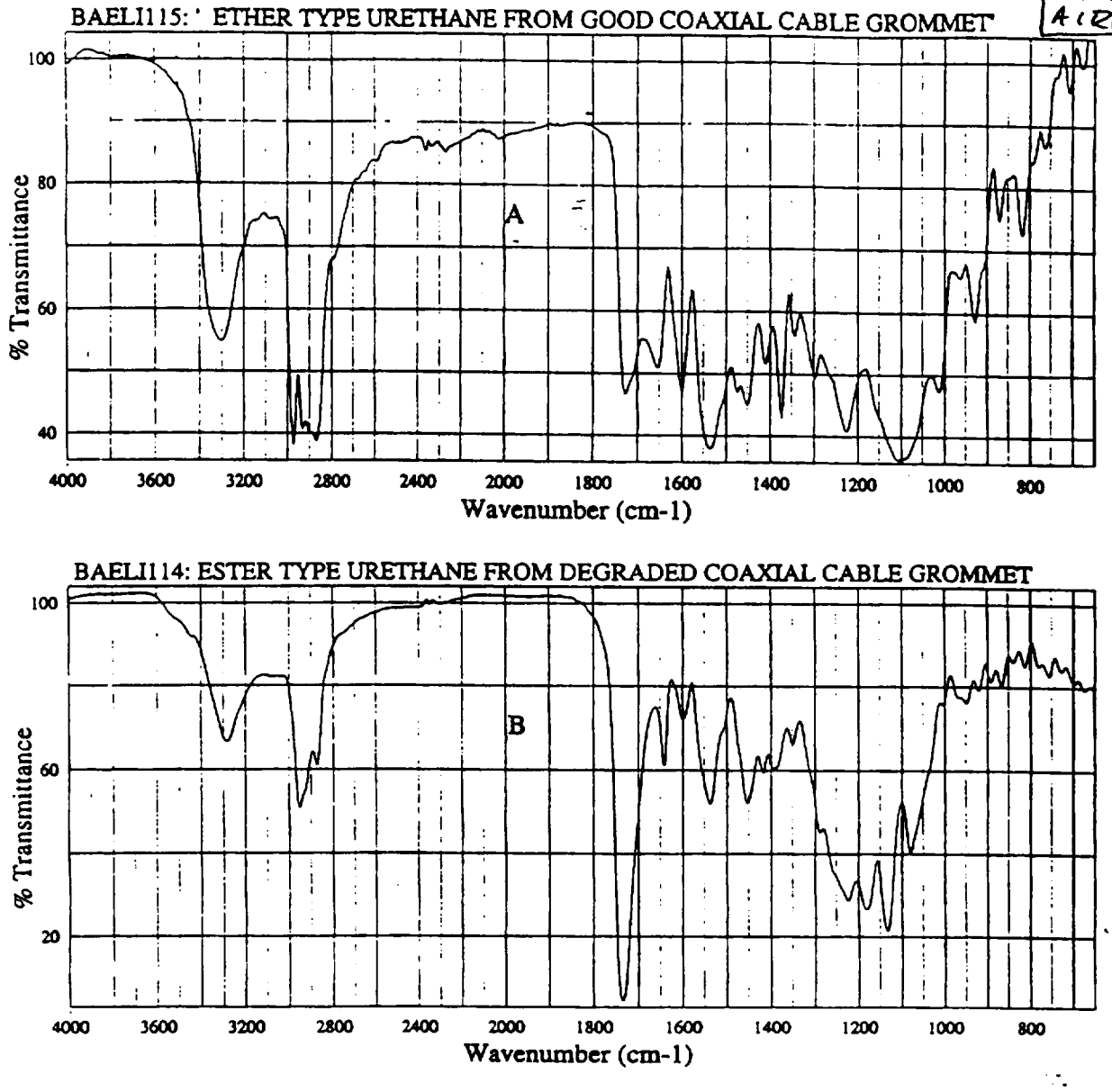


Figure 2. Infrared reference spectra of (A) a polyether urethane and (B) a polyester urethane.

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:CIRCUIT KEYWORD 2:CIRCUITRY KEYWORD 3:BREAKER

Log Number 7-RE-0021

Issue Date 1/12/67 HARRISBURG PA 29-Nov-66

OUR INVESTIGATION OF AN ACCIDENT INVOLVING AN ALLEGHENY AIRLINES CONVAIR 340 TYPE AIRCRAFT, N3414, DISCLOSED SEVERAL CONDITIONS THAT WE CONSIDER HAZARDOUS TO FLIGHT. A NEARLY TOTAL FAILURE OF THE AIRCRAFT ELECTRICAL SYSTEM OCCURRED DURING THE TAKEOFF RUN OF ALLEGHENY FLIGHT 305 AT HARRISBURG, PENNSYLVANIA, ON NOVEMBER 29, 1966. THE TAKEOFF WAS ABORTED AND WHEEL BRAKING APPLIED. THE ENGINE THROTTLES WERE PLACED IN THE REVERSE THRUST POSITION, BUT BECAUSE OF THE ELECTRICAL FAILURE THE PROPELLERS DID NOT MOVE TO A NEGATIVE PITCH WHICH RESULTED IN THE REAPPLICATION OF FORWARD THRUST. THE AIRCRAFT RAN OFF THE END OF THE RUNWAY AND STRUCK AN APPROACH LIGHT STANCHION WHICH TORE AWAY A SECTION OF THE LEFT WING. THE AIRCRAFT CAME TO REST NEAR THE BOTTOM OF A HILL BEYOND THE END OF RUNWAY 26, THE NOSE WHEEL COLLAPSED AND THE OUTBOARD FUEL TANK IN THE LEFT WINGWAS SLIGHTLY DAMAGED BUT RETAINED ITS FUEL.

Recommendation # A-67-003

Overall Status CAA **Priority**

CLOSED - ACCEPTABLE ACTION

IT IS RECOMMENDED THAT ALL USERS OF CONVAIR 340, 440 AND 580 MODELS BE ALERTED TO THIS VARIATION IN ELECTRICAL COCKPIT HEATERS, THAT THE TERMINALS BE PROMINENTLY IDENTIFIED AND MANUAL INSTRUCTIONS CITE THE DIFFERENT TERMINAL CONFIGURATIONS WITH APPROPRIATE INSTALLATION INSTRUCTIONS. IT IS RECOMMENDED THAT THE CONVAIR 340, 440 AND 580 AIRCRAFT HEATER CIRCUITS BE MODIFIED TO PROVIDE CIRCUIT PROTECTION THAT WILL OPEN UNDER THE MOST ADVERSE FAULT CONDITION BEFORE THE FEEDER LIMITER OPENS. DURING THE INVESTIGATION, TWO MAINTENANCE ITEMS WERE NOTED WHICH WE BELIEVE ARE WORTHY OF YOUR ATTENTION. WHILE EXAMINING THE AIRCRAFT, LOOSE NUTS, SCREWS, DRILL SHAVINGS AND TRASH WERE FOUND INSIDE OF THE CIRCUIT BREAKER PANEL COMPARTMENT. ALSO, IT WAS REVEALED THAT NO FUNCTIONAL TESTS WERE PERFORMED ON THE HEATER AFTER ITS INSTALLATION BEFORE RELEASING THE AIRCRAFT FOR PASSENGER SERVICE.

FAA	CLOSED - ACCEPTABLE ACTION	1/1/75

2/2/67 Addressee ALLEGHENY AIRLINES HAS ISSUED FLIGHT CAMPAIGN DIRECTIVE NO. 66-103 WHICH REQUIRES THE FOLLOWING: 1. INSPECT ALL AIRCRAFT FOR PROPER HEATER INSTALLATION. REPLACE AND DESTROY ALL NONSTANDARD HEATERS. 2. CHECK HEATER CIRCUIT BREAKERS FOR PROPER RATING. 3. CHECK HEATER WIRING FOR CONFORMANCE TO HEATER WIRING DIAGRAMS. 4. WHENEVER A HEATER IS REPLACED, THE STRUT SWITCH IS TO BE BYPASSED AND THE WIRING STUDS CHECKED FOR PROPER POLARITY. (A FULL FUNCTIONAL CHECK CANNOT BE CONDUCTED DUE TO LACK OF RAM AIR). THE FEDERAL AVIATION AGENCY IS IN THE PROCESS OF ISSUING AN ALERT BULLETIN WHICH INSTRUCTS FIELD INSPECTORS TO ALERT ALL OPERATORS OF CV-340, 440 AND580 MODEL AIRCRAFT TO THE POSSIBILITY OF IMPROPER HEATER INSTALLATION AND TO ASCERTAIN THAT MAINTENANCE MANUALS CONTAIN ADEQUATE INSTRUCTIONS CONCERNING HEATER REPLACEMENTS. MANUFACTURING DATA CALL FOR THE IDENTIFICATION OF POWER TERMINALS. AN FAA ENGINEERING REVIEW IS BEING MADE OF THE ELECTRICAL SYSTEM ON THESE AIRCRAFT TO DETERMINE THE NEED FOR MODIFICATION OF THE CIRCUIT PROTECTIVE DEVICES. TO PRECLUDE ACCUMULATION OF TRASH AND UNWANTED ITEMS IN THE CIRCUIT BREAKER PANEL COMPARTMENT, ALLEGHENY AIRLINES IS IN THE PROCESS OF ISSUING AN INSPECTION CARD CALLING FOR VACUUMING THIS COMPARTMENT EACH 300 HOURS.

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1265

Issue Date **8/26/81** IOWA CITY IA 02-Sep-80

ON SEPTEMBER 2, 1980, AN ISRAEL AIRCRAFT INDUSTRIES MODEL 1124 EXPERIENCED A CABIN FIRE WHILE CRUISING AT 35,000 FEET NEAR IOWA CITY, IOWA. MOST OF THE PILOT'S INSTRUMENTS FAILED; THE PILOT'S INSTRUMENT LIGHTS WENT OUT; THE COMPUTER FOR THE LEFT ENGINE FUEL CONTROL BECAME INOPERATIVE; AND CONTROL OF SEVERAL OTHER SYSTEMS WAS LOST. WARNING LIGHTS DID NOT COME ON, AND NO CIRCUIT BREAKER OPENED. THE FIRE WAS EXTINGUISHED BUT REIGNITED TWICE DURING THE DESCENT AND LANDING. BECAUSE FUEL COULD NOT BE DUMPED, AN OVERWEIGHT (21,000 POUNDS) NIGHT, EMERGENCY LANDING WAS ACCOMPLISHED. LANDING FLAPS AND THRUST REVERSING WERE UNAVAILABLE, THE ANTISKID WAS INOPERATIVE, AND BECAUSE HEAVY BRAKING WAS USED, THE BRAKES CAUGHT FIRE AND SUBSEQUENTLY FAILED. AS A RESULT, THE AIRCRAFT OVERRAN THE RUNWAY AND STOPPED BEYOND THE END WHERE THE PASSENGERS AND CREW DISEMBARKED. THE FIRE DEPARTMENT EXTINGUISHED THE FIRE. THERE WERE NO INJURIES; HOWEVER, THE AIRCRAFT WAS SUBSTANTIALLY DAMAGED.

Recommendation # A-81-093

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: EVALUATE THE ADEQUACY OF THE ELECTRICAL SYSTEM FAULT PROTECTION DEVICES ON ISRAEL INDUSTRIES 1124 AIRCRAFT TO ENSURE THAT THE PROTECTIVE DEVICES WILL ELIMINATE HAZARDS TO THE AIRCRAFT WHEN SHORT CIRCUITS OCCUR.

FAA	CLOSED - ACCEPTABLE ACTION	6/21/82

10/19/81	Addressee	FAA LTR: THE FAA CONCURS IN THIS RECOMMENDATION. A SIMULATION TEST IS UNDERWAY TO STUDY THE BEHAVIOR OF THE CIRCUITRY ASSOCIATED WITH THIS INCIDENT. WE ANTICIPATE FINALIZATION OF TEST RESULTS BY JANUARY 15, 1982. UPON REVIEW OF THE SIMULATOR TEST RESULTS AND STUDY, THE FAA WILL TAKE FURTHER APPROPRIATE ACTION.
11/5/81	NTSB	
5/3/82	NTSB	
5/17/82	Addressee	FAA LTR: AN EVALUATION OF THE ADEQUACY OF THE MODEL 1124 ELECTRICAL SYSTEM FAULT PROTECTION DEVICES HAS BEEN ACCOM PLISHED IN COOPERATION WITH THE ISRAEL CIVIL AVIATION AUTHORITY AND ISRAEL AIRCRAFT INDUSTRIES. A SIMULATION TEST WAS ACCOMPLISHED WHICH STUDIED THE BEHAVIOR OF THE CIRCUITRY ASSOCIATED WITH THIS INCIDENT. IT WAS DEMONSTRA TED THAT THE ELECTRICAL FAULT PROTECTION DEVICES (CIRCUIT BREAKER) COMPLY WITH APPLICABLE AIRWORTHINESS REQUIREMENTS, OPERATE PROPERLY, AND OPERATE WITH THE CURRENT STATE-OF THE-ART.
6/21/82	NTSB	

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1429

Issue Date 6/7/82 MIDDLETOWN PA 11-Jun-82

ON JUNE 11, 1981, A SHORTS SD3-30 TWIN-TURBOPROP TRANSPORT AIRCRAFT, N331CA, WAS INVOLVED IN A LANDING APPROACH INCIDENT AT HARRISBURG INTERNATIONAL AIRPORT AT MIDDLETOWN, PENNSYLVANIA. AFTER THE LANDING GEAR HAD BEEN EXTENDED IN PREPARATION FOR LANDING AT THE AIRPORT, THE RIGHT MAIN GEAR UNLOCKED INDICATOR LIGHT ILLUMINATED. THE LIGHT REMAINED ILLUMINATED EVEN AFTER THE LANDING GEAR WAS RECYCLED. THE CAPTAIN DISCUSSED THE PROBLEM WITH COMPANY MAINTENANCE PERSONNEL AND THEN FLEW BY THE CONTROL TOWER FOR A VISUAL OBSERVATION OF THE LANDING GEAR BY TOWER CONTROLLERS. THE LANDING GEAR APPEARED FULLY EXTENDED, AND THE AIRCRAFT WAS LANDED WITHOUT FURTHER DIFFICULTY. THE AIRCRAFT, OPERATED BY PENNSYLVANIA COMMUTER AIRLINES, HAD BEEN MANUFACTURED BY SHORT BROTHERS LIMITED OF BELFAST, NORTHERN IRELAND, AND HAD BEEN IMPORTED TO THE UNITED STATES IN ACCORDANCE WITH APPROPRIATE FEDERAL AVIATION REGULATIONS. THE INVESTIGA TION DISCLOSED THAT THE GEAR UNLOCKED INDICATOR LIGHT HAD ILLUMINATED BECAUSE AN ELECTRICAL WIRE HAD BROKEN IN THE RIGHT MAIN GEAR DOWNLOCK SWITCH.

Recommendation # A-82-046

Overall Status CUA — **CLOSED - UNACCEPTABLE ACTION**

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE APPLICABLE TO SHORTS SD3-30 AIRCRAFT OUTLINING APPROPRIATE INTERIM ACTION TO BE TAKEN TO PREVENT FLEXING AND BREAKAGE OF CURRENTLY INSTALLED LANDING GEAR DOWNLOCK SWITCH ELECTRICAL WIRES.

FAA	CLOSED - UNACCEPTABLE ACTION	3/17/83

8/16/82	Addressee	FAA LTR: THE FAA IS UNABLE TO ESTABLISH, UNDER 14 CFR 39, THAT A SUBSTANTIAL HAZARD TO SAFETY (UNSAFE CONDITION) EXISTS IN THIS CASE SINCE THE WIRING FAILURES DO NOT DIRECTLY AFFECT THE OPERATION OF THE LANDING GEAR SYSTEM. ACCORDINGLY, THE FAA DOES NOT PLAN TO ISSUE AN AIRWORTHINESS DIRECTIVE AND PLANS NO FURTHER ACTION ON THIS RECOMMENDA TION.
10/14/82	NTSB	
12/7/82	Addressee	FAA LETTER: FOLLOWING CONSULTATION WITH THE UNITED KINGDOM CIVIL AVIATION AUTHORITY AND THE MANUFACTURER, THE FEDERAL AVIATION ADMINISTRATION HAS DETERMINED THAT AIRWORTHINESS DIRECTIVE ACTION IS NOT JUSTIFIED WITH RESPECT TO THE LANDING GEAR POSITION INDICATING SYSTEM WIRING. THE REPORTED WIRING FAILURES HAVE NO DIRECT EFFECT ON OPERATION OF THE LANDING GEAR SYSTEM. THE UNITED KINGDOM CIVIL AVIATION AUTHORITY CONCURS IN THIS DETERMINATION.
3/17/83	NTSB	

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1429

Issue Date 6/7/82 MIDDLETOWN PA 11-Jun-82

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Recommendation # A-82-047

Overall Status CUA **CLOSED - UNACCEPTABLE ACTION**

Priority **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE SHORT BROTHERS LIMITED TO MODIFY THE DESIGN OF THE SHORTS SD3-30 LANDING GEAR DOWNLOCK SWITCHES TO PREVENT FLEXING AND BREAKAGE OF THE ELECTRICAL WIRES TO THE SWITCH AND REQUIRE THE RETROFIT OF ALL SD3-30 AIRCRAFT REGISTERED IN THE UNITED STATES WITH THE IMPROVED DESIGN.

FAA	CLOSED - UNACCEPTABLE ACTION	3/17/83

8/16/82	Addressee	FAA LTR: THE FAA HAS REQUESTED THE U.K. CIVIL AVIATION AUTHORITY AND SHORT BROTHERS TO TAKE EARLY ACTION TO IMPROVE THE RELIABLITY OF THE LANDING GEAR POSITION INDICATING SYSTEM.
10/14/82	NTSB	
12/7/82	Addressee	FAA LETTER: THE MANUFACTURER HAS ISSUED SERVICE INFORMATION AND OBTAINED VENDOR IMPROVEMENTS TO THE CABLE AND SWITCH ASSEMBLIES. SHORT BROTHERS, LTD., HAS CONFIRMED THAT IMPROVED SWITCHES ARE BEING INSTALLED DURING LANDING GEAR OVERHAUL. SWITCHES WHICH MAY FAIL IN SERVICE ARE BEING REPLACED BY THE IMPROVED DESIGN. THE FAA BELIEVES THE ACTIONS TAKEN BY THE MANUFACTURER ARE SATISFACTORY AND ADEQUATELY ADDRESS THE BOARD'S CONCERNS IN RECOMMENDATIONS A-82-46 AND -47.
3/17/83	NTSB	

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

THE LOSS OF ELECTRICAL OUTPUT.

1/14/86 NTSB

Log Number 1606

Issue Date 7/19/83 CINCINNATI OH 02-Jun-83

ON JUNE 2, 1983, AN IN-FLIGHT FIRE OCCURRED ON BOARD AIR CANADA FLIGHT 797, AND FOLLOWING AN EMERGENCY LANDING AT THE GREATER CINCINNATI AIRPORT, THE CABIN INTERIOR OF THE MCDONNELL DOUGLAS DC-9-32 CONTINUED TO BURN. FIVE CREWMEMBERS AND 18 PASSENGERS WERE ABLE TO EVACUATE THE BURNING CABIN; THE REMAINING 23 PASSENGERS DIED IN THE FIRE.

Recommendation # A-83-047 **Overall Status** CAAA — CLOSED - ACCEPTABLE ALTERNATE ACTION **Priority** CLASS I

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE (1) TO REQUIRE AN IMMEDIATE INSPECTION OF THE LAVATORY FLUSHING PUMP MOTOR AND THE ASSOCIATED WIRING HARNESSES BETWEEN THE TIMING COMPONENTS AND THE MOTOR IN THE LAVATORIES OF TRANSPORT CATEGORY AIRPLANES FOR EVIDENCE OF MOISTURE-INDUCED CORROSION OR DETERIORATED INSULATION AND TO REQUIRE THAT FLUSHING PUMP MOTORS OR WIRING HARNESSES WHICH EXHIBIT SUCH CONDITIONS BE RELPLACED, AND (2) TO ESTABLISH APPROPRIATE PERIODIC INTERVALS FOR REPETITION OF THESE INSPECTIONS.

FAA	CLOSED - ACCEPTABLE ALTERNATE ACTION	11/17/86

10/21/83 Addressee

6/12/84 NTSB

11/17/86 Addressee THE FAA HAS WITNESSED COMPONENT TESTING OF LAVATORY FLUSHING PUMP MOTORS, INCLUDING TEST CONDITIONS IN WHICH THE MOTORS WERE INTENTIONALLY OVERHEATED. BOTH NEW AND USED MOTOR UNITS WERE TESTED. THE RESULTS INDICATED THAT OVERHEATING OF THE MOTORS IS NOT SUFFICIENT TO GENERATE A FIRE, ALTHOUGH SMOKE DOES DEVELOP. THE SMOKE IS THE PRODUCT OF BURNED WINDINGS. NUMEROUS TRANSPORT CATEGORY AIRPLANES WERE IN SPECTED IN THE AREA OF THE LAVATORIES WITH SPECIAL EMPHASIS ON THE FLUSHING PUMP MOTOR AND ASSOCIATED WITH (2) ELECTRI CAL WIRING AND CIRCUITRY. FROM THESE INSPECTIONS AND THE LACK OF FURTHER DATA PRESENTED TO DETERMINE THE FIRE SOURCE ON AIR CANADA FLIGHT 797, THE FAA HAS DETERMINED THAT THE TRANSPORT CATEGORY AIRPLANES ARE SUFFICIENT FOR DETECTING DETERIORATED OR CORROSION-DAMAGE CONDITIONS. (3) ACCUMULA TION OF FLUIDS WHICH CAN CAUSE CORROSION OF WIRE HARNESSES AND OTHER ELECTRICAL COMPONENTS. ADDITIONALLY, IN RESPONSE TO SAFETY RECOMMENDATION A-83-73, WHICH ALSO RESULTED FROM THE BOARD'S INVESTIGATION OF THE AIR CANADA INFLIGHT FIRE, THE FAA INFORMED THE BOARD THAT IT HAD PERFORMED A DETAILED EVALUATION OF THE LAVATORY PUMP MOTOR SYSTEMS OF TRANSPORT CATEGORY AIRPLANES. THIS EVALUATION LEAD TO THE DEVELOPMENT OF TOILET FLUSH MOTOR POWER WIRE HARNESSES ON CERTAIN MODELS OF MCDONNEL DOUGLAS DC-9 AIRPLANES.

11/17/86 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1606

Issue Date 7/19/83 CINCINNATI OH 02-Jun-83

ON JUNE 2, 1983, AN IN-FLIGHT FIRE OCCURRED ON BOARD AIR CANADA FLIGHT 797, AND FOLLOWING AN EMERGENCY LANDING AT THE GREATER CINCINNATI AIRPORT, THE CABIN INTERIOR OF THE MCDONNELL DOUGLAS DC-9-32 CONTINUED TO BURN. FIVE CREWMEMBERS AND 18 PASSENGERS WERE ABLE TO EVACUATE THE BURNING CABIN; THE REMAINING 23 PASSENGERS DIED IN THE FIRE.

Recommendation # A-83-048

Overall Status CAAA — CLOSED - ACCEPTABLE ALTERNATE ACTION

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ESTABLISH, IN CONJUNCTION WITH THE FLUSH PUMP MOTOR, TIMER, AND AIRFRANE MANUFACTURERS, A PROCEDURE WHICH AIRLINE MAINTENANCE PERSONNEL COULD EMPLOY TO VERIFY THAT THE ELECTRICAL CIRCUITRY OF LAVATORY FLUSHING PUMP MOTORS HAS BEEN DAMAGED BY CORROSION OR OTHER CAUSES SO AS TO PRODUCE EXCESSIVE HEAT DURING MOTOR OPERATION.

FAA	CLOSED - ACCEPTABLE ALTERNATE ACTION	11/17/86

10/21/83 Addressee

11/17/86 Addressee THE FAA HAS WITNESSED COMPONENT TESTING OF LAVATORY FLUSHING PUMP MOTORS, INCLUDING TEST CONDITIONS IN WHICH THE MOTORS WERE INTENTIONALLY OVERHEATED. BOTH NEW AND USED MOTOR UNITS WERE TESTED. THE RESULTS INDICATED THAT OVERHEATING OF THE MOTORS IS NOT SUFFICIENT TO GENERATE A FIRE, ALTHOUGH SMOKE DOES DEVELOP. THE SMOKE IS THE PRODUCT OF BURNED WINDINGS. NUMEROUS TRANSPORT CATEGORY AIRPLANES WERE IN SPECTED IN THE AREA OF THE LAVATORIES WITH SPECIAL EMPHASIS ON THE FLUSHING PUMP MOTOR AND ASSOCIATED WITH (2) ELECTRI CAL WIRING AND CIRCUITRY. FROM THESE INSPECTIONS AND THE LACK OF FURTHER DATA PRESENTED TO DETERMINE THE FIRE SOURCE ON AIR CANADA FLIGHT 797, THE FAA HAS DETERMINED THAT THE TRANSPORT CATEGORY AIRPLANES ARE SUFFICIENT FOR DETECTING DETERIORATED OR CORROSION-DAMAGE CONDITIONS. (3) ACCUMULA TION OF FLUIDS WHICH CAN CAUSE CORROSION OF WIRE HARNESSES AND OTHER ELECTRICAL COMPONENTS. ADDITIONALLY, IN RESPONSE TO SAFETY RECOMMENDATION A-83-73, WHICH ALSO RESULTED FROM THE BOARD'S INVESTIGATION OF THE AIR CANADA INFLIGHT FIRE, THE FAA INFORMED THE BOARD THAT IT HAD PERFORMED A DETAILED EVALUATION OF THE LAVATORY PUMP MOTOR SYSTEMS OF TRANSPORT CATEGORY AIRPLANES. THIS EVALUATION LEAD TO THE DEVELOPMENT OF TOILET FLUSH MOTOR POWER WIRE HARNESSES ON CERTAIN MODELS OF MCDONNEL DOUGLAS DC-9 AIRPLANES.

11/17/86 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1606

Issue Date 7/19/83 CINCINNATI OH 02-Jun-83

ON JUNE 2, 1983, AN IN-FLIGHT FIRE OCCURRED ON BOARD AIR CANADA FLIGHT 797, AND FOLLOWING AN EMERGENCY LANDING AT THE GREATER CINCINNATI AIRPORT, THE CABIN INTERIOR OF THE MCDONNELL DOUGLAS DC-9-32 CONTINUED TO BURN. FIVE CREWMEMBERS AND 18 PASSENGERS WERE ABLE TO EVACUATE THE BURNING CABIN; THE REMAINING 23 PASSENGERS DIED IN THE FIRE.

Recommendation # A-83-049

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority CLASS I

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE A MAINTENANCE ALERT BULLETIN TO REQUIRE PRINCIPAL MAINTENANCE INSPECTORS TO ASSURE THAT AIRLINES HAVE AN ACCEPTABLE PROGRAM (1) FOR THE FREQUENT REMOVAL OF WASTE FROM ALL AREAS OF THE LAVATORY WITH PARTICULAR ATTENTION TO THOSE ENCLOSED AREAS IN AND AROUND THE WASTE RECEPTACLES, AND (2) WHICH GIVES SUFFICIENT EMPHASIS TO AREAS SUSCEPTIBLE TO THE ACCUMULATION OF FLUIDS IN THE VICINITY OF WIRE HARNESSES AND OTHER ELECTRICAL COMPONENTS WHICH CAN CAUSE CORROSION.

FAA	CLOSED - ACCEPTABLE ACTION	10/21/83

10/21/83 Addressee — FAA LETTER: AS MENTIONED IN OUR COMMENT TO RECOMMENDATION A-83-47, THE FAA'S INVESTIGATION HAS NOT INDICATED THAT A SAFETY PROBLEM EXISTS WITH RESPECT TO CORROSION OF THE LAVATORY FLUSHING PUMP MOTOR UNITS AND ASSOCIATED WIRING OR DETERIORATION OF THE WIRE INSULATION. THEREFORE, REQUIRING AN ADDITIONAL INSPECTION PROCEDURE IS NOT CONSIDERED NECESSARY.

6/12/84 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1636

Issue Date **10/31/83** **CINCINNATI OH** **02-Jun-83**

THE NATIONAL TRANSPORTATION SAFETY BOARD IS CONTINUING ITS INVESTIGATION OF THE ACCIDENT INVOLVING AIR CANADA FLIGHT 797 WHICH OCCURRED ON JUNE 2, 1983, WHEN THE FLIGHTCREW OF THE MCDONNELL DOUGLAS DC-9 AIRPLANE WAS FORCED TO MAKE AN EMERGENCY LANDING AT THE GREATER CINCINNATI AIRPORT BECAUSE OF AN IN-FLIGHT FIRE. THE INTERIOR MATERIALS OF THE AIRPLANE'S CABIN CONTINUED TO BURN AFTER THE LANDING. FIVE CREWMEMBERS AND 18 PASSENGERS WERE ABLE TO EVACUATE THE BURNING CABIN; THE REMAINING 23 PASSENGERS DIED IN THE FIRE. THE SAFETY BOARD'S INVESTIGATION HAS DETERMINED THAT THE FIRE BEGAN IN THE AIRPLANE'S LEFT REAR LAVATORY, BUT THE SOURCE OF IGNITION HAS NOT YET BEEN IDENTIFIED. TO PROMOTE A COMPREHENSIVE PROGRAM TO ADDRESS THE POTENTIALLY HAZARDOUS SITUATION POSED BY IN-FLIGHT FIRES, THE SAFETY BOARD IS ISSUING NEW SAFETY RECOMMENDATIONS RATHER THAN REITERATING RELEVANT SAFETY RECOMMENDATIONS PREVIOUSLY ISSUED TO THE FAA.

Recommendation # A-83-073

Overall Status **CAA** **Priority**

CLOSED - ACCEPTABLE ACTION **CLASS I**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: EVALUATE THE ELECTRICAL CIRCUIT PROTECTION, INCLUDING REDUCED CIRCUIT BREAKER RATED VALUES AND INTEGRAL COMPONENT THERMAL PROTECTION DEVICES, NEEDED TO ELIMINATE THE POTENTIAL FOR OVERHEATING OF THE WIRING AND COMPONENTS IN THE LAVATORY FLUSHING PUMP MOTOR SYSTEMS IN TRANSPORT CATEGORY AIRPLANES AND ISSUE AIRWORTHINESS DIRECTIVES AS REQUIRED.

FAA	CLOSED - ACCEPTABLE ACTION	4/16/86

1/27/84	Addressee	FAA COMMENT: THE FAA HAS EVALUATED THE ELECTRICAL DESIGN DETAILS OF LAVATORY FLUSHING PUMP MOTOR SYSTEMS ON TRANSPORT CATEGORY AIRPLANES AND HAS IDENTIFIED SEVERAL SITUATIONS WHERE IMPROVEMENT IN WIRE ROUTING, CIRCUIT BREAKER PROTECTION, AND/OR THERMAL PROTECTION COULD BE MADE. AT THIS TIME, THE VARIOUS OPTIONS FOR MODIFICATION ARE BEING DEVELOPED. ACTION ON THIS PROJECT IS SCHEDULED TO BE COMPLETED BY MARCH 1984. MANDATORY ACCOMPLISHMENT OF THE MODIFICATIONS IS UNDER CONSIDERATION.
7/9/84	NTSB	
1/22/85	Addressee	FAA LTR: THE FAA HAS COMPLETED ITS EVALUATION OF THE LAVATORY PUMP MOTOR SYSTEMS ON TRANSPORT CATEGORY AIRPLANES AND HAS CONCLUDED THAT ONLY THE MCDONNELL DOUGLAS DC-9 AIRPLANES, FUSELAGE NO. 855 AND PRIOR, REVEAL A POTENTIALLY HAZARDOUS CONDITION REQUIRING MANDATORY ACTION. MCDONNELL DOUGLAS DC-9 SERVICE BULLETIN 24-76, WAS RELEASED ON SEPTEMBER 30, 1984. THIS BULLETIN PROVIDES THE INSTRUCTIONS FOR REROUTING THE WIRE HARNESS OUTBOARD AND AWAY FROM THE PUMP ASSEMBLY, THEREBY REMOVING POTENTIALLY HAZARDOUS CON DITIONS. ON OCTOBER 1, 1984, A NOTICE OF PROPOSED RULEMAKING DOCKET NUMBER 84-NM-99-AD WAS PUBLISHED IN THE FEDERAL REGISTER (COPY ENCLOSED) THAT PROPOSES AN AIRWORTHI NESS DIRECTIVE (AD) BE ISSUED TO REQUIRE ACCOMPLISHMENT OF THE REROUTING MODIFICATION ON ALL AFFECTED AIRPLANES. THE PUBLIC COMMENT PERIOD ON THIS NPRM ENDED ON DECEMBER 20, 1984. AFTER COMPLETION OF OUR REVIEW OF THE COMMENTS WE WILL ADVISE THE BOARD OF OUR PROPOSED ACTIONS.
5/10/85	NTSB	
2/27/86	Addressee	ENCLOSED FOR THE BOARD'S INFORMATION IS A COPY OF A FINAL RULE THAT WAS ISSUED ON MARCH 27, 1985, AND BECAME EFFECTIVE ON MAY 13, 1985. THIS AMENDMENT ADDS A NEW AIRWORTHINESS DIRECTIVE (AD 85-07-10) WHICH REQUIRES REROUTING OF THE TOILET FLUSH MOTOR POWER WIRE

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Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

HARNESS IN THE FORWARD AND AFT LAVATORIES ON CERTAIN MCDONNELL DOUGLAS MODEL DC-9 AND C-9 (MILITARY) SERIES AIRPLANES. THIS ACTION WAS NECESSARY TO AID IN ELIMINATING A POTENTIAL FIRE.

4/16/86 Addressee

6/2/86 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

9/10/85 NTSB

10/23/85 Addressee

Log Number 1689

Issue Date 5/25/84 **MINNEAPOLIS MN** **17-May-84**

ON MAY 17, 1984, A NORTHWEST ORIENT AIRLINES' MCDONNELL DOUGLAS DC-10-40, N150US, DEPARTED THE MINNEAPOLIS/ST.PAUL INTERNATIONAL AIRPORT, MINNESOTA, AS FLIGHT 42. THERE WERE 236 PASSENGERS AND A CREW OF 12 INCLUDING 3 FLIGHT CREWMEMBERS AND 9 FLIGHT ATTENDANTS ON BOARD. WHILE CLIMBING THROUGH FLIGHT LEVEL 330, SMOKE AND SPARKS ERUPTED FROM BENEATH THE FIRST OFFICER'S GLARESHIELD PANEL, AND THE MASTER CAUTION LIGHT ON THE FIRST OFFICER'S GLARESHIELD, AND THE MASTER WARNING LIGHT AND THE ENGINE FAILURE WARNING LIGHTS ON BOTH THE CAPTAIN'S AND FIRST OFFICER'S GLARESHIELD ILLUMINATED. THE INSULATION ON A WIRING BUNDLE AND A PLASTIC INSULATOR UNDER THE GLARESHEILD BURNED FOR ABOUT 2 MINUTES. THE BURNING CEASED SPONTANEOUSLY. THE FLIGHT CREW DECLARED AN EMERGENCY AND THE FLIGHT SAFELY RETURNED TO THE MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT. THE SAFETY BOARD'S INVESTIGATION OF THE INCIDENT REVEALED THAT THE WIRING BUNDLE UNDER THE FIRST OFFICER'S GLARESHIELD WAS CHAFED AND BURNED AND THAT THE WIRE BUNDLE WAS IMPROPERLY ROUTED UNDER THE ISOLUME LIGHT, P/N 90090-1, IN SUCH A WAY THAT THE SHARP EDGE OF THE LIGHT BRACKET HAD RUBBED THROUGH THE WIRING SLEEVE AND THE INSULATION, CAUSING THE WIRES TO SHORT CIRCUIT.

Recommendation # A-84-053

Overall Status CAA **CLOSED - ACCEPTABLE ACTION**

Priority **CLASS I**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE A TELEGRAPHIC AIR CARRIER OPERATIONS BULLETIN TO ALL DC-10 PRINCIPAL OPERATIONS INSPECTORS FOR IMMEDIATE NOTIFICATION OF DC-10 OPERATORS PROVIDING INFORMATION THAT (1) THE POTENTIAL FOR A SHORT CIRCUIT EXISTS IN ELECTRICAL WIRING BENEATH THE GLARESHIELDS ABOVE BOTH PILOT STATIONS; (2) SUCH A SHORT CIRCUIT COULD BE ACCOMPANIED BY SPARKS AND SMOKE; AND (3) CIRCUITS TO THE MASTER CAUTION LIGHT, MASTER WARNING LIGHT, AND ENGINE FAILURE WARNING LIGHT COULD BE ACTIVATED.

FAA	CLOSED - ACCEPTABLE ACTION	8/27/84

8/27/84 Addressee FAA LETTER: "ON THE SAME DAY THE NTSB RECOMMENDATION WAS ISSUED, THE FEDERAL AVIATION ADMINISTRATION'S (FAA) OFFICE OF AIRWORTHINESS ISSUED GENERAL NOTICE N8320.298 WHICH DIRECTED THAT PRINCIPAL AVIONICS INSPECTORS REQUEST THEIR ASSIGNED OPERATORS OF DC-10 SERIES AIRCRAFT ACCOMPLISH A DC-10 SERIES FLEET INSPECTION CAMPAIGN TO VERIFY PROPER CONDITION, SECURITY, AND ROUTING OF THE WIRE BUNDLE AT BOTH THE CAPTAIN'S AND FIRST OFFICER'S POSITIONS. OPERATORS WERE REQUESTED TO VERIFY THAT THEIR MANUALS CONTAIN INSTRUCTIONS WHICH CAUTION MAINTENANCE PERSONNEL OF THE NECESSITY FOR THE PROPER ROUTING OF THE BUNDLES. RESULTS OF THE INSPECTIONS WERE TO INCLUDE ANY DETERIORATION NOTED AND THE IDENTIFICA TION OF THE OBJECT(S) THAT A WIRE BUNDLE WAS CHAFING AGAINST. ADDITIONALLY, ON MAY 30, 1984, MCDONNELL DOUGLAS CORPORATION ISSUED AN ALL OPERATORS LETTER 10-1759 TO ALL DC-10 OPERATORS SUGGESTING THAT OPERATORS VERIFY GLARESHIELD HARNESS ROUTING AND INTEGRITY ON BOTH THE LEFT-HAND AND RIGHT-HAND SIDES AND RESTORE THEM TO PROPER CONFIGURATION SHOULD THEY BE MISROUTED AND/OR CHAFED."

1/9/85 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1689

Issue Date 5/25/84 **MINNEAPOLIS MN** **17-May-84**

ON MAY 17, 1984, A NORTHWEST ORIENT AIRLINES' MCDONNELL DOUGLAS DC-10-40, N150US, DEPARTED THE MINNEAPOLIS/ST.PAUL INTERNATIONAL AIRPORT, MINNESOTA, AS FLIGHT 42. THERE WERE 236 PASSENGERS AND A CREW OF 12 INCLUDING 3 FLIGHT CREWMEMBERS AND 9 FLIGHT ATTENDANTS ON BOARD. WHILE CLIMBING THROUGH FLIGHT LEVEL 330, SMOKE AND SPARKS ERUPTED FROM BENEATH THE FIRST OFFICER'S GLARESHIELD PANEL, AND THE MASTER CAUTION LIGHT ON THE FIRST OFFICER'S GLARESHIELD, AND THE MASTER WARNING LIGHT AND THE ENGINE FAILURE WARNING LIGHTS ON BOTH THE CAPTAIN'S AND FIRST OFFICER'S GLARESHIELD ILLUMINATED. THE INSULATION ON A WIRING BUNDLE AND A PLASTIC INSULATOR UNDER THE GLARESHEILD BURNED FOR ABOUT 2 MINUTES. THE BURNING CEASED SPONTANEOUSLY. THE FLIGHT CREW DECLARED AN EMERGENCY AND THE FLIGHT SAFELY RETURNED TO THE MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT. THE SAFETY BOARD'S INVESTIGATION OF THE INCIDENT REVEALED THAT THE WIRING BUNDLE UNDER THE FIRST OFFICER'S GLARESHIELD WAS CHAFED AND BURNED AND THAT THE WIRE BUNDLE WAS IMPROPERLY ROUTED UNDER THE ISOLUME LIGHT, P/N 90090-1, IN SUCH A WAY THAT THE SHARP EDGE OF THE LIGHT BRACKET HAD RUBBED THROUGH THE WIRING SLEEVE AND THE INSULATION, CAUSING THE WIRES TO SHORT CIRCUIT.

Recommendation # A-84-054

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority CLASS I

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE AN IMMEDIATE VISUAL INSPECTION OF WIRING BUNDLES BENEATH THE DC-10 COCKPIT GLARESHIELDS TO DETERMINE THAT THEY ARE NOT CHAFED AND ARE ROUTED SO THAT THEY ARE NOT SANDWICHED BETWEEN THE ISOLUME LIGHT, AND THE FLIGHT GUIDANCE CONTROL PANEL OR THE GLARESHIELD.

FAA	CLOSED - ACCEPTABLE ACTION	8/27/84

8/27/84 Addressee — FAA LETTER: "ON JULY 30, 1984, THE TRANSPORT AIRPLANE CERTIFICATION DIRECTORATE IN THE FAA'S NORTHWEST MOUNTAIN REGION ISSUED A FINAL RULE, DOCKET NO. 84-NM-74-AD. THIS AMENDMENT, ADOPTING A NEW AIRWORTHINESS DIRECTIVE (AD) WHICH WILL BE EFFECTIVE AUGUST 20, 1984, APPLIES TO MCDONNELL DOUGLAS DC-10 AND KC-10A (MILITARY) AIRPLANES CERTIFICATED IN ALL CATEGORIES, AND REQUIRES COMPLIANCE WITHIN 30 DAYS AFTER THE EFFECTIVE DATE UNLESS ALREADY ACCOMPLISHED. THE AD REQUIRES A VISUAL INSPECTION OF WIRING BUNDLES BENEATH THE COCKPIT GLARESHIELD TO ENSURE THAT THEY ARE NOT CHAFED AND ARE ROUTED PROPERLY OVER THE FLUORESCENT LIGHT SHROUD."

1/9/85 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1700

Issue Date 6/19/84 SPOKANE WA 04-Jun-84

ON JUNE 4, 1984, A CASCADE AIRWAYS' BEECH 1900C, N123CZ (S/N UB-10) WAS INVOLVED IN AN INCIDENT SHORTLY AFTER IT DEPARTED THE SPOKANE INTERNATIONAL AIRPORT, SPOKANE, WASHINGTON, AS FLIGHT 104. THE FLIGHT WAS OPERATING UNDER 14 CFR 135, AND THERE WERE THREE PASSENGERS AND TWO FLIGHT CREWMEMBERS ON BOARD. DURING CLIMBOUT FROM RUNWAY 21, AT AN ALTITUDE OF ABOUT 500 FEET, SMOKE, FIRE AND SPARKS ERUPTED FROM THE LOWER AND UPPER FORWARD CORNERS OF THE CIRCUIT BREAKER PANEL ON THE FIRST OFFICER'S SIDEWALL. THE CAPTAIN TURNED OFF THE MAIN ELECTRICAL POWER AND GENERATOR SWITCHES, CONTACTED THE AIRPORT CONTROL TOWER ON THE NO. 1 COMMUNI CATIONS RADIO USING THE DIRECT-POWER ACCESS FEATURE, AND REQUESTED AN IMMEDIATE RETURN AND LANDING ON THE NEAREST RUNWAY. CABIN PRESSURE WAS VENTED AND THE COCKPIT SIDE WINDOWS WERE OPENED TO CLEAR SMOKE FROM THE COCKPIT AND CABIN. AFTER THE CAPTAIN LANDED THE AIRPLANE ON RUNWAY 3, THE FIRE SELF-EXTINGUISHED. THERE WERE NO INJURIES TO THE PASSENGERS OR FLIGHTCREW. THE AIRPLANE SUSTAINED MINOR DAMAGE. THE NATIONAL TRANSPORTATION SAFETY BOARD'S CONTINUING INVESTIGATION OF THE INCIDENT REVEALED SEVERE ARCING AND BURNING OF WIRES WHICH PASS THROUGH THE FORWARD OPENING IN THE HORIZONTAL SUPPORT INTERCOSTAL TO WHICH THE CIRCUIT BREAKER PANEL IS HINGED. THESE WIRES INCLUDED ONE OF THE POWER SUPPLY CABLES, A WIRE BUNDLE FOR VARIOUS CIRCUITS, AND THE DIODE LEADS.

Recommendation # A-84-063

Overall Status CAA — CLOSED - ACCEPTABLE ACTION

Priority CLASS I

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE THE BEECH AIRCRAFT CORPORATION TO MODIFY THE MAIN CIRCUIT BREAKER PANEL INSTALLATIONS IN ALL MODEL 1900C AIRPLANES (1) TO PREVENT CONTACT BETWEEN THE ADEL CLAMPS, WHICH HOLD THE CIRCUIT WIRE BUNDLES IN PLACE AT THE LOWER PANEL CORNERS, AND THE ADJACENT CIRCUIT BREAKER BUS BARS, (2) TO PROVIDE COMPLETE ANTICHAFE PROTECTION FOR ELECTRICAL WIRING TO AND FROM THE CIRUIT BREAKER PANEL WHERE THE WIRES PASS THROUGH THE SUPPORT INTERCOSTAL OPENINGS, AND (3) TO ELIMINATE THE POSSIBILITY OF CRIMPING THE ADJACENT DIODE LEADS DURING CLOSURE OF THE CIRCUIT BREAKER PANEL.

FAA	CLOSED - ACCEPTABLE ACTION	9/13/84

9/13/84 Addressee — FAA LETTER: THE FAA CONCURS WITH THIS RECOMMENDATION AND HAS VERIFIED THAT THE BEECH AIRCRAFT CORPORATION TYPE DESIGN DATA FOR THE MODEL 1900C AIRPLAN HAS BEEN REVISED TO INCLUDE THE BOARD'S RECOMMENDATION FOR PRODUCTION AIRPLANES. BEECH HAS ISSUED LETTER NO. 52-84-1395, DATED JUNE 13, 1984, AND LETTER NO. 52-84-1821, DATED JUNE 29, 1984, TO THEIR MODEL 1900C OPERATORS WHICH DEFINE THE FIELD MODIFICATION NECESSARY FOR SHOWING COMPLIANCE TO THE REVISED TYPE DESIGN DATA. FAA FIELD INSPECTORS HAVE VERIFIED THAT ALL IN-SERVICE MODEL 1900C AIRPLANES HAVE BEEN MODIFIED TO BEECH LETTERS 52-84-1395 AND 52-84-1821 AND, THEREFORE, ARE IN COMPLIANCE WITH THE REVISED TYPE DESIGN DATA.

12/5/84 NTSB

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:CIRCUIT KEYWORD 2:CIRCUITRY KEYWORD 3:BREAKER

Log Number 2067

Issue Date **6/27/88** **DETROIT MI** **16-Aug-87**

ABOUT 2046 EASTERN DAYLIGHT TIME ON AUGUST 16, 1987, NORTHWEST AIRLINES, INC., FLIGHT 255 CRASHED SHORTLY AFTER TAKING OFF FROM RUNWAY 3 CENTER AT THE DETROIT METROPOLITAN WAYNE COUNTY AIRPORT (DETROIT-METRO), ROMULUS, MICHIGAN. FLIGHT 255, A McDONNELL DOUGLAS DC-9-82, U.S. REGISTRY N312RC, WAS A REGULARLY SCHEDULED PASSENGER FLIGHT AND WAS EN ROUTE TO PHOENIX, ARIZONA. ACCORDING TO WITNESSES, FLIGHT 255 BEGAN ITS TAKEOFF ROTATION ABOUT 1,200 TO 1,500 FEET FROM THE END OF THE RUNWAY AND LIFTED OFF NEAR THE END OF THE RUNWAY. AFTER LIFTOFF, THE WINGS OF THE AIRPLANE ROLLED TO THE LEFT AND THE RIGHT ABOUT 35 DEGREES IN EACH DIRECTION. THE AIRPLANE COLLIDED WITH OBSTACLES NORTHEAST OF THE RUNWAY WHEN THE LEFT WING STRUCK A LIGHT POLE LOCATED 2,760 FEET BEYOND THE END OF THE RUNWAY. THEREAFTER THE AIRPLANE STRUCK OTHER LIGHT POLES, THE ROOF OF A RENTAL CAR FACILITY, AND THEN THE GROUND. IT CONTINUED TO SLIDE ALONG A PATH ALIGNED GENERALLY WITH THE EXTENDED CENTERLINE OF THE TAKEOFF RUNWAY. THE AIRPLANE BROKE UP AS IT SLID ACROSS THE GROUND AND POSTIMPACT FIRES ERUPTED ALONG THE WRECKAGE PATH. AND NUMEROUS VACANT VEHICLES IN A RENTAL CAR PARKING LOT ALONG THE AIRPLANE'S PATH WERE DESTROYED BY IMPACT FORCES AND/OR FIRE. OF THE PERSONS ON BOARD FLIGHT 255, 148 PASSENGERS AND 6 CREWMEMBERS WERE KILLED; 1 PASSENGER, A 4 YEAR-OLD CHILD, WAS INJURED SERIOUSLY. ON THE GROUND, TWO PERSONS WERE KILLED, ONE PERSON WAS INJURED SERIOUSLY, AND FOUR PERSONS SUFFERED MINOR INJURIES.

Recommendation # A-88-064

Overall Status **CAAA** **CLOSED - ACCEPTABLE ALTERNATE ACTION**

Priority **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: CONDUCT A DIRECTED SAFETY INVESTIGATION TO DETERMINE THE RELIABILITY OF CIRCUIT BREAKERS AND THE MECHANISMS BY WHICH FAILURES INTERNAL TO THE CIRCUIT BREAKERS CAN DISABLE OPERATING SYSTEMS AND TO IDENTIFY APPROPRIATE CORRECTIVE ACTIONS AS NECESSARY.

FAA	CLOSED - ACCEPTABLE ALTERNATE ACTION	10/24/89

9/22/88	Addressee	THE FAA IS EVALUATING THE ISSUES ADDRESSED IN THESE SAFETY RECOMMENDATIONS. AS SOON AS THE EVALUATION IS COMPLETED, I WILL APPRISE THE BOARD OF THE FAA'S PLANNED ACTION.
10/13/88	NTSB	
2/1/89	Addressee	"THE FAA IS GATHERING DATA FROM BOTH THE AIRPLANE AND CIRCUIT MANUFACTURERS TO IDENTIFY ANY PROBLEMS THAT MAY EXIST. THE FAA WILL ANALYZE THESE DATA AND MAKE A DETERMINATION AS TO WHAT, IF ANY, ACTION IS NEEDED."
10/24/89	Addressee	THE FAA REQUESTED THAT MECHANICAL PRODUCTS INC., TEXAS INSTRUMENTS INC., AND THE ATA TO SUPPLY THE FOLLOWING INFORMATION ON ONE TO TEN AMPERE AIRCRAFT CIRCUIT BREAKERS: 1. FAILURE RATES 2. FAILURE MODES 3. HISTORY OF AN FAILURE MODE(S) WHICH COULD CAUSE THE CIRCUIT BREAKER TO FAIL OPEN, BUT REMAIN CLOSED 4. PROBLEM WITH CONTAMINATION OF CONTACTS FROM EXTERNAL OR 5. FIXES OR IMPROVEMENTS MADE SINCE JANUARY 1979 TO RESOLVE FAILURE MODE OR CONTAMINATION PROBLEMS 6. QUALITY ASSURANCE PROBLEMS AND SOLUTIONS SINCE JANUARY 1979 THE FAA BELIEVES THAT THE CIRCUIT BREAKERS, WHEN USED PROPERLY, ARE HIGHLY RELIABLE DEVICES, AND SINCE NO SIGNIFICANT PROBLEMS WITH CIRCUIT BREAKER MECHANISMS WERE IDENTIFIED, NO CORRECTIVE ACTION IS CONSIDERED NECESSARY.
3/29/90	NTSB	

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1729

Issue Date 10/23/85 MIAMI FL 11-Nov-83

ON NOVEMBER 11, 1983, AT 1926, E.S.T., EASTERN AIR LINES (EASTERN) FLIGHT 836, N812EA, A B-727-225A, WITH 152 PASSENGERS AND 7 CREWMEMBERS ABOARD, TOOK OFF FROM MIAMI INTERNATIONAL AIRPORT, MIAMI, FLORIDA. THE FLIGHTCREW STATED THAT THE CLIMBOUT WAS NORMAL UNTIL THE FLIGHT REACHED APPROXIMATELY 10,900 FEET. AT THAT POINT A LOUD BANG WAS HEARD, FOLLOWED BY ILLUMINATION OF THE RED DOORS AND RED RIGHT GEAR WARNING LIGHTS ABOVE THE LANDING GEAR LEVER. IN ACCORDANCE WITH PRESCRIBED PROCEDURES, THE FIRST OFFICER MOVED THE LANDING GEAR LEVER FROM THE OFF TO THE UP POSITION. FOLLOWING THE FIRST OFFICER'S ACTIONS, THE SECOND OFFICER REPORTED LOSS OF FLUID AND PRESSURE IN THE A AND B HYDRAULIC SYSTEMS. THE PRIMARY FLIGHT CONTROLS REVERTED TO MANUAL OPERATION, AND THE CLIMB WAS TERMINATED.

Recommendation # A-85-086

Overall Status CUA — **CLOSED - UNACCEPTABLE ACTION**

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: INCOOPERATION WITH THE BOEING COMMERCIAL AIRPLANE COMPANY, DETERMINE THE FEASIBILITY OF SHIELDING THE A AND B HYDRAULIC SYSTEM LINES, ELECTRICAL WIRING, AND CONTROL SYSTEM CABLES LOCATED IN THE WHEEL WELL OF B-727 AIRPLANES, AND OF MODIFYING THE WHEEL WELL LIGHTING SYSTEMS TO MAKE LESS VULNERABLE TO DAMAGE IN THE EVENT OF A TIRE EXPLOSION WITHIN THE WHEEL WELL.

FAA	CLOSED - UNACCEPTABLE ACTION	3/5/87

1/13/86	Addressee	THE FAA HAS CONCLUDED DISCUSSIONS WITH BOEING CONCERNING THIS RECOMMENDATION AND OFFERS THE FOLLOWING COMMENTS: (3) IT IS CONSIDERED THAT ADDING PROTECTIVE SCREENS IN THE WHEEL WELL WOULD BE INEFFECTIVE. EXPERIENCE WITH AIRCRAFT WITH SCREENS INDICATES THAT THE SCREENS THEMSELVES DEFORM UNDER TIRE BURST CONDITIONS AND CAN DO MORE DAMAGE THAN THE AIR BLAST OR TIRE SEGMENTS. (4) KEEPING THE WHEEL WELL LIGHTING SYSTEM IS NOT PRACTICAL IF HYDRAULIC SYSTEM FAILURES CAUSE A SKYDROL MIST TO COAT THE LENSES.
3/7/86	Addressee	
7/3/86	NTSB	
11/18/86	Addressee	FAA COMMENTS: (1) THERE HAVE BEEN ONLY SIX RECORDED INCI DENTS INVOLVING TIRES BURSTING IN THE WHEEL WELL ON B-727 AIRPLANES. THE SUBJECT INCIDENT WAS THE ONLY ONE WHICH INVOLVED LANDING WITH ANY GEAR RETRACTED. (2) THE MANUAL EXTENSION SYSTEM WAS TESTED ON THE GROUND AFTER THE ACCIDENT AND WORKED PROPERLY. (3) IT IS CONSIDERED THAT ADDING PRO TECTIVE SCREENS IN THE WHEEL WELLS WOULD BE INEFFECTIVE. EXPERIENCE ON AIRPLANES WITH SCREENS INDICATES THAT THE SCREENS THEMSELVES DEFORM UNDER TIRE BURST CONDITIONS AND CAN DO MORE DAMAGE THAN THE AIR BLAST OR TIRE BURST CONDI TIONS AND CAN DO MORE DAMAGE THAN THE AIR BLAST OR TIRE SEG MENTS. (4) KEEPING THE WHEEL WELL LIGHTING SYSTEM CLEAN IS NOT PRACTICAL IF HYDRAULIC SYSTEM FAILURES CAUSE A SKYDROL MIST TO COAT THE LENSES. (5) THE PROBABLE CAUSE TO THIS ACCIDENT APPEARS TO BE IMPROPER REPAIR OF THE CARCASS IN CLUDING GRINDING THROUGH SEVERAL LAYERS OF COVER PLIES. BASED UPON THE ABOVE CONSIDERATIONS, THE FAA STATED THAT IT DID NOT CONSIDER THAT ADDING SCREENS OR CHANGING THE LIGHT ING SYSTEMS IN THE WHEEL WELL WOULD BE EFFECTIVE IN PREVENT ING FURTHER INCIDENTS OF THIS KIND.

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1829

Issue Date 10/25/85

THE NATIONAL TRANSPORTATION SAFETY BOARD IS PARTICIPATING IN THE INVESTIGATION OF AN IN-FLIGHT FIRE WHICH OCCURRED ABOARD A LOCKHEAD L-1011 OPERATED BY ROYAL JORDANIAN AIRLINES, ON OCTOBER 18, 1985. THE INVESTIGATION INTO THE CAUSE OF FIRE IS CONTINUING IN SINGAPORE, WHERE THE AIRPLANES LANDED; HOWEVER, PRELIMINARY FINDINGS AT THIS POINT SUGGEST THE NEED FOR URGENT ACTION TO PRECLUDE SIMILAR FIRES IN THE FUTURE. PRELIMINARY INFORMATION FROM THE FLIGHT CREW AND THE COCKPIT VOICE RECORDER REVEALED THAT THE FLIGHT WAS DESCENDING THROUGH ABOUT 20,000 FEET FOR LANDING WHEN AN APPARENT ELECTRICAL FAULT OCCURRED FOLLOWED SHORTLY THEREAFTER BY A J-AREA OVERHEAT WARNING IN THE COCKPIT. (THE J-AREA INCLUDED THE LEFT-SIDE UNDER-FLOOR AREA OUTBOARD OF THE C-3 CARGO COMPARTMENT AND IMMEDIATELY AFT OF THE AFT PRESSURE BULKHEAD.) THE CREW THEN RECEIVED A NO. 2 ENGINE FIRE WARNING, SHUT DOWN THE ENGINE, AND ACTUATED THE FIRE EXTINGUISHER. THE WARNING LIGHT WENT OUT, BUT THE CABIN PRESSURE WAS LOST AND SMOKE REPORTEDLY FILLED THE COCKPIT AND CABIN. THE AIRPLANE WAS LANDED SUCCESSFULLY WITH NO REPORTED INJURIES.

Recommendation # A-85-091

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority CLASS I

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE A TELEGRAPHIC AIRWORTHINESS DIRECTIVE TO REQUIRE AN IMMEDIATE INSPECTION OF ALL LOCKHEAD L-1011 AIRPLANES TO CONFIRM THE PROPER INSTALLATION OF ELECTRICAL WIRES AND CABLES ADJACENT TO THE TITANIUM BLEED AIR DUCTS.

FAA	CLOSED - ACCEPTABLE ACTION	1/13/86

1/13/86 Addressee "--AS IS NORMAL WITH THE ISSUANCE OF AN AD, ALL FOREIGN AUTHORITIES WITH AFFECTED AIRCRAFT OPERATING IN THEIR COUNTRIES ARE SENT COPIES OF THE AD. ACCORDINGLY, WHEN THE TELEGRAPHIC AD WAS ISSUED THE FOREIGN AUTHORITIES WERE NOTIFIED".

3/25/86 NTSB

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 1829

Issue Date 10/25/85

THE NATIONAL TRANSPORTATION SAFETY BOARD IS PARTICIPATING IN THE INVESTIGATION OF AN IN-FLIGHT FIRE WHICH OCCURRED ABOARD A LOCKHEAD L-1011 OPERATED BY ROYAL JORDANIAN AIRLINES, ON OCTOBER 18, 1985. THE INVESTIGATION INTO THE CAUSE OF FIRE IS CONTINUING IN SINGAPORE, WHERE THE AIRPLANES LANDED; HOWEVER, PRELIMINARY FINDINGS AT THIS POINT SUGGEST THE NEED FOR URGENT ACTION TO PRECLUDE SIMILAR FIRES IN THE FUTURE. PRELIMINARY INFORMATION FROM THE FLIGHT CREW AND THE COCKPIT VOICE RECORDER REVEALED THAT THE FLIGHT WAS DESCENDING THROUGH ABOUT 20,000 FEET FOR LANDING WHEN AN APPARENT ELECTRICAL FAULT OCCURRED FOLLOWED SHORTLY THEREAFTER BY A J-AREA OVERHEAT WARNING IN THE COCKPIT. (THE J-AREA INCLUDED THE LEFT-SIDE UNDER-FLOOR AREA OUTBOARD OF THE C-3 CARGO COMPARTMENT AND IMMEDIATELY AFT OF THE AFT PRESSURE BULKHEAD.) THE CREW THEN RECEIVED A NO. 2 ENGINE FIRE WARNING, SHUT DOWN THE ENGINE, AND ACTUATED THE FIRE EXTINGUISHER. THE WARNING LIGHT WENT OUT, BUT THE CABIN PRESSURE WAS LOST AND SMOKE REPORTEDLY FILLED THE COCKPIT AND CABIN. THE AIRPLANE WAS LANDED SUCCESSFULLY WITH NO REPORTED INJURIES.

Recommendation # A-85-092

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority — **CLASS I**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: IMMEDIATELY NOTIFY ALL FOREIGN CERTIFICATING AUTHORITIES WITH RESPONSIBILITY CONCERNING LOCKHEAD L-1011 AIRPLANES ABOUT THE CIRCUMSTANCES OF THE TITANIUM FIRE OCCURRENCE AT SINGAPORE ON OCTOBER 18, 1985, AND THE NEED TO CONSIDER AN IMMEDIATE INSPECTION OF THE AIRPLANES FOR PROPER INSTALLATION OF ELECTRICAL WIRES AND CABLE ADJACENT TO TITANIUM BLEED AIR DUCTS.

FAA	CLOSED - ACCEPTABLE ACTION	1/13/86

1/13/86 Addressee "ON OCTOBER 30, 1985, THE FAA ISSUED TELEGRAPHIC AIRWORTHINESS DIRECTIVE (AD) T85-22-51 (COPY ENCLOSED). THIS AD IS APPLICABLE TO THE LOCKHEED L-1011-385 SERIES AIRPLANES AND WAS EFFECTIVE 10 DAYS AFTER RECEIPT. THE AD REQUIRES AN INSPECTION OF THE AUXILIARY POWER UNIT CABLES TO DETERMINE IF ADEQUATE CLEARANCE EXISTS BETWEEN THE CABLES AND THE BLEED AIR DUCT INSULATED COVER, AND ADJUSTMENT IS NECESSARY, AND INSPECTION OF THE CABLES FOR DAMAGE TO INSULATION AND WIRING, AND REPAIR IF DAMAGE IS FOUND.---"

3/25/86 NTSB

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Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2179

Issue Date **8/23/89** **HONOLULU HI** **24-Feb-89**

ON FEBRUARY 24, 1989, UNITED AIRLINES, INC., (UAL), FLIGHT 811, A BOEING 747-122, N4713U, WITH 3 FLIGHT CREWMEMBERS, 15 CABIN CREWMEMBERS, AND 337 PASSENGERS ON BOARD, EXPERIENCED AN EXPLOSIVE DECOMPRESSION AS A RESULT OF THE IN-FLIGHT LOSS OF THE RIGHT FORWARD LOWER LOBE CARGO COMPARTMENT DOOR AND A PART OF THE RIGHT CABIN FUSELAGE. FLIGHT 811 WAS EN ROUTE FROM LOS ANGELES, CALIFORNIA, TO SYDNEY, AUSTRALIA (SYD) WITH INTERMEDIATE STOPS IN HONOLULU, HAWAII (HNL) AND AUCK LAND, NEW ZEALAND (AKL). IT WAS A REGULARLY SCHEDULED FLIGHT CONDUCTED UNDER THE PROVISIONS OF 14 CODE OF FEDERAL REGULATIONS (CFR) PART 121.

Recommendation # A-89-094

Overall Status **CAA** **CLOSED - ACCEPTABLE ACTION**

Priority **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE THAT FAIL-SAFE DESIGN CONSIDERATIONS FOR NON PLUG CARGO DOORS ON PRESENT AND FUTURE TRANSPORT CATEGORY AIRPLANES ACCOUNT FOR CONCEIVABLE HUMAN ERROS IN ADDITION TO ELECTRICAL AND MECHANICAL MALFUNCTIONS.

FAA	CLOSED - ACCEPTABLE ACTION	10/30/96

11/3/89	Addressee	
6/29/93	Addressee	THE FAA IS CONSIDERING THE ISSUANCE OF AN NPRM TO ADDRESS THIS SAFETY RECOMMENDATION. THE FAA HAS ASKED THE AVIATION RULEMAKING ADVISORY COMMITTEE TO PARTICIPATE IN THE DRAFTING OF THIS DOCUMENT.
11/4/93	NTSB	THE BOARD NOTES THAT THE FAA IS CONSIDERING THE ISSUANCE OF A NOTICE OF PROPOSED RULEMAKING TO ADDRESS THIS RECOMMENDATION AND HAS ASKED THE AVIATION RULEMAKING ADVISORY COMMITTEE TO PARTICIPATE IN THE DRAFTING OF THE DOCUMENT. BASED ON THIS INFORMATION, THE BOARD CLASSIFIES RECOMMENDATION A-89-94 "OPEN--ACCEPTABLE RESPONSE."
9/5/96	Addressee	THE FAA ASKED THE AIRCRAFT INDUSTRY TO FORM AN INDUSTRY TASK GROUP TO REVIEW CARGO DOOR DESIGNS ON THE FLEET OF TRANSPORT AIRPLANES & TO PROVIDE THE FAA WITH RECOMMENDATIONS REGARDING ANY DEFICIENCIES FOUND AS A RESULT OF THE REVIEW. SUBSEQUENTLY, THE FAA ISSUED AIRWORTHINESS DIRECTIVES (AD'S) IN ACCORDANCE WITH THE RECOMMENDATIONS RECEIVED FROM THE TASK GROUP TO PREVENT NON-PLUG CARGO DOORS FROM OPENING IN FLIGHT. COPIES OF THE AD'S WERE PROVIDED TO THE BOARD IN RESPONSE OF A-89-93. THE FAA IS SATISFIED THAT THE TASK GROUP REVIEWED THESE DESIGNS I AN EFFECTIVE & COMPREHENSIVE CONSIDERATIONS IN BOTH 14 CFR 25.783 (AS AMENDED BY AMENDMENT 25-72 & ADVISORY CIRCULAR 25-783-1 ARE ADEQUATE FOR THE CURRENT FLEET OF TRANSPORT CATEGORY AIRPLANES. THE FAA ALSO DEVELOPED A TRAINING COURSE FOR AIRCRAFT CERTIFICATION ENGINEERS TO ADDRESS THE FAIL-SAFE DESIGN REQUIREMENTS & THE HUMAN FACTORS ASPECTS OF PROPER DOOR LOCKING & LATCHING MECHANISMS. ALL CERTIFICATION ENGINEERS ASSIGNED TO WORK ON DOOR ISSUES HAVE RECEIVED THE TRAINING. I BELIEVE THAT THE FAA HAS TAKEN APPROPRIATE ACTION TO ADDRESS THIS RECOMMENDATION, & I CONSIDER THE FAA'S ACTION TO BE COMPLETED.
10/30/96	NTSB	THE BOARD NOTES THAT THE FAA URGED THE AIRCRAFT INDUSTRY TO FORM A TASK GROUP TO REVIEW CARGO DOOR DESIGNS & TO PROVIDE THE FAA WITH RECOMMENDATIONS REGARDING ANY DEFICIENCIES NOTED DURING THE REVIEW. SUBSEQUENTLY, THE FAA ISSUED AIRWORTHINESS DIRECTIVES IN RESPONSE TO THE RECOMMENDATIONS DEVELOPED BY THE

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

TASK GROUP TO PREVENT NON-PLUG DOORS FROM OPENING IN FLIGHT. THE FAA ALSO DEVELOPED A TRAINING COURSE FOR ALL AIRCRAFT CERTIFICATION ENGINEERS TO ADDRESS THE FAIL-SAFE DESIGN REQUIREMENTS & THE HUMAN FACTORS ASPECTS OF PROPER DOOR LOCKING & LATCHING MECHANISMS. ALL CERTIFICATION ENGINEERS ASSIGNED TO WORK ON DOOR ISSUES HAVE RECEIVED THE TRAINING. IN VIEW OF THE ACTIONS TAKEN BY THE FAA, THE BOARD CLASSIFIES A-89-94 "CLOSED--ACCEPTABLE ACTION"

Log Number 2194A

Issue Date **1/17/90** TUSAYAN AZ 27-Sep-89

ON SEPTEMBER 27, 1989, GRAND CANYON AIRLINES, FLIGHT CANYON 5, A DE HAVILLAND DHC-6-300, TWIN OTTER N75GC, CRASHED DURING ITS ATTEMPTED LANDING AT THE GRAND CANYON NATIONAL PARK AIRPORT, TUSAYAN, ARIZONA. THE 2 CREWMEMBERS AND 8 OF THE PASSENGERS WERE FATALLY INJURED; OF THE REMAINING 11 PASSENGERS, 9 SUSTAINED SERIOUS INJURIES AND 2 SUSTAINED MINOR INJURIES. NO FIRE OCCURRED.

Recommendation # A-90-003

Overall Status CAA — **CLOSED - ACCEPTABLE ACTION**

Priority **CLASS II**

THE NTSB RECOMMENDS THAT THE ARIZONA DEPARTMENT OF TRANSPORTATION, GRAND CANYON NATIONAL PARK AIRPORT: INSTALL AN AUTO-TRANSFER START SYSTEM ON EMERGENCY ELECTRICAL GENERATOR FOR AUTOMATIC START-UP OF THE GENERATOR IF COMMERCIAL ELECTRICAL POWER IS LOST.

ARIZONA, DOT	CLOSED - ACCEPTABLE ACTION	8/28/90

3/26/90	Addressee	"INSTALLATION OF AN AUTO-TRANSFER START SYSTEM ON THE EMERGENCY ELECTRICAL GENERATOR FOR AUTOMATIC START-UP OF THE GENERATOR SHOULD BE COMPLETED BY SEPTEMBER 1990."
8/2/90	NTSB	
8/28/90	Addressee	AUTOSWITCH WAS COMPLETED 8/10/90, COMMUNICATIONS EQUIPMENT WAS EQUIPPED WITH NICAD BATTERIES & A TRICKLE CHARGER, AND DIRECT CALL-DOWN LINES TO THE AIRPORT MANAGER'S OFFICE WERE ADDED.
11/30/90	NTSB	

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2252

Issue Date 8/1/90 MANILA RP 11-May-90

ON MAY 11, 1990 A BOEING 737-300, IRELAND REGISTRATION EI-BZB, LEASED TO AND OPERATED BY PHILIPPINE AIR LINES, EXPLODED AND BURNED AT MANILA, REPUBLIC OF THE PHILIPPINES, SHORTLY AFTER PUSHBACK FROM THE RAMP. AT THE TIME OF THE ACCIDENT, THE AIRPLANE WAS OPERATING ON POWER FROM THE AUXILIARY POWER UNIT. OF THE 119 PERSONS ON BOARD, 8 PERSONS FATALLY INJURED AND 30 RECEIVED SERIOUS INJURIES. THE AIRPLANE WAS DESTROYED BY FIRE.

Recommendation # A-90-100 **Overall Status** CUA **Priority**

CLOSED - UNACCEPTABLE ACTION **CLASS I**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE TO REQUIRE IMMEDIATE INSPECTION OR TESTING OF FLOAT SWITCH WIRING FROM THE FLOAT SWITCHES TO THE REFUELING PANEL FOR CHAFFED OR DAMAGED IN SULATION MATERIAL ON BOEING 737-300, -400, AND -500 SERIES AIRPLANES. THE DIRECTIVE SHOULD STATE THAT SPECIAL EMPHASIS BE PLACED ON INSPECTING THE WIRE BUNDLE WHERE IT PASSES THROUGH THE WING PYLON VAPOR SEALS AND UNDER THE WIRE BUNDLE CLAMPS.

FAA	CLOSED - UNACCEPTABLE ACTION	5/2/91

10/9/90 Addressee (SUMMARIZED) THE INVESTIGATION OF THE ACCIDENT IS STILL IN PROGRESS. THE FAA IS WORKING WITH BOEING, THE PHILLIPINE AUTHORITIES, AND COMPONENT MANUFACTURERS AND PLANS NO ACTION UNTIL THE INVESTIGATION PROVIDES EVIDENCE. I WILL APPRISE THE BOARD....

12/21/90 NTSB

5/2/91 Addressee THE FAA DOES NOT PLAN TO ISSUE AN AD AT THIS TIME AGAINST THE FLOAT SWITCH WIRING. DURING THE INVESTIGATION, A NICK APPROXIMATELY 3/8-INCH LONG WAS FOUND IN ONE OF THE FLOAT SWITCH WIRES, EXPOSING THE CONDUCTOR. IN ABOUT THE SAME LOCATION IN THE WIRE BUNDLE, THE 15-VOLT NUMBER 6 SLAT PROXIMITY SENSOR AND THE 115-VOLT INPUT WIRE TO THE RIGHT WING ANTI-ICE VALVE WERE ALSO DAMAGED. ASSUMING AN INTERNAL SHORT TO THE CASE OF THE FLOAT SWITCH, THE MAXIMUM HEAT DISSIPATED IN THE SWITCH FROM THE 15-VOLT SOURCE WOULD BE LESS THAN 9.9 MILLIWATTS. THIS IS FAR BELOW THE LEVELS REQUIRED TO INCREASE THE SWITCH TEMPERATURE TO IGNITION LEVELS. ASSUMING 115 VOLTS WERE APPLIED TO THE FLOAT SWITCH WIRING, THE NEGATIVE HALF-CYCLE OF THE AC SINUSOID WOULD BE SHORT CIRCUITED BY A DIODE. THE DIODE IN THE ACCIDENT AIRPLANE WAS NOT DAMAGED, THUS INDICATING THAT IT DID NOT EXPERIENCE THE 115-VOLT POWER.

3/24/92 NTSB

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2252

Issue Date 8/1/90 MANILA RP 11-May-90

ON MAY 11, 1990 A BOEING 737-300, IRELAND REGISTRATION EI-BZB, LEASED TO AND OPERATED BY PHILIPPINE AIR LINES, EXPLODED AND BURNED AT MANILA, REPUBLIC OF THE PHILIPPINES, SHORTLY AFTER PUSHBACK FROM THE RAMP. AT THE TIME OF THE ACCIDENT, THE AIRPLANE WAS OPERATING ON POWER FROM THE AUXILIARY POWER UNIT. OF THE 119 PERSONS ON BOARD, 8 PERSONS FATALLY INJURED AND 30 RECEIVED SERIOUS INJURIES. THE AIRPLANE WAS DESTROYED BY FIRE.

Recommendation # A-90-102

Overall Status CUA — CLOSED - UNACCEPTABLE ACTION

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE APPLICABLE TO ALL 14 CFR PART 121 AIRPLANES TO REQUIRE, AT THE NEXT SCHEDULED MAJOR MAINTENANCE INSPECTION, AN INSPECTION OF THE WIRES IN WIRE BUNDLES IN THE WINGS WHERE ADDITIONAL WIRING HAS BEEN ADDED SINCE THE AIRPLANE WAS MANUFACTURED. THE INSPECTION SHOULD BE DIRECTED TO THE DETERMINATION OF INSULATION DAMAGE WHERE THE WIRE BUNDLE IS UNDER CLAMPS AND INSIDE VAPOR SEALS AND PRESSURE SEALS.

FAA	CLOSED - UNACCEPTABLE ACTION	5/2/91

10/9/90	Addressee	(SUMMARIZED) THE INVESTIGATION OF THE ACCIDENT IS STILL IN PROGRESS. THE FAA IS WORKING WITH BOEING, THE PHILLIPINE AUTHORITIES, AND COMPONENT MANUFACTURERS AND PLANS NO ACTION UNTIL THE INVESTIGATION PROVIDES EVIDENCE. I WILL APPRISE THE BOARD....
12/21/90	NTSB	
5/2/91	Addressee	THE BOEING 737 MAINTENANCE PLANNING DOCUMENT, WHICH IS THE INITIAL MANUFACTURER'S RECOMMENDED INSPECTION REQUIREMENTS FOR U.S. OPERATORS OF BOEING 737-300 AIRPLANES, RECOMMENDS A ZONAL VISUAL INSPECTION OF THE INTERIOR CENTER WING TANK AT EVERY 7C CHECK (APPROXIMATELY 21,000 FLIGHT HOURS). THIS CHECK ENCOMPASSES THE INSPECTION OF THE WIRES AND WIRE BUNDLES. A ZONAL INSPECTION OF THE LEFT, RIGHT, AND CENTER WING AT INTERVALS OF 20,000 FLIGHT HOURS IS ALSO ACCOMPLISHED.
3/24/92	NTSB	

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2303

Issue Date 8/14/91 GOOSE BAY CAN 17-Mar-91

ON MARCH 17, 1991, AT 1618 ATLANTIC STANDARD TIME, DELTA AIR LINES FLIGHT 15, 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 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 PASSENGER SEATS (SEAT 41A). THE FLIGHT ATTENDANT PROMPTLY DISCHARGED A HALON FIRE EXTINGUSIHER 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.

Recommendation # A-91-070

Overall Status CAA **Priority**

CLOSED - ACCEPTABLE ACTION **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE SPECIFIC QUALITY CONTROL & 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.

FAA	CLOSED - ACCEPTABLE ACTION	10/5/93

10/30/91 Addressee — THE FAA REVIEWED BOEING'S AND MCDONNELL DOUGLAS' APPROVED QUALITY CONTROL AND TYPE DESIGN DATA FOR WIRE BUNDLE INSTALLATION AS THEY APPLY TO PROPER BEND RADII, CHAFE PROTECTION, AND ROUTING PRACTICES AND DETERMINED THAT THE APPROVED INSPECTION CRITERIA FOR THE WIRE BUNDLE INSTALLATIONS ARE ADEQUATE. THE FAA'S REVIEW ALSO INDICATED THAT THE INSPECTION ACCEPTANCE RECORDS ARE ADEQUATELY MAINTAINED AND DOCUMENTED. THE FAA IS REQUESTING THAT EACH CERTIFICATION DIRECTORATE EVALUATE ITS TRANSPORT CATEGORY MANUFACTURERS' WIRE BUNDLE INSPECTION REQUIREMENTS AND PLACE SPECIAL EMPHASIS ON THESE SYSTEMS DURING THE NEXT AUDIT OR EVALUATION.

4/29/92 NTSB

10/5/93 Addressee — THE FAA REVIEWED BOEING'S AND MCDONNELL DOUGLAS' APPROVED QUALITY CONTROL AND TYPE DESIGN DATA FOR WIRE BUNDLE INSTALLATION AS THEY APPLY TO PROPER BEND RADII, CHAFE PROTECTION, AND ROUTING PRACTICES AND DETERMINED THAT THE APPROVED INSPECTION CRITERIA FOR THE WIRE BUNDLE INSTALLATION WERE ADEQUATE. EACH CERTIFICATION DIRECTORATE HAS ALSO BEEN ASKED TO EVALUATE ITS TRANSPORT CATEGORY MANUFACTUERERS' WIRE BUNDLE INSPECTION REQUIREMENTS AND PLACE SPECIAL EMPHASIS ON THESE SYSTEMS DURING THE NEXT AUDIT OR EVALUATION. TO ENSURE THAT EFFECTIVE QUALITY CONTROL PROCEDURES ARE CARRIED OUT AT THE FACILITIES OF INDIVIDUAL OPERATORS, THE FAA ISSUED HANDBOOK BULLETIN 91-15, ORIGIN AN PROPAGATION OF INACESSIBLE AIRCRAFT FIRE UNDER IN-FLIGHT AIRFLOW CONDITIONS. THE BULLELTIN REQUESTS THAT PRINCIPAL MAINTENANCE INSPECTORS REVIEW THEIR OPERATORS MAINTENANCE PROGRAMS TO ENSURE THAT THEY INCLUDE INSPECTION OF AIRCRAFT WIRING, ESPECIALLY IN INACESSIBLE AREAS. THE BULLETIN SPECIFICALLY REFERENCE ADVISORY CIRCULAR 43.13-1A, ACCEPTABLE METHODS, TECHNIQUES, AND PRACTICES–AIRACRAFT INSPECTION AND REPAIR, PAGE 203 CHAPTER 11, SECTION 7, PARAGRAPH 515, CONCERNING WIRE BEND RADII, THIS BULLETIN HAS BEEN

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

		INCORPORATED INTO FAA ORDER 8300.10, AIRWORTHINESS INSPECTORS HANDBOOK.
2/10/94	NTSB	THE BOARD HAS REVIEWED HANDBOOK BULLETIN 91-15, "ORIGIN AND PROPAGATION OF INACCESSIBLE AIRCRAFT FIRE UNDER IN-FLIGHT AIRFLOW CONDITIONS," WHICH REQUESTS FLIGHT STANDARDS PRINCIPAL MAINTENANCE INSPECTORS TO REVIEW THEIR OPERATORS' MAINTENANCE PROGRAMS TO ENSURE THAT THE PROGRAMS INCLUDE INSPECTION OF AIRCRAFT WIRING, AND TO ENSURE THAT EFFECTIVE QUALITY CONTROL PROCEDURES ARE IN PLACE THAT WOULD DISCOVER INSULATION BREAKDOWNS. THE BOARD NOTES THAT THE FOREGOING MATERIAL HAS BEEN INCORPORATED INTO FAA ORDER 8300.10 "AIRWORTHINESS INSPECTORS HANDBOOK." BASED ON THIS INFORMATION, RECOMMENDATION A-91-70 IS CLASSIFIED "CLOSED–ACCEPTABLE ACTION."

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2303

Issue Date 8/14/91 **GOOSE BAY CAN** **17-Mar-91**

ON MARCH 17, 1991, AT 1618 ATLANTIC STANDARD TIME, DELTA AIR LINES FLIGHT 15, 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 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 PASSENGER SEATS (SEAT 41A). THE FLIGHT ATTENDANT PROMPTLY DISCHARGED A HALON FIRE EXTINGUSIHER 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.

Recommendation # A-91-071

Overall Status CAA **CLOSED - ACCEPTABLE ACTION** **Priority** **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: NOTIFY PRINCIPAL MAINTENANCE INSPECTORS & OPERATORS OF TRANSPORT CATEGORY AIRCRAFT OF THE FIRE HAZARD POSED BY ACCUMULATIONS OF LINT AND OTHER DEBRIS ON WIRE BUNDLES.

FAA	CLOSED - ACCEPTABLE ACTION	8/13/92

10/30/91	Addressee	THE FAA HAS DRAFTED AN AIRWORTHINESS INSPECTOR'S HANDBOOK BULLETIN ENTITLED ORIGIN AND PROPAGATION OF INACCESSIBLE AIRCRAFT FIRE UNDER INFLIGHT AIRFLOW CONDITIONS. THIS BULLETIN PROVIDES INFORMATION ON THE POTENTIAL SAFETY HAZARD APPLICABLE TO ALL TRANSPORT CATEGORY AIRCRAFT FROM THE ACCUMULATION OF LINT AND OTHER DEBRIS ON WIRE BUNDLES. THIS BULLETIN REQUESTS THAT PRINCIPAL MAINTENANCE INSPECTORS DISSEMINATE THIS INFORMATION TO ALL OPERATORS OF TRANSPORT CATEGORY AIRCRAFT. THE BULLETIN ALSO REQUESTS THAT PRINCIPAL MAINTENANCE INSPECTORS REVIEW THEIR OPERATORS' MAINTENANCE PROGRAMS TO ENSURE THAT THEY INCLUDE INSPECTION OF AIRCRAFT WIRING AND REMOVAL OF CONTAMINANTS, ESPECIALLY IN ACCESSIBLE AREAS.
4/29/92	NTSB	
8/13/92	Addressee	THE FAA AGREES WITH THIS SAFETY RECOMMENDATION. ON DECEMBER 9, 1991, THE FAA ISSUED HANDBOOK BULLETIN 91-15, ORIGIN AND PROPAGATION OF INACESSIBLE AIRCRAFT FIRE UNDER IN-FLIGHT AIRFLOW CONDITIONS. THIS BULLETIN PROVIDES INFORMATION ON THE POTENTIAL SAFETY HAZARD APPLICABLE TO ALL TRANSPORT CATEGORY AIRCRAFT FROM THE ACCUMULATION OF LINT AND OTHER DEBRIS ON WIRE BUNDLES. THIS BULLETIN REQUESTS THAT PRINCIPAL MAINTENANCE INSPECTORS OF TRANSPORT CATEGORY AIRCRAFT OPERATORS ENSURE THAT PROGRAMS ARE IN PLACE TO ADDRESS THE INSPECTION OF AIRCRAFT WIRING AND THE REMOVAL OF CONTAMINANTS, ESPECIALLY IN INACCESSIBLE AREAS. THIS BULLETIN HAS BEEN COORDINATED WITH THE AIRCRAFT CERTIFICATION SERVICE AND WILL BE DISTRIBUTED TO ALL CERTIFICATION OFFICES FOR THEIR INFORMATION AND COORDINATION WITH MANUFACTURERS FOR INCLUSION IN FUTURE DESIGN CONSIDERATIONS.
10/20/92	NTSB	THE BOARD NOTES THAT THE FAA AGREES WITH THIS RECOMMENDATION & ON 12/9/91, ISSUED HANDBOOK BULLETIN 91-15, ORIGIN & PROPAGATION OF INACCESSIBLE AIRCRAFT FIRE UNDER IN-FLIGHT AIRFLOW CONDITIONS. THIS BULLETIN PROVIDES INFORMATION ON THE POTENTIAL SAFETY HAZARD (APPLICABLE TO ALL TRANSPORT CATEGORY AIRCRAFT) FROM THE

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ACCUMULATION OF LINT & OTHER DEBRIS ON WIRE BUNDLES. ALSO, THIS BULLETIN HAS BEEN COORDINATED WITH THE AIRCRAFT CERTIFICATION SERVICE & WILL BE DISTRIBUTED TO ALL CERTIFICATION OFFICES FOR THEIR INFORMATION & COORDINATION WITH MANUFACTURERS FOR INCLUSION IN FUTURE DESIGN CONSIDERATIONS. BASED ON THIS INFORMATION, RECOMMENDATION A-91-71 IS CLASSIFIED AS "CLOSED--ACCEPTABLE ACTION."

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2309

Issue Date 8/28/91 JAMACIA NY 13-Jun-91

ON JUNE 13, 1991, UNITED AIRLINES (UAL) MAINTENANCE PERSON NEL WERE UNABLE TO ELECTRICALLY OPEN THE AFT CARGO DOOR ON A BOEING 747-222B, N152UA, AT JOHN F. KENNEDY AIRPORT (JFK), JAMAICA, NEW YORK. THE AIRPLANE WAS ONE OF TWO USED EX CLUSIVELY ON NONSTOP FLIGHTS BETWEEN NARITA, JAPAN, & JFK. THIS PARTICULAR AIRPLANE HAD ACCUMULATED 19,053 HOURS AND 1,547 CYCLES AT THE TIME OF THE OCCURRENCE.

Recommendation # A-91-083

Overall Status CR — **CLOSED - RECONSIDERED**

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE APPLICABLE TO ALL BOEING 747 AIRPLANES WITH A FLEXIBLE CONDUIT PROTECTING THE WIRING BUNDLE BETWEEN THE FUSELAGE & AFT CARGO DOOR TO RE QUIRE AN EXPEDITED INSPECTION OF: 1) THE WIRING BUNDLE IN THE AREA NORMALLY COVERED BY THE CONDUIT FOR THE PRESENCE OF DAMAGED INSULATION (USING EITHER AN ELECTRICAL TEST METHOD OR VISUAL EXAMINATION); 2) THE CONDUIT SUPPORT BRACKET AND ATTACHED STANDOFF PIN ON THE UPPER ARM OF THE FORWARD LIFT ACTUATOR MECHANISM; 3) THE FLEXIBLE CONDUIT FOR THE PRESENCE OF CRACKING IN THE CONVOLUTED INNERCORE. WIRES WITH DAMAGED INSULATION SHOULD BE REPAIRED BEFORE FURTHER SERVICE. DAMAGE TO THE FLEXIBLE CONDUIT, CONDUIT SUPPORT BRACKET & STANDOFF PIN SHOULD RESULT IN AN IMMEDI ATE REPLACEMENT OF THE CONDUIT AS WELL AS THE DAMAGED PARTS. THE INSPECTION SHOULD BE REPEATED AT AN APPROPRIATE CYCLIC INTERVAL.

FAA	CLOSED - RECONSIDERED	4/5/93

11/1/91	Addressee	THE FEDERAL AVIATION ADMINISTRATION AGREES WITH THE INTENT OF THESE RECOMMENDATIONS AND IS CONSIDERING THE ISSUANCE OF A NOTICE OF PROPOSED RULEMAKING TO ADDRESS THESE ISSUES.
11/27/91	NTSB	
4/5/93	Addressee	THE FAA AGREES WITH THE INTENT OF THE RECOMMENDATION AND ISSUED AN NPRM. THE NPRM WAS WITHDRAWN, HOWEVER, BECAUSE THE FAA AND BOEING FOUND THAT THE LEVEL OF REDUNDANCY PROTECTION IN THE CARGO DOORS IS SUFFICIENT TO PRECLUDE THE NECESSITY OF PERFORMING A PERIODIC INSPECTION OF THE WIRE BUNDLES. THE FAA IS CONVINCED THAT AD 90-09-06 IS SUFFICIENT TO MAINTAIN THE DOOR OPENING/LOCKING DEVICES. FURTHER, DISCUSSION WITH FAA STAFF HAS REVEALED THAT THE FAA IS ALSO CONCERNED THAT SAFETY PROBLEMS COULD ACTUALLY BE CREATED DURING THE SUGGESTED INTRUSIVE INSPECTIONS THAT MIGHT BE MORE HAZARDOUS THAN THE CHAFFED WIRES SHORTED CIRCUITS.
11/8/93	NTSB	THE BOARD FURTHER RECOMMENDED THAT WIRES WITH DAMAGED INSULATION BE REPAIRED BEFORE FURTHER SERVICE. DAMAGE TO THE FLEXIBLE CONDUIT, CONDUIT SUPPORT BRACKET, AND STANDOFF PIN SHOULD RESULT IN AN IMMEDIATE REPLACEMENT OF THE CONDUIT AS WELL AS THE DAMAGED PARTS. THE INSPECTION SHOULD BE REPEATED AT AN APPROPRIATE CYCLIC INTERVAL. THE BOARD THAN ASKED, THE SAFETY RECOMMENDATION A-91-84, THAT THE FAA EVALUATE THE DESIGN, INSTALLATION, AND OPERATION OF THE FORWARD CARGO DOOR FLEXIBLE CONDUITS ON BOEING 747 AIRPLANES SO EQUIPPED AND ISSUE, IF WARRANTED, AN AIRWORTHINESS DIRECTIVE FOR INSPECTION AND REPAIR OF THE FLEXIBLE CONDUIT AND UNDERLYING WIRING BUNDLE, SIMILAR TO THE PROVISIONS RECOMMENDED IN RECOMMENDATION A-91-83. BASED ON THE LEVEL OF REDUNDANCY THAT NOW EXISTS TO PREVENT INADVERTENT DOOR OPENING IN FLIGHT, THE BOARD HAS CLASSIFIED RECOMMENDATIONS A-91-83 AND -84 AS "CLOSED--RECONSIDERED." THE BOARD WILL CLOSELY MONITOR INCIDENTS RELATED TO THE UNCOMMANDED OPENING OF CARGO DOORS ON 747 AIRPLANES TO FURTHER DOCUMENT THIS POSITION.

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2309

Issue Date 8/28/91 JAMACIA NY 13-Jun-91

ON JUNE 13, 1991, UNITED AIRLINES (UAL) MAINTENANCE PERSON NEL WERE UNABLE TO ELECTRICALLY OPEN THE AFT CARGO DOOR ON A BOEING 747-222B, N152UA, AT JOHN F. KENNEDY AIRPORT (JFK), JAMAICA, NEW YORK. THE AIRPLANE WAS ONE OF TWO USED EX CLUSIVELY ON NONSTOP FLIGHTS BETWEEN NARITA, JAPAN, & JFK. THIS PARTICULAR AIRPLANE HAD ACCUMULATED 19,053 HOURS AND 1,547 CYCLES AT THE TIME OF THE OCCURRENCE.

Recommendation # A-91-084

Overall Status CR — CLOSED - RECONSIDERED

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: EVALUATE THE DESIGN, INSTALLATION, & OPERATION OF THE FORWARD CARGO DOOR FLEXIBLE CONDUITS ON BOEING 747 AIRPLANES SO EQUIPPED & ISSUE, IF WARRANTED, AN AIRWORTHINESS DIRECTIVE FOR INSPECTION & REPAIR OF THE FLEXIBLE CONDUIT & UNDERLYING WIRING BUNDLE, SIMILAR TO THE PROVISIONS RECOMMENDED IN A-91-83.

FAA	CLOSED - RECONSIDERED	4/5/93

11/1/91	Addressee	THE FEDERAL AVIATION ADMINISTRATION AGREES WITH THE INTENT OF THESE RECOMMENDATIONS AND IS CONSIDERING THE ISSUANCE OF A NOTICE OF PROPOSED RULEMAKING TO ADDRESS THESE ISSUES.
11/27/91	NTSB	
4/5/93	Addressee	THE FAA AGREES WITH THE INTENT OF THE RECOMMENDATION AND ISSUED AN NPRM. THE NPRM WAS WITHDRAWN, HOWEVER, BECAUSE THE FAA AND BOEING FOUND THAT THE LEVEL OF REDUNDANCY PROTECTION IN THE CARGO DOORS IS SUFFICIENT TO PRECLUDE THE NECESSITY OF PERFORMING A PERIODIC INSPECTION OF THE WIRE BUNDLES. THE FAA IS CONVINCED THAT AD 90-09-06 IS SUFFICIENT TO MAINTAIN THE DOOR OPENING/LOCKING DEVICES. FURTHER, DISCUSSION WITH FAA STAFF HAS REVEALED THAT THE FAA IS ALSO CONCERNED THAT SAFETY PROBLEMS COULD ACTUALLY BE CREATED DURING THE SUGGESTED INTRUSIVE INSPECTIONS THAT MIGHT BE MORE HAZARDOUS THAN THE CHAFFED WIRES SHORTED CIRCUITS.
11/8/93	NTSB	THE BOARD FURTHER RECOMMENDED THAT WIRES WITH DAMAGED INSULATION BE REPAIRED BEFORE FURTHER SERVICE. DAMAGE TO THE FLEXIBLE CONDUIT, CONDUIT SUPPORT BRACKET, AND STANDOFF PIN SHOULD RESULT IN AN IMMEDIATE REPLACEMENT OF THE CONDUIT AS WELL AS THE DAMAGED PARTS. THE INSPECTION SHOULD BE REPEATED AT AN APPROPRIATE CYCLIC INTERVAL. THE BOARD THAN ASKED, THE SAFETY RECOMMENDATION A-91-84, THAT THE FAA EVALUATE THE DESIGN, INSTALLATION, AND OPERATION OF THE FORWARD CARGO DOOOR FLEXIBLE CONDUITS ON BOEING 747 AIRPLANES SO EQUIPPED AND ISSUE, IF WARRANTED, AN AIRWORTHINESS DIRECTIVE FOR INSPECTION AND REPAIR OF THE FLEXIBLE CONDUIT AND UNDERLYING WIRING BUNDLE, SIMILAR TO THE PROVISIONS RECOMMENDED IN RECOMMENDATION A-91-83. BASED ON THE LEVEL OF REDUNDANCY THAT NOW EXISTS TO PREVENT INADVERTENT DOOR OPENING IN FLIGHT, THE BOARD HAS CLASSIFIED RECOMMENDATIONS A-91-83 AND -84 AS "CLOSED--RECONSIDERED." THE BOARD WILL CLOSELY MONITOR INCIDENTS RELATED TO THE UNCOMMANDED OPENING OF CARGO DOORS ON 747 AIRPLANES TO FURTHER DOCUMENT THIS POSITION.

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2352

Issue Date 4/9/92 HONOLULU HI 24-Feb-89

ON FEBRUARY 24, 1989, UNITED AIRLINES FLIGHT 811, A BOEING 747-122 (B-747), N4713U, WAS OPERATING AS A REGULARLY SCHEDULED FLIGHT FROM LOS ANGELES, CALIFORNIA, TO SYDNEY, AUSTRALIA, WITH INTERMEDIATE STOPS IN HONOLULU, HAWAII, AND AUCKLAND, NEW ZEALAND. THERE WAS 3 FLIGHT CREWMEMBERS 15 FLIGHT ATTENDANTS AND 337 PASSENGERS ABOARD THE AIRPLANE. THE FLIGHTCREW'S FIRST INDICATION OF A PROBLEM WAS WHILE THE AIRPLANE WAS CLIMBING BETWEEN 22,000 AND 23,000 FEET AT AN INDICATED AIRSPEED OF 300 KNOTS. THEY HEARD A SOUND, DESCRIBED AS A "THUMP," WHICH SHOOK THE AIRPLANE. THIS SOUND WAS FOLLOWED IMMEDIATELY BY A "TREMENDOUS EXPLOSION." THE AIRPLANE HAD EXPERIENCED AN EXPLOSIVE DECOMPRESSION. POWER WAS LOST FROM THE NOS. 3 AND 4 ENGINES BECAUSE OF DAMAGE FROM FOREIGN OBJECT INGESTION.

Recommendation # A-92-021

Overall Status CAAA — CLOSED - ACCEPTABLE ALTERNATE ACTION

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE THAT THE ELECTRICAL ACTUATING SYSTEMS FOR NONPLUG CARGO DOORS ON TRANSPORT-CATEGORY AIRCRAFT PROVIDE FOR THE REMOVAL OF ALL ELECTRICAL POWER FROM CIRCUITS ON THE DOOR AFTER CLOSURE (EXCEPT FOR ANY INDICATING CIRCUIT POWER NECESSARY TO PROVIDE POSITIVE INDICATION THAT THE DOOR IS PROPERLY LATCHED AND LOCKED) TO ELIMINATE THE POSSIBILITY OF UNCOMMANDED ACTUATOR MOVEMENTS CAUSED BY WIRING SHORT CIRCUITS.

FAA	CLOSED - ACCEPTABLE ALTERNATE ACTION	4/20/93

6/22/92	Addressee	THE FAA HAS INITIATED A REVIEW OF ALL OUTWARD OPENING NONPLUG CARGO DOORS ON TRANSPORT CATEGORY AIRPLANES. ONE ASPECT OF THIS REVIEW IS TO VERIFY THAT ALL ELECTRICAL POWER TO THE DOORS (EXCEPT FOR ANY INDICATING CIRCUIT POWER NECESSARY TO PROVIDE POSITIVE INDICATION THAT THE DOOR IS PROPERLY LATCHED AND LOCKED) IS REMOVED IN FLIGHT. THE FAA HAS COMPLETED ITS REVIEW OF THE BOEING MODELS 747, 757, 767, 737, AND 727 AND CONCLUDED THAT THE POWER IS REMOVED FROM THE DOORS IN FLIGHT. CONSEQUENTLY, THE FAA DOES NOT PLAN TO INITIATE MANDATORY ACTION ON THESE MODELS.
8/31/92	NTSB	THE SAFETY BOARD BELIEVES THAT BY REQUIRING THAT ALL ELECTRICAL POWER BE REMOVED FROM DOOR ACTUATING CIRCUITS AFTER CLOSURE, THE POSSIBILITY OF UNCOMMANDED ACTUATOR MOVEMENTS CAUSED BY WIRING SHORT CIRCUITS THAT MIGHT OCCUR BETWEEN THE TIME THAT THE DOOR IS CLOSED AND THE TIME THAT THE AIRPLANE TAKES OFF IS ELIMINATED. PENDING FURTHER INFORMATION, THE SAFETY BOARD CLASSIFIES SAFETY RECOMMENDATION A-92-21 AS "OPEN-AWAIT RESPONSE."
4/20/93	Addressee	THE FAA HAS COMPLETED ITS REVIEW OF THIS RECOMMENDATION AND AGREES WITH THE INTENT. THE FAA HAS EVALUATED THE DOOR DESIGNS OF ALL LARGE TRANSPORT CATEGORY AIRPLANES FOR ISOLATION OF POWER TO THE DOORS DURING FLIGHT. ALL OF THE NONPLUG DOORS ON THESE CATEGORY AIRPLANES HAVE BEEN MODIFIED AS NECESSARY TO ACHIEVE THIS OBJECTIVE. NONPLUG DOORS ALREADY HAVE A SEPARATE POWER SWITCH AT THE DOOR OPERATOR'S STATION THAT REMOVES POWER FROM THE DOOR. SOME SWITCHES OPERATE DIRECTLY WHILE OTHERS, SUCH AS THE POWER SWITCHES ON THE BOEING MODELS 737, 747, AND 767, ARE OPERATED BY THE LOCK HANDLE. THE BOEING MODELS 727 AND 757 HAVE SEPARATE DISARM SWITCHES. ON THE LIGHTER TRANSPORT CATEGORY AIRPLANES, THE OUTWARD OPENING DOORS WITHOUT POWERED LATCHES AND LOCKS DO NOT HAVE THE POTENTIAL SAFETY PROBLEMS ASSOCIATED

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	WITH INADVERTENT OPERATION DUE TO ELECTRICAL SHORTS.
8/10/93 NTSB	THE BOARD NOTES THAT DURING THE PAST YEAR THE FAA HAS WORKED WITH & ENCOURAGED THE AIRLINE INDUSTRY IN THE DEVELOPMENT OF NEW METHODS FOR REMOVAL OF ELECTRICAL POWER FROM NONPLUG CARGO DOOR ACTUATING SYSTEMS ON TRANSPORT-CATEGORY AIRCRAFT. FURTHERMORE, THE FAA HAS REVIEWED THE NONPLUG CARGO DOOR CONFIGURATIONS CURRENTLY INSTALLED ON LARGE TRANSPORT-CATEGORY AIRPLANES & FOUND THAT ELECTRICAL POWER IS REMOVED FROM ALL OF THESE DOORS BEFORE THE AIRPLANE LEAVE THE GATE. ADDITIONALLY, ON SOME OF THESE AIRPLANES, ALL ELECTRICAL POWER TO THE DOOR OPERATING CONTROLS IS REMOVED AS SOON AS AN ENGINE IS STARTED & ITS ASSOCIATED GENERATOR IS PLACED ON-LINE. ANY INADVERTENT CHANGE IN THE POSITION OF THE DOOR LOCK MECHANISMS THAT OCCURRED BEFORE THE REMOVAL OF ELECTRICAL POWER WOULD BE ANNUNCIATED TO THE FLIGHTCREW. THE REVIEW VERIFIED THAT THE WARNING SYSTEMS ON THE DOORS OF THESE AIRPLANES MEET THE POLICIES CONTAINED IN ADVISORY CIRCULAR 25.783-1. THE BOARD ACCEPTS THE FAA POSITION THAT REMOVAL OF ELECTRICAL POWER FROM DOOR CIRCUITS BEFORE TAXI IN CONJUNCTION WITH REDUNDANT & RELIABLE LOCK POSITION WARNING SYSTEMS AS DESCRIBED IN THE AC MEET THE INTENT OF A-92-21. THUS, A-92-21 IS CLASSIFIED "CLOSED--ACCEPTABLE ALTERNATE ACTION."

SUFFICIENT MONITORING FUNCITONS TO WARN THE CREW OF FAILURES, & ANY UNANNUNICIATED FAILURE IS READILY DETECTABLE BY THE CREW FROM OTHER DISPLAYED INFO.

12/14/94 NTSB — THE BOARD NOTES THAT THE FAA REEXAMINED THE DESIGN OF THE LOCKHEED L-1011 STALL WARNING SYSTEM, INCLUDING THE FAILURE MODES, THE RELIABILITY OF THE STALL WARNING SYSTEM, & THE IMPACT OF FALSE STALL WARNING ON THE SAFETY OF FLIGHT. HOWEVER BOARD CONTINUES TO BELIEVE THAT THE FACTS OF THE REFERENCED ACCIDENT ILLUSTRATE THE NEED FOR AIRWORTHINESS ACTIONS TO PREVENT A RECURRENCE. IF THE FAILURE IN THE STALL WARNING SYSTEM THAT LED TO THIS ACCIDENT HAD TRIGGERED SOME WARNING OF AN UNRELIABLE STALL WARNING SYSTEM DURING THE CRITICAL TIME OF ROTATION, THE CREW PROBABLY WOULD HAVE CONTINUED THE TAKEOFF & AVOIDED THE ACCIDENT. IN VIEW OF THE FAA'S POSITION ON THIS ISSUE & ITS INTENT FOR NO FURTHER ACTION, THE BOARD CLASSIFIES A-93-51 "CLOSED--UNACCPETABLE ACTION."

Log Number 2518

Issue Date 7/18/94 — **MUNICH GM** — 16-Oct-93

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 REGULARLY SCHEDULED PASSENGER FLIGHT FROM MUNICH, GERMANY, TO ZURICH, SWITZERLAND. ON BOARD THE AIRPLANE WERE 88 PASSENGERS AND 7 CREWMEMBERS, FOUTREEN PASSENGERS AND ONE CREWMEMBERS 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.

Recommendation # A-94-134

Overall Status CAA: **CLOSED - ACCEPTABLE ACTION** — **Priority**: **CLASS II**

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: DETERMINE THE FEASIBILITY OF REPLACING THE EMERGENCY POWER SWITCH, PART NUMBER (P/N) 103-2200, WITH RELAY TYPE CIRCUIT, OR DEVELOPING A DESIGN THAT WOULD REMOVE ALL NONESSENTIAL HIGH CURRENT RELAYS AND WIRES FROM AIRCRAFT OVERHEAD PANELS AND THE COCKPIT AREA.

FAA	CLOSED - ACCEPTABLE ACTION	10/7/94

10/7/94 Addressee — THE EPS IS LOCATED IN THE COCKPIT TO FACILITATE THE SAFE OPERATION OF THE AIPLANE IN THE EVENT OF A PRIMARY ELETRICAL POWER SYSTEM FAILURE. THE ANALYSIS OF THE DESIGN OF THE DC-9/MD-80 EPS SYSTEM & SWITCH LOCATION CONCLUDED THAT IT IS FEASIBLE TO REDESIGN THE SYSTEM TO REMOVE THE HIGH CURRENT ELECTRIC RELAYS & WIRES FROM THE OVERHEAD PANELS & COCKPIT. HOWEVER, THE FAA IS CONSIDERING THE ISSUANCE OF AD IN RESPONSE TO A-94-133 WHICH WILL PRECLUDE THE NEED FOR THIS SAFETY MODIFICATON.

3/6/95 NTSB — THE BOARD NOTES THAT THE FAA HAS COMPLIED WITH THE INTENT OF THIS RECOMMENDATION BY STUDYING THE FEASIBILITY OF REPLACING THE EMERGENCY POWER SWITCH WITH A RELAY TYPE CIRCUIT. THE FAA STUDY INDICATED THAT REDESIGN OF THE SYSTEM WOULD BE PROHIBITIVELY EXPENSIVE & THAT THE AD MENTIONED IN RESPONSE TO A-94-133 WOULD EFFECTIVELY CORRECT THE PROBLEM THAT CAUSED THE FIRE ON BOARD HB-INH. BASED ON THE ACTIONS TAKEN, A-94-134 IS CLASSIFIED "CLOSED--ACCEPTABLE ACTION."

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2518

Issue Date 7/18/94 MUNICH GM 16-Oct-93

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 REGULARLY SCHEDULED PASSENGER FLIGHT FROM MUNICH, GERMANY, TO ZURICH, SWITZERLAND. ON BOARD THE AIRPLANE WERE 88 PASSENGERS AND 7 CREWMEMBERS, FOUTREEN PASSENGERS AND ONE CREWMEMBERS 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.

Recommendation # A-94-136

Overall Status CAA **CLOSED - ACCEPTABLE ACTION**

Priority CLASS II

THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: 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.

FAA	CLOSED - ACCEPTABLE ACTION	10/7/94

10/7/94	Addressee	THE FAA, IN CONJUCTION WITH MCDONNELL DOUGLAS, COMPLETED A REVIEW TO DETERMINE THE SOURCE OF THE HIGH ELECTRICAL CURRENT WHICH DAMAGED THE EPS & THE REASON FOR THE SPORADIC FAILURE OF THE CAPTAIN'S FLIGHT INSTRUMENTS. THE INVESTIGATION DETECTED BURNT TERMINALS ON THE EPS THAT WERE ATTRIBUTED TO WIRE TERMINALS BECOMING LOOSE & ARCING. THE SWITCH FROM THE AIRPLANE INVOLVED IN THE INCIDENT HAD ACCUMULATED ABOUT 25,000 SWITCHING OPERATIONS. AN ALERT SERVICE BULLETIN BY MCDONNELL DOUGLAS INSTRUCTS ALL DC-9/MD-80 OPERATORS TO INSPECT THE EPS TERMINAL ATTACHMENT SCREWS FOR PROPER TORQUE. THE INVESTIGATION ALSO INDICATED THE POSSIBILITY OF A PROBLEM WITH THE INPUT FILTER CAPACITOR TOLERANCE IN THE POWER INVERTER SINCE THE INVERTER CONTACTS OF THE EPS WERE WORN SLIGHTLY MORE ON ONE TYPE INVERTER THAN THE SWITCH DAMAGE POTENTIAL IMPOSED BY THE INVERTER IS A FUNCTION OF WHERE IN THE TOLERANCE BAND THE ACTUAL CAPACITANCE VALUE IS FOUND.
3/6/95	NTSB	THE BOARD FINDS THAT THE FAA'S ACTION TO DETERMINE THE SOURCE OF THE HIGH ELECTRICAL CURRENT THAT DAMAGED THE EMERGENCY POWER SWITCH & THE REASON FOR THE SPORADIC FAILURE OF THE CAPTAIN'S FLIGHT INSTRUMENTS COMPLIES WITH THE INTENT OF THIS RECOMMENDATION. ADDITIONALLY, THE BOARD AGREES THAT THE PROPOSED AD MENTIONED IN RESPONSE TO A-94-133 SHOULD GREATLY REDUCE THE POTENTIAL FOR FURTHER SUCH INCIDENTS. THEREFORE A-94-136 IS CLASSIFIED CLOSED–ACCEPTABLE ACTION."

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2573

Issue Date **10/17/95** **FRESNO CA** **14-Dec-94**

ON 12/14/94, ABOUT 1146:23 PACIFIC STANDARD TIME (PST), A PHOENIX AIR GROUP, INC. (PHOENIX AIR) LEARJET 35A, REGISTRATION N521PA, CRASHED IN FRESNO, CALIFORNIA. OPERATING UNDER THE CALL SIGN DART 21, THE FLIGHTCREW HAD DECLARED AN EMERGENCY INBOUND TO FRESNO AIR TERMINAL DUE TO ENGINE FIRE INDICATIONS. THEY FLEW THE AIRPLANE TOWARD A RIGHT BASE FOR THEIR REQUESTED RUNWAY, BUT THE AIRPLANE CONTINUED PAST THE AIRPORT. THE FLIGHTCREW WAS HEARD ON FRESNO TOWER FREQUENCY ATTEMPTING TO DIAGNOSE THE EMERGENCY CONDITIONS & CONTROL THE AIRPLINE UNTIL IT CRASHED, WITH LANDING GEAR DOWN, ON AN AVENUE IN FRESNO. BOTH PILOTS WERE FATALLY INJURED. TWENTY-ONE PERSONS ON THE GROUND WERE INJURED, & 12 APARTMENT UNITS IN 2 BUILDINGS WERE DESTROYED OR SUBSTANTIALLY DAMAGED BY IMPACT & FIRE.

Recommendation # A-95-079 **Overall Status** **CAA** **Priority**

CLOSED - ACCEPTABLE ACTION **CLASS II**

THE NTSB RECOMMENDS THAT THE FAA: PUBLISH AN FAA SPECIAL AIRWORTHINESS INFO BULLETIN THAT DESCRIBES THE CIRCUMSTANCES OF THIS ACCIDENT, INCLUDING THE CONSEQUENCES OF IMPROPER INSTALLATION OF THE SPECIAL MISSION WIRING, WHERE ELECRTICAL POWER WIRES WERE UNPROTECTED BY CURRENT LIMITERS. IN ADDITION, EMPHASIZE THAT ALL MAJOR AIRCRAFT REPAIRS & ALTERATIONS REQUIRING FAA FORM 337 MUST BE PERFORMED IN STRICT ACCORDANCE WITH THE TECHNICAL DATA CONTAINED IN THE FAA FORM 337, & THAT IT IS UNACCPETABLE TO USE SIMILAR WORK DONE ON ANOTHER AIRCRAFT AS A TECHNICAL GUIDE IN LIEU OF THE INFO ON THE FAA FORM 337.

FAA	CLOSED - ACCEPTABLE ACTION	12/3/96

12/15/95	Addressee	THE FAA AGREES WITH THE INTENT OF THIS RECOMMENDATION & WILL PUBLISH AN ARTICLE IN ADVISORY CIRCULAR (AC) 43-16, GENERAL AVIATION AIRWORTHINESS ALERTS. THE ALERT WILL DISCUSS THE CIRCUMSTANCES OF THE ACCIDENT, THE CONSEQUENCES OF IMPROPER INSTALLATION OF THE SPECIAL MISSION WIRING WHERE ELECTRICAL POWER WIRES WERE UNPROTECTED BY CURRENT LIMITERS, & THE IMPORTANCE OF PERFORMING ALL REPAIRS & ALTERATIONS IN STRICT ACCORDANCE WITH FAA-APPROVED DATA. IT IS ANTICIPATED THAT THE ARTICLE WILL PUBLISHED DATA. IT IS ANTICIPATED THAT THE ARTICLE WILL BE PUBLISHED IN THE FEBRUARY 1996 EDITION OF AC 43-16. I WILL PROVDE THE BOARD WITH A COPY OF THE ARTICLE AS SOON AS IT IS ISSUED.
5/6/96	NTSB	THE BOARD NOTES THAT THE FAA WILL PUBLISH AN ARTICLE IN ADVISORY CIRCULAR (AC) 43-16, "GENERAL AVIATION AIRWORTHINESS ALERTS." THE ARTICLE WILL DISCUSS THE CIRCUMSTANCES OF THE ACCIDENT, THE CONSEQUENCES OF IMPROPER INSTALLATION OF THE SPECIAL MISSION WIRING WHERE ELECTRICAL POWER WIRES WERE UNPROTECTED BY CURRENT LIMITERS, & THE IMPORTANCE OF PERFORMING ALL REPAIRS & ALTERATIONS IN STRICT ACCORDANCE WITH FAA-APPROVED DATA. THE FAA HAD ANTICIPATED THAT THE ARTICLE WOULD BE PUBLISHED IN THE FEBRUARY 1996 EDITION OF AC 43-16; HOWEVER, THE BOARD HAS RECEIVED A COPY OF THE FEBRUARY 1996 AC 43-16, & IT CONTAINS NO MENTION OF EITHER THE REFERENCED ACCIDENT OR RECOMMENDATION. UNTIL THE ARTICLE IS PUBLISHED, A-95-79 IS CLASSIFIED "OPEN--ACCEPTABLE RESPONSE."
9/16/96	Addressee	THAT THE FAA PUBLISH AN FAA SPECIAL AIRWORTHINESS INFO BULLETIN THAT DESCRIBES THE CIRCUMSTANCES OF THIS ACCIDENT, INCLUDING THE CONSEQUENCES OF IMPROPER INSTALLATION OF THE SPECIAL MISSION WIRING, WHERE ELECTRICAL POWER WIRES WERE UNPROTECTED BY CURRENT LIMITERS, IN ADDITION, EMPHASIZE THAT ALL MAJOR AIRCRAFT REPAIRS & ALTERATIONS REQUIRING FAA FORM 337 MUST BE PERFORMED IN

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

		STRICT ACCORDANCE WITH THE TECHNICAL DATA CONTAINED IN THE FAA FORM 337, & THAT IT IS UNACCEPTABLE TO USE SIMILAR WORK DONE ON ANOTHER AIRCRAFT AS A TECHNICAL GUIDE IN LIEU OF THE INFO ON THE FAA FORM 337.
12/3/96	NTSB	A-95-79 ASKED THE FAA TO PUBLISH A SPECIAL AIRWORTHINESS INFO BULLETIN THAT DESCRIBES THE CIRCUMSTANCES OF THE AVIATION ACCIDENT THAT OCCURRED ON 12/14/94, IN FRESNO, CALIFORNIA, INCLUDING THE CONSEQUENCES OF IMPROPER INSTALLATION OF THE SPECIAL MISSION WIRING, WHERE ELECTRICAL POWER WIRES WERE UNPROTECTED BY CURRENT LIMITERS. IN ADDITION, THE RECOMMENDATION ASKED THE FAA TO EMPHASIZE THAT ALL MAJOR AIRCRAFT REPAIRS & ALTERATION REQUIRING FAA FORM 337 MUST BE PERFORMED IN STRICT ACCORDANCE WITH THE TECHNICAL DATA CONTAINED IN FAA FORM 337, & THAT IT IS UNACCEPTABLE TO USE SIMILAR WORK DONE ON ANOTHER AIRCRAFT AS A TECHNICAL GUIDE IN LIEU OF THE INFO ON FAA FORM 337. THE FAA HAS PUBLISHED AN ARTICLE IN THE JULY 1996 ADVISORY CIRCULAR 43-16, "GENERAL AVIATION AIRWORTHINESS ALERTS," THAT EMPHASIZE THE IMPORTANCE OF PROPER REPAIRS & ALTERATIONS & ADHERENCE TO FAA-APPROVED DATA. BECAUSE THIS ARTICLE SATISFIES THE INTENT OF A-95-079 THIS RECOMMENDATION IS CLASSIFIED "CLOSED--ACCEPTABLE ACTION."

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2610B

Issue Date 4/7/98 **EAST MORICHES NY** **17-Jul-96**

ON 7/17/96, ABOUT 2031 EASTERN DAYLIGHT TIME, A BOEING 747-131, N93-119, OPERATED AS TRANS WORLD AIRLINES FLIGHT 800 (TWA800), CRASHED INTO THE ATLANTIC OCEAN, ABOUT 8 MILES SOUTH OF EAST MORICHES, NEW YORK, AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT (JFK), JAMACIA, NEW YORK. ALL 230 PEOPLE ABOARD THE AIRPLANE WERE KILLED. THE AIRPLANE, WHICH WAS OPERATED UNDER TITLE 14 CODE OF FEDERAL REGULATIONS (CFR) PART 121, WAS BOUND FOR CHARLES DE GAULLE INTERNATIONAL AIRPORT (CDG), PARIS, FRANCE. THE FLIGHT DATA RECORDER (FDR) & COCKPIT VOICE RECORDER (CFR) ENDED SIMULTANEOUSLY, ABOUT 13 MINUTES AFTER TAKEOFF. EVIDENCE INDICATES THAT AS THE AIRPLANE WAS CLIMBING NEAR 13,800 FEET MEAN SEA LEVEL (MSL), AN IN-FLIGHT EXPLOSION OCCURRED IN THE CENTER WING FUEL TANK (CTW); THE CWT WAS NEARLY EMPTY.

Recommendation # A-98-034

Overall Status OUA **Priority**

OPEN - UNACCEPTABLE ACTION

THE NTSB RECOMMENDS THAT THE FAA: ISSUE, AS SOON AS POSSIBLE, AN AIRWORTHINESS DIRECTIVE TO REQUIRE A DETAILED INSPECTION OF FUEL QUANTITY INDICATION SYSTEM WIRING IN BOEING 747-100,-200 &-300 SERIES AIRPLANE FUEL TANKS FOR DAMAGE, & THE REPLACEMENT OR THE REPAIR OF ANY WIRES FOUND TO BE DAMAGED. WIRES ON HONEYWELL SERIES 1-3 PROBES & COMPENSATORS SHOULD BE REMOVED FOR EXAMINATION.

FAA	OPEN - UNACCEPTABLE ACTION
6/10/98 Addressee	Letter Mail Controlled 6/15/98 3:34:33 PM MC# 980767 THE FAA AGREES WITH THE INTENT OF THESE RECOMMENDATIONS. ON 4/16/98, BOEING ISSUED SERVICE BULLETIN (SB) 747-28-2205, REVISION 1, TO ADDRESS INSPECTIONS AND TESTING TO VERIFY THAT THE WIRING, TUBING AND COMPONENT INSTALLATIONS INSIDE THE CENTER WING FUEL TANK ARE IN SATISFACTORY CONDITION AND ELECTRICALLY BONDED TO THE AIRPLANE STRUCTURE. BOEING SB 747-28-2205, REVISION 1, ALSO ADDS AN INSPECTION OF THE BODY FUEL TANK COMPONENTS AND MEASUREMENT OF THE PRESSURE SWITCH CASE GROUND RESISTANCE ON THE AUXILIARY POWER UNIT. BOEING RECENTLY ISSUED TWO ADDITIONAL SB'S TO ADDRESS FUEL QUANTITY INDICATING SYSTEMS. BOEING SB 747-28A2208 ADDRESSES THE INSPECTION, TESTING, REPLACEMENT, AND/OR REWORK OF THE FUEL QUANTITY INDICATING SYSTEM, TO INCLUDE THE REPLACEMENT OF SERIES 1-3 PROBES WITH SERIES 4 OR LATER PROBES. BOEING SD 747-28A2210 PROVIDES INSTRUCTIONS TO INSTALL A FLAME ARRESTOR IN THE INLET LINE OF THE ELECTRICAL MOTOR-OPERATED SCAVENGE PUMP LOCATED IN THE CENTER FUEL TANK. THE FAA WILL ISSUE A NOTICE OF PROPOSED RULEMAKING (NPRM) PROPOSING TO ADOPT AN AIRWORTHINESS DIRECTIVE (AD) TO REQUIRE THAT OPERATORS COMPLY WITH THE INSPECTIONS, TESTS, AND MODIFICATIONS DESCRIBED IN BOEING SB'S 747-28A2208, 747-28A2210, AND 747-28-2205, REV. 1.
2/9/99 NTSB	THE SAFETY BOARD BELIEVES THAT THESE SB'S DO NOT CONTAIN SUFFICIENTLY DETAILED INSTRUCTIONS TO ASSURE THAT THE INSPECTIONS ARE ADEQUATELY THOROUGH. THE SB'S ALSO DO NOT ADDRESS MIGRATION (COLD FOW) OF INSULATION MATERIAL OR THE PRESENCE OF LOCALIZED BLACKENING ON THE WIRE SURFACES, WHICH MAY INDICATE BREACHES IN THE INSULATION. THE FAA HAS PROVIDED NO STATISTICAL ANALYSIS THAT VALIDATES THE SELECTION OF 20 YEARS AS AN APPROPRIATE LIFE LIMIT FOR THESE PARTS BUT, RATHER, HAS BASED THE REPLACEMENT INTERVAL ON HAVING OBSERVED EXTENSIVE COPPER-SULFIDE DEPOSITS. PENDING FURTHER INFORMATION FROM THE FAA THAT STATES THAT ADEQUATE AND THOROUGH INDPECTIONS WILL BE REQUIRED OR THAT DEMONSTRATES THE APPROPRIATENESS OF ACCEPTING A 20-YEAR SERVICE LIFE BEFORE FQIS COMPONENTS ARE REPLACED, A-98-34 IS CLASSIFIED "OPEN--UNACCEPTABLE

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Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2610B

Issue Date 4/7/98 **EAST MORICHES NY** **17-Jul-96**

ON 7/17/96, ABOUT 2031 EASTERN DAYLIGHT TIME, A BOEING 747-131, N93-119, OPERATED AS TRANS WORLD AIRLINES FLIGHT 800 (TWA800), CRASHED INTO THE ATLANTIC OCEAN, ABOUT 8 MILES SOUTH OF EAST MORICHES, NEW YORK, AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT (JFK), JAMACIA, NEW YORK. ALL 230 PEOPLE ABOARD THE AIRPLANE WERE KILLED. THE AIRPLANE, WHICH WAS OPERATED UNDER TITLE 14 CODE OF FEDERAL REGULATIONS (CFR) PART 121, WAS BOUND FOR CHARLES DE GAULLE INTERNATIONAL AIRPORT (CDG), PARIS, FRANCE. THE FLIGHT DATA RECORDER (FDR) & COCKPIT VOICE RECORDER (CFR) ENDED SIMULTANEOUSLY, ABOUT 13 MINUTES AFTER TAKEOFF. EVIDENCE INDICATES THAT AS THE AIRPLANE WAS CLIMBING NEAR 13,800 FEET MEAN SEA LEVEL (MSL), AN IN-FLIGHT EXPLOSION OCCURRED IN THE CENTER WING FUEL TANK (CTW); THE CWT WAS NEARLY EMPTY.

Recommendation # A-98-035

Overall Status OAA **Priority**

OPEN - ACCEPTABLE RESPONSE

THE NTSB RECOMMENDS THAT THE FAA: ISSUE AN AIRWORTHINESS DIRECTIVE TO REQUIRE THE EARLIEST POSSIBLE REPLACEMENT OF THE HONEYWELL CORPORATION SERIES 1-3 TERMINAL BLOCKS USED ON BOEING 747 FUEL PROBES WITH TERMINAL BLOCKS THAT DO NOT HAVE KNURLED SURFACES OR SHARP EDGES THAT MAY DAMAGE FUEL QUANTITY INDICATION SYSTEM WIRING.

FAA	OPEN - ACCEPTABLE RESPONSE

6/10/98 Addressee — Letter Mail Controlled 6/15/98 3:34:33 PM MC# 980767 THE FAA AGREES WITH THE INTENT OF THESE SAFETY RECOMMENDATIONS. ON 4/16/98, BOEING ISSUED SERVICE BULLETIN (SB) 747-28-2205, REVISION 1, TO ADDRESS INSPECTIONS AND TESTING TO VERIFY THAT THE WIRING, TUBING, AND COMPONENT INSTALLATIONS INSIDE THE CENTER WING FUEL TANK ARE IN SATISFACTORY CONDITION AND ELECTRICALLY BONDED TO THE AIRPLANE STRUCTURE. BOEING SB 747-28-2205, REVISION 1, ALSO ADDS AN INSPECTION OF THE BODY FUEL TANK COMPONENTS AND MEASUREMENT OF THE PRESSURE SWITCH CASE GROUND RESISTANCE ON THE AUXILIARY POWER UNIT. BOEING RECENTLY ISSUED TWO ADDITIONAL SB'S TO ADDRESS FUEL QUANTITY INDICATING SYSTEMS. BOEING SB 747-28A2208 ADDRESSES THE INSPECTION, TESTING, REPLACEMENT, AND/OR REWORK OF THE FUEL QUANTITY INDICATING SYSTEM, TO INCLUDE THE REPLACEMENT OF SERIES 1-3 PROBES WITH SERIES 4 OR LATER PROBES. BOEING SD 747-28A2210 PROVIDES INSTRUCTIONS TO INSTALL A FLAME ARRESTOR IN THE INLET LINE OF THE ELECTRICAL MOTOR-OPERATED SCAVENGE PUMP LOCATED IN THE CENTER FUEL TANK. THE FAA WILL ISSUE A NOTICE OF PROPOSED RULEMAKING (NPRM) PROPOSING TO ADOPT AN AIRWORTHINESS DIRECTIVE (AD) TO REQUIRE THAT OPERATORS COMPLY WITH THE INSPECTIONS, TESTS, AND MODIFICATIONS DESCRIBED IN BOEING SB'S 747-28A2208, 747-28A2210, AND 747-28-2205, REV. 1.

2/9/99 NTSB — THE BELIEVES THAT THESE SB'S DO NOT CONTAIN SUFFICIENTLY DETAILED INSTRUCTIONS TO ASSURE THAT THE INSPECTIONS ARE ADEQUATELY THOROUGH. THE SB'S ALSO DO NOT ADDRESS MIGRATION (COLD FLOW) OF INSTALLATION MATERIAL OR THE PRESENCE OF LOCALIZED BLACKENING ON THE WIRE SURFACES, WHICH MAY INDICATE BREACHES IN THE INSULATION. IN ADDITION TO THE INSPECTIONS AND ACTIONS NOTED ABOVE, NPRM 98-NM-163-AD ALSO PROPOSES TO REQUIRE THE REPLACEMENT OF SERIES 1-3 EQUIPPED FUEL PROBES WITHIN 2 YEARS AND TOTAL REPLACEMENT OF FQIS COMPONENTS INSIDE THE FUEL TANKS, INCLUDING THE FUEL PROBES AND HARNESSES, WITHIN 20 YEARS FROM THE DATE OF MANUFACTURE. A-98-35 IS CLASSIFIED "OPEN–ACCEPTABLE RESPONSE," PENDING FINAL RULEMAKING TO REMOVE SERIES 1-3 TERMINAL BLOCKS FROM THE B-747 FUEL TANKS WITHIN 2 YEARS OF THE FINAL AD'S EFFECTIVE DATE.

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2610B

Issue Date 4/7/98 EAST MORICHES NY 17-Jul-96

ON 7/17/96, ABOUT 2031 EASTERN DAYLIGHT TIME, A BOEING 747-131, N93-119, OPERATED AS TRANS WORLD AIRLINES FLIGHT 800 (TWA800), CRASHED INTO THE ATLANTIC OCEAN, ABOUT 8 MILES SOUTH OF EAST MORICHES, NEW YORK, AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT (JFK), JAMACIA, NEW YORK. ALL 230 PEOPLE ABOARD THE AIRPLANE WERE KILLED. THE AIRPLANE, WHICH WAS OPERATED UNDER TITLE 14 CODE OF FEDERAL REGULATIONS (CFR) PART 121, WAS BOUND FOR CHARLES DE GAULLE INTERNATIONAL AIRPORT (CDG), PARIS, FRANCE. THE FLIGHT DATA RECORDER (FDR) & COCKPIT VOICE RECORDER (CFR) ENDED SIMULTANEOUSLY, ABOUT 13 MINUTES AFTER TAKEOFF. EVIDENCE INDICATES THAT AS THE AIRPLANE WAS CLIMBING NEAR 13,800 FEET MEAN SEA LEVEL (MSL), AN IN-FLIGHT EXPLOSION OCCURRED IN THE CENTER WING FUEL TANK (CTW); THE CWT WAS NEARLY EMPTY.

Recommendation # A-98-038

Overall Status OAA **Priority**

OPEN - ACCEPTABLE RESPONSE

THE NTSB RECOMMENDS THAT THE FAA: REQUIRE IN BOEING 747 AIRPLANES, & IN OTHER AIRPLANES WITH FUEL QUANTITY INDICATION SYSTEM (FQIS) WIRE INSTALLATIONS THAT ARE COROUTED WITH WIRES THAT MAY BE POWERED, THE PHYSICAL SEPARATION & ELECTRICAL SHIELDING OF FQIS WIRES TO THE MAXIMUM EXTENT POSSIBLE.

FAA	OPEN - ACCEPTABLE RESPONSE

6/10/98 Addressee Letter Mail Controlled 6/15/98 3:34:33 PM MC# 980767 THE FAA ISSUED NPRM 97-NM-272 ON 11/26/97, PROPOSING TO ADOPT AN AD APPLICABLE TO BOEING 747-100, -200, -300, -SP, AND -SR AIRPLANES. THE AD, IF ADOPTED WOULD REQUIRE INSTALLATION OF ELECTRICAL TRANSIENT SUPPRESSION SYSTEMS AND/OR THE INSTALLATION OF SHIELDING AND SEPARATION OF THE ELECTRICAL WIRING OF THE FUEL QUANTITY INDICATION SYSTEM LOCATED OUTSIDE THE FUEL TANKS. THE ORIGINAL COMMENT PERIOD FOR THIS NPRM CLOSED 3/3/98. IN ORDER TO ALLOW ADDITIONAL TIME FOR THE MANUFACTURER TO DEVELOP DESIGN MODIFICATIONS, THE FAA REOPENED THE COMMENT PERIOD FOR AN ADDITIONAL 60 DAYS BY ISSUING A SECOND NOTICE ON 3/27/98. THE NEW COMMENT PERIOD CLOSED 5/26/98. THIS SAFETY RECOMMENDATION WILL BE INCLUDED IN THE COMMENTS TO THE NPRM DOCKET. THE FAA WILL EVALUATE THE COMMENTS RECEIVED FROM THE NPRM TO DETERMINE WHAT ACTION IS APPROPRIATE. THE FAA ISSUED A SIMILAR NPRM (98-NM-50-AD) PROPOSING TO ADOPT AN AD APPLICABLE TO THE BOEING 737-100, -200, -300, -400, AND -500 AIRPLANES. THIS AD, IF ADOPTED, WOULD REQUIRE INSTALLATION OF ELECTRICAL TRANSIENT SUPPRESSION SYSTEMS (OR SURGE SUPPRESSION SYSTEMS) AND/OR THE INSTALLATION OF SHIELDING AND SEPARATION OF THE ELECTRICAL WIRING OF THE FUEL QUANTITY INDICATION SYSTEM LOCATED OUTSIDE THE FUEL TANKS. THE COMMENT PERIOD FOR THIS NPRM CLOSED 6/8/98. THIS RECOMMENDATION WILL ALSO BE INCLUDED IN THE COMMENTS TO THE NPRM. WITH REGARD TO OTHER TRANSPORT-CATEGORY AIRPLANES WITH FUEL QUANTITY INDICATION SYSTEM WIRES, THE SFAR TEAM WORKING ON THE NPRM SFAR IN RESPONSE TO A-96-174 THROUGH -177 IS DEVELOPING ADVISORY MATERIAL FOR CONDUCTING THE DESIGN REVIEWS REQUIRED UNDER THE PLANNED SFAR. THE ADVISORY MATERIAL WILL INCLUDE INFORMATION ON THE USE OF WIRE SEPARATION AND ELECTRICAL SHIELDING AND/OR TRANSIENT PROTECTION SYSTEMS TO PROTECT THE FUEL QUANTITY INDICATING SYSTEM WIRING INSIDE FUEL TANKS WHEN APPLICABLE TO THE DIFFERENT AIRPLANE DESIGNS. WITH REGARD TO WIRE SEPARATION AND SHIELDING DISCUSSED IN RESPONSE TO A-98-38, THE ADVISORY MATERIAL ASSOCIATED WITH THE PLANNED FUEL TANK SAFETY SFAR WILL INCLUDE INFORMATION ON THE LESSONS LEARNED DURING THE TWA FLIGHT 800 ACCIDENT INVESTIGATION. THE ADVISORY MATERIAL WILL

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MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

		INCLUDE THE USE OF TRANSIENT OR SURGE PROTECTION SYSTEMS AND/OR WIRE SEPARATION AND ELECTRICAL SHIELDING OF FUEL QUANTITY INDICATING SYSTEM WIRES AS APPLICABLE TO THE DIFFERENT AIRPLANE DESIGNS. THE DESIGN REVIEWS REQUIRED UNDER THE PROPOSED SFAR WOULD ADDRESS THE USE OF ELECTRICAL SURGE PROTECTION SYSTEMS ON THE FUEL QUANTITY INDICATING SYSTEM WIRES OUTSIDE THE FUEL TANKS IN TRANSPORT-CATEGORY AIRPLANES.
2/9/99	NTSB	THE SAFETY BOARD IS PLEASED TO LEARN THAT THE FAA WILL REQUIRE FQIS WIRES TO BE SEPARATED BUT IS CONCERNED THAT AD 98-20-40 MAY NOT ADEQUATELY PROTECT FUEL TANKS FROM FQIS WIRING DEFICIENCIES THAT MIGHT ALLOW EXCESSIVE ENERGY INTO THE TANKS. ALTHOUGH THE MAJORITY OF WIRING REQUIRED BY THE AD WILL BE REPLACED WITH SHIELDED WIRING, BOEING'S MINIMUM STANDARD OF SEPARATION IS TYPICALLY 1/4 INCH, WHICH MAY BE INSUFFICIENT BASED ON INFORMATION FROM INVESTIGATIONS. THE BOARD HAS REQUESTED OBJECTIVE JUSTIFICATION OF THE WIRE SEPARATION CRITERIA FROM BOEING AND HAS NOT YET RECEIVED A REPLY. CONCERN FOR ADEQUATE SEPARATION OF FQIS WIRING IS NOT LIMITED TO THE BOEING 747. SAFETY BOARD STAFF RECENTLY SHARED WITH THE FAA STAFF A LETTER THAT SHOWS SIMILAR COROUTING OR POWERED CABLES AND FQIS WIRING IN AIRBUS A-300 AND A-310 AIRCRAFT, WHICH INDICATES A SIMILAR POTENTIAL PROBLEM IN THESE AIRCRAFT. PENDING RECEIPT OF FURTHER DETAILS REGARDING THE WIRING SEPARATION THAT WILL BE ACCOMPLISHED BY AD 98-20-40 AND PLANNED ACTIVITIES FOR OTHER AIRPLANE MODELS, A-98-38 IS CLASSIFIED "OPEN--ACCEPTABLE RESPONSE."

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2610B

Issue Date 4/7/98 EAST MORICHES NY 17-Jul-96

ON 7/17/96, ABOUT 2031 EASTERN DAYLIGHT TIME, A BOEING 747-131, N93-119, OPERATED AS TRANS WORLD AIRLINES FLIGHT 800 (TWA800), CRASHED INTO THE ATLANTIC OCEAN, ABOUT 8 MILES SOUTH OF EAST MORICHES, NEW YORK, AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT (JFK), JAMACIA, NEW YORK. ALL 230 PEOPLE ABOARD THE AIRPLANE WERE KILLED. THE AIRPLANE, WHICH WAS OPERATED UNDER TITLE 14 CODE OF FEDERAL REGULATIONS (CFR) PART 121, WAS BOUND FOR CHARLES DE GAULLE INTERNATIONAL AIRPORT (CDG), PARIS, FRANCE. THE FLIGHT DATA RECORDER (FDR) & COCKPIT VOICE RECORDER (CFR) ENDED SIMULTANEOUSLY, ABOUT 13 MINUTES AFTER TAKEOFF. EVIDENCE INDICATES THAT AS THE AIRPLANE WAS CLIMBING NEAR 13,800 FEET MEAN SEA LEVEL (MSL), AN IN-FLIGHT EXPLOSION OCCURRED IN THE CENTER WING FUEL TANK (CTW); THE CWT WAS NEARLY EMPTY.

Recommendation # A-98-039

Overall Status OUA **Priority**

OPEN - UNACCEPTABLE ACTION

THE NTSB RECOMMENDS THAT THE FAA: REQUIRE, IN ALL APPLICABLE TRANSPORT AIRPLANE FUEL TANKS, SURGE PROTECTION SYSTEMS TO PREVENT ELECTRICAL POWER SURGES FROM ENTERING FUEL TANKS FUEL QUANTITY INDICATION SYSTEM WIRES.

FAA	OPEN - UNACCEPTABLE ACTION

6/10/98 Addressee Letter Mail Controlled 6/15/98 3:34:33 PM MC# 980767 THE FAA ISSUED NPRM 97-NM-272 ON 11/26/97, PROPOSING TO ADOPT AN AD APPLICABLE TO BOEING 747-100, -200, -300, -SP, AND -SR AIRPLANES. THE AD, IF ADOPTED, WOULD REQUIRE INSTALLATION OF ELECTRICAL TRANSIENT SUPPRESSION SYSTEMS AND/OR THE INSTALLATION OF SHIELDING AND SEPARATION OF THE ELECTRICAL WIRING OF THE FUEL QUANTITY INDICATION SYSTEM LOCATED OUTSIDE THE FUEL TANKS. THE ORIGINAL COMMENT PERIOD FOR THIS NPRM CLOSED 3/3/98. IN ORDER TO ALLOW ADDITIONAL TIME FOR THE MANUFACTURER TO DEVELOP DESIGN MODIFICATIONS, THE FAA REOPENED THE COMMENT PERIOD FOR AN ADDITIONAL 60 DAYS BY ISSUING A SECOND NOTICE ON 3/27/98. THE NEW COMMENT PERIOD CLOSED 5/26/98. THIS RECOMMENDATION WILL BE INCLUDED IN THE COMMENTS TO THE NPRM DOCKET. THE FAA WILL EVALUATE THE COMMENTS RECEIVED FROM THE NPRM TO DETERMINE WHAT ACTION IS APPROCIATE. THE FAA ISSUED A SIMILAR NPRM (98-NM-50-AD) PROPOSING TO ADOPT AN AD APPLICABLE TO THE BOEING 737-100, -200, -300, -400, AND -500 AIRPLANES. THIS AD, IF ADOPTED, WOULD REQUIRE INSTALLATION OF ELECTRICAL TRANSIENT SUPPRESSION SYSTEMS (OR SURGE SUPPRESSION SYSTEMS) AND/OR THE INSTALLATION OF SHIELDING AND SEPARATION OF THE ELECTRICAL WIRING OF THE FUEL QUANTITY INDICATION SYSTEM LOCATED OUTSIDE THE FUEL TANKS. THE COMMENT PERIOD FOR THIS NPRM CLOSED 6/8/98. THIS RECOMMENDATION WILL ALSO BE INCLUDED IN THE COMMENTS TO THE NPRM. WITH REGARD TO OTHER TRANSPORT-CATEGORY AIRPLANES WITH FUEL QUANTITY INDICATION SYSTEM WIRES, THE SFAR TEAM WORKING ON THE NPRM SFAR IN RESPONSE TO A-96-174 THROUGH -177 IS DEVELOPING ADVISORY MATERIAL FOR CONDUCTING THE DESIGN REVIEWS REQUIRED UNDER THE PLANNED SFAR. THE ADVISORY MATERIAL WILL INCLUDE INFORMATION ON THE USE OF WIRE SEPARATION AND ELECTRICAL SHIELDING AND/OR TRANSIENT PROTECTION SYSTEMS TO PROTECT THE FUEL QUANTITY INDICATING SYSTEM WIRING INSIDE FUEL TANKS WHEN APPLICABLE TO THE DIFFERENT AIRPLANE DESIGNS. WITH REGARD TO WIRE SEPARATION AND SHIELDING DISCUSSED IN RESPONSE TO A-98-38, THE ADVISORY MATERIAL ASSOCIATED WITH THE PLANNED FUEL TANK SAFETY SFAR WILL INCLUDE INFORMATION ON THE LESSONS LEARNED DURING THE TWA FLIGHT 800 ACCIDENT INVESTIGATION. THE ADVISORY MATERIAL WILL INCLUDE THE USE OF TRANSIENT OR SURGE PROTECTION SYSTEMS AND/OR

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Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2660

Issue Date 1/15/98 BUFFALO NY 03-Apr-97

ON 4/3/97, ABOUT 1948 EASTERN STANDARD TIME, A CESSNA 650 (CITATION III), N553AC, OPERATED BY MERCURY COMMUNICATIONS, EXPERIENCE AN IN-FLIGHT FIRE WHILE ON APPROACH TO THE GREATER BUFFALO INTERNATIONAL AIRPORT IN BUFFALO, NEW YORK. WHILE DESCENDING THROUGH 4,000 FEET, THE CREW SMELLED SMOKE, A NAVIGATION DISPLAY WENT BLANK, & RADIO COMMUNICATIONS WERE LOST. AFTER AN EMERGENCY LANDING, GROUND PERSONNEL SAW FLAMES BURNING THROUGH A HOLE IN THE AFT FUSELAGE & INFORMED THE CREW. THE FLIGHTCREW & PASSENGER EVACUATED WITH NO INJURIES; HOWEVER, THE AIRPLANE WAS SUBSTANTIALLY DAMAGED. THE FLIGHT WAS BEING CONDUCTED UNDER THE PROVISIONS OF TITLE 14 CODE OF FEDERAL REGULATIONS PART 91 AS A CORPORATE FLIGHT FROM WELLSVILLE, NEW YORK, TO BUFFALO. THE BOARD IS AWARE OF OTHER RECENT INCIDENTS CAUSED BY INADEQUATE CLEARANCE BETWEEN ELECTRICAL WIRING & ADJACENT COMPONENTS. ON 6/25/96, DELTA AIR LINES FLIGHT 148 A BOEING 767 -300ER , EXPERIENCED A FLIGHT CONTROL MALFUNCTION AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMACIA, NY. THE BOARD LEARNED OF A 1995 INCIDENT ABOARD JAPAN AIRLINES WITH INADEQUATE CLEARENCE LED TO ARCING BETWEEN ELECTRICAL WIRING & AN OXYGEN LINE FITTING NEAR THE CAPTAIN'S OXYGEN MASK.

Recommendation # A-98-001

Overall Status OAA **Priority**

OPEN - ACCEPTABLE RESPONSE

THE NTSB RECOMMENDS THAT THE FAA: REVIEW THE DESIGN, MANUFACTURING, & INSPECTION PROCEDURES OF AIRCRAFT MANUFACTURERS, & REQUIRE REVISIONS, AS NECESSARY, TO ENSURE THAT ADEQUATE CLEARANCE IS SPECIFIED AROUND ELECTRICAL WIRING, IN ACCORDANCE WITH PUBLISHED FAA GUIDELINES.

FAA	OPEN - ACCEPTABLE RESPONSE

3/25/98 Addressee Letter Mail Controlled 3/30/98 3:14:46 PM MC# 980411) THE FAA AGREES WITH THE INTENT OF THESE RECOMMENDATIONS & IS REVIEWING THE MANUFACTURERS, MANUFACTURING & INSPECTION PROCEDURES REGARDING ELECTRICAL WIRING. THE AIRCRAFT CERTIFICATION OFFICES HAVE REQUESTED THAT THEIR RESPECTIVE AIRPLANE MANUFACTURERS SHOW HOW THE ELECTRICAL DESIGN PRACTICES, GUIDELINES, & ENGINEERING DESIGN MANUALS MEET THE FAA'S ESTABLISHED GUIDELINES CONTAINED IN ADVISORY CIRCULARS (AC) 43.13-1A & 65-15. THE AIRCRAFT CERTIFICATION OFFICES WILL ALSO REVIEW HOW EACH MANUFACTURER ENSURES THAT ITS DESIGN PRINCIPLES & PROCEDURES ARE IMPLEMENTED IN THE DESIGN OF THEIR PRODUCT. IT IS ANTICIPATED THAT THE REVIEW WILL BE COMPLETED BIY AUGUST 1998. BASED ON THE RESULT OF THIS REVIEW, THE FAA WILL INITIATE APPROPRIATE CORRECTIVE ACTION. TO ADDRESS THE MANUFACTURING & INSPECTION ASPECTS OF THIS SAFETY ISSUE, THE FAA IS CONDUCTING TWO SEPARATE EVALUATIONS. THE FIRST EVALUATION WILL RELY ON THE USE OF SPECIAL EMPHASIS ITEMS UNDER THE FAA'S AIRCRAFT CERTIFICATION SYSTEM EVALUATION PROGRAM (ACSEP). SPECIAL EMPHASIS ITEMS ADDRESS UNIQUE ITEMS THAT ARE NOT NORMALLY COVERED DURING REGULAR ACSEP EVALUATIONS. EVALUATORS WILL FOCUS ON THESE SPECIAL EMPHASIS ITEMS DURING THE NEXT 2 YEARS AT REGULARLY SCHEDULED ACSEP EVALUATIONS AT U.S. PRODUCTION CERTIFICATION HOLDERS. THE SECOND EVALUATION WILL RELY ON SPECIAL INSPECTIONS AS PART OF THE CONTINUING CERTIFICATE MANAGEMENT EFFORT AT AIRCRAFT PRODUCTION APPROVAL HOLDERS. THE FAA WILL USE A CHECKLIST CONTAINING INSPECTION ITEMS TO ENSURE THAT ADEQUATE CLEARANCE IS SPECIFIED AROUND ELECTRICAL WIRING IN ACCORDANCE WITH PUBLISHED FAA GUIDELINES. THE AIRCRAFT MANUFACTURERS WILL BE REQUIRED TO CONDUCT THESE INSPECTIONS & PROVIDE A STATEMENT OF CONFORMITY TO THE FAA, SHOWING COMPLIANCE TO THE PUBLISHED FAA GUIDELINES. IN ORDER O ADDRESS AIRPLANES MANUFACTURED OUTSIDE THE UNITED STATES, THE FAA HAS NOTIFIED THE INTERNATIONAL CIVIL AVIATION AUTHORITIES OF THE ACTIONS INITIAED TO ADDRESS THESE

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

		SAFETY RECOMMENDATIONS. THE FAA HAS SUGGESTED THAT THE INTERNATIONAL CIVIL AVIATION AUTHORITIES CONDUCT A SIMILAR EVALUATION ON THOSE AIRPLANES MANUFACTURED OUTSIDE THE UNITED STATES. THE FAA WILL TAKE APPROPRIATE ACTION BASED ON THE INFO GATHERED FROM THE AIRPLANE MANUFACTURERS & A REVIEW OF ANY FINDINGS IDENTIFIED AT THE REGULARLY SCHEDULED ACSEP EVALUATIONS OR SPECIAL INSPECTIONS TO IDENTIFY & FIX DEVIATIONS & "NON-ADHERENCE" TO DESIGN PRACTICES.
7/13/98	NTSB	THE BOARD APPRECIATES THE FAA'S PROMPT & COMPREHENSIVE RESPONSE TO THESE RECOMMENDATIONS. PENDING COMPLETION OF THE ABOVE ACTIONS, A-98-1 &2 ARE CLASSIFIED "OPEN--ACCPETABLE RESPONSE."
6/9/99	Addressee	Letter Mail Controlled 6/11/99 2:55:39 PM MC# 990624

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2660

Issue Date 1/15/98 BUFFALO NY 03-Apr-97

ON 4/3/97, ABOUT 1948 EASTERN STANDARD TIME, A CESSNA 650 (CITATION III), N553AC, OPERATED BY MERCURY COMMUNICATIONS, EXPERIENCE AN IN-FLIGHT FIRE WHILE ON APPROACH TO THE GREATER BUFFALO INTERNATIONAL AIRPORT IN BUFFALO, NEW YORK. WHILE DESCENDING THROUGH 4,000 FEET, THE CREW SMELLED SMOKE, A NAVIGATION DISPLAY WENT BLANK, & RADIO COMMUNICATIONS WERE LOST. AFTER AN EMERGENCY LANDING, GROUND PERSONNEL SAW FLAMES BURNING THROUGH A HOLE IN THE AFT FUSELAGE & INFORMED THE CREW. THE FLIGHTCREW & PASSENGER EVACUATED WITH NO INJURIES; HOWEVER, THE AIRPLANE WAS SUBSTANTIALLY DAMAGED. THE FLIGHT WAS BEING CONDUCTED UNDER THE PROVISIONS OF TITLE 14 CODE OF FEDERAL REGULATIONS PART 91 AS A CORPORATE FLIGHT FROM WELLSVILLE, NEW YORK, TO BUFFALO. THE BOARD IS AWARE OF OTHER RECENT INCIDENTS CAUSED BY INADEQUATE CLEARANCE BETWEEN ELECTRICAL WIRING & ADJACENT COMPONENTS. ON 6/25/96, DELTA AIR LINES FLIGHT 148 A BOEING 767 -300ER , EXPERIENCED A FLIGHT CONTROL MALFUNCTION AFTER TAKING OFF FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMACIA, NY. THE BOARD LEARNED OF A 1995 INCIDENT ABOARD JAPAN AIRLINES WITH INADEQUATE CLEARENCE LED TO ARCING BETWEEN ELECTRICAL WIRING & AN OXYGEN LINE FITTING NEAR THE CAPTAIN'S OXYGEN MASK.

Recommendation # A-98-002

Overall Status OAA **Priority**

OPEN - ACCEPTABLE RESPONSE

THE NTSB RECOMMENDS THAT THE FAA: REVIEW THE EXISTING DESIGN OF ALL TRANSPORT-CATEGORY AIRPLANES TO DETERMINE IF ADEQUATE CLEARANCE IS PROVIDED AROUND ELECTRICAL WIRING, IN ACCORDANCE WITH PUBLISHED FAA GUIDELINES. IF DEVIATIONS ARE FOUND, REQUIRE THAT MODIFICATIONS BE MADE TO ENSURE ADEQUATE CLEARANCE.

FAA	OPEN - ACCEPTABLE RESPONSE

3/25/98 Addressee Letter Mail Controlled 3/30/98 3:14:46 PM MC# 980411) THE FAA AGREES WITH THE INTENT OF THESE RECOMMENDATIONS & IS REVIEWING THE MANUFACTURERS, MANUFACTURING & INSPECTION PROCEDURES REGARDING ELECTRICAL WIRING. THE AIRCRAFT CERTIFICATION OFFICES HAVE REQUESTED THAT THEIR RESPECTIVE AIRPLANE MANUFACTURERS SHOW HOW THE ELECTRICAL DESIGN PRACTICES, GUIDELINES, & ENGINEERING DESIGN MANUALS MEET THE FAA'S ESTABLISHED GUIDELINES CONTAINED IN ADVISORY CIRCULARS (AC) 43.13-1A & 65-15. THE AIRCRAFT CERTIFICATION OFFICES WILL ALSO REVIEW HOW EACH MANUFACTURER ENSURES THAT ITS DESIGN PRINCIPLES & PROCEDURES ARE IMPLEMENTED IN THE DESIGN OF THEIR PRODUCT. IT IS ANTICIPATED THAT THE REVIEW WILL BE COMPLETED BIY AUGUST 1998. BASED ON THE RESULT OF THIS REVIEW, THE FAA WILL INITIATE APPROPRIATE CORRECTIVE ACTION. TO ADDRESS THE MANUFACTURING & INSPECTION ASPECTS OF THIS SAFETY ISSUE, THE FAA IS CONDUCTING TWO SEPARATE EVALUATIONS. THE FIRST EVALUATION WILL RELY ON THE USE OF SPECIAL EMPHASIS ITEMS UNDER THE FAA'S AIRCRAFT CERTIFICATION SYSTEM EVALUATION PROGRAM (ACSEP). SPECIAL EMPHASIS ITEMS ADDRESS UNIQUE ITEMS THAT ARE NOT NORMALLY COVERED DURING REGULAR ACSEP EVALUATIONS. EVALUATORS WILL FOCUS ON THESE SPECIAL EMPHASIS ITEMS DURING THE NEXT 2 YEARS AT REGULARLY SCHEDULED ACSEP EVALUATIONS AT U.S. PRODUCTION CERTIFICATION HOLDERS. THE SECOND EVALUATION WILL RELY ON SPECIAL INSPECTIONS AS PART OF THE CONTINUING CERTIFICATE MANAGEMENT EFFORT AT AIRCRAFT PRODUCTION APPROVAL HOLDERS. THE FAA WILL USE A CHECKLIST CONTAINING INSPECTION ITEMS TO ENSURE THAT ADEQUATE CLEARANCE IS SPECIFIED AROUND ELECTRICAL WIRING IN ACCORDANCE WITH PUBLISHED FAA GUIDELINES. THE AIRCRAFT MANUFACTURERS WILL BE REQUIRED TO CONDUCT THESE INSPECTIONS & PROVIDE A STATEMENT OF CONFORMITY TO THE FAA, SHOWING COMPLIANCE TO THE PUBLISHED FAA GUIDELINES. IN ORDER O ADDRESS AIRPLANES MANUFACTURED OUTSIDE THE UNITED STATES, THE FAA HAS NOTIFIED THE INTERNATIONAL CIVIL

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

		AVIATION AUTHORITIES OF THE ACTIONS INITIAED TO ADDRESS THESE SAFETY RECOMMENDATIONS. THE FAA HAS SUGGESTED THAT THE INTERNATIONAL CIVIL AVIATION AUTHORITIES CONDUCT A SIMILAR EVALUATION ON THOSE AIRPLANES MANUFACTURED OUTSIDE THE UNITED STATES. THE FAA WILL TAKE APPROPRIATE ACTION BASED ON THE INFO GATHERED FROM THE AIRPLANE MANUFACTURERS & A REVIEW OF ANY FINDINGS IDENTIFIED AT THE REGULARLY SCHEDULED ACSEP EVALUATIONS OR SPECIAL INSPECTIONS TO IDENTIFY & FIX DEVIATIONS & "NON-ADHERENCE" TO DESIGN PRACTICES.
7/13/98	NTSB	THE BOARD APPRECIATES THE FAA'S PROMPT & COMPREHENSIVE RESPONSE TO THESE RECOMMENDATIONS. PENDING COMPLETION OF THE ABOVE ACTIONS, A-98-1 &2 ARE CLASSIFIED "OPEN--ACCPETABLE RESPONSE."
6/9/99	Addressee	Letter Mail Controlled 6/11/99 2:55:39 PM MC# 990624

Recommendation Report

Monday, July 19, 1999

MODE:AVIATION KEYWORD 1:ELECTRICAL KEYWORD 2:WIRING KEYWORD 3:WIRE

Log Number 2735

Issue Date 1/11/99 NOVA SCOTIA CAN 02-Sep-98

ON 9/2/98, AT 2018 EASTERN DAYLIGHT TIME, SWISSAIR FLIGHT 111, A MCDONNELL DOUGLAS MD-11 REGISTERED AS HB-IWF, DEPARTED FROM JOHN F. KENNEDY INTERNATIONAL AIRPORT IN JAMAICA, NY. SWISSAIR FLIGHT 111 WAS A REGULARLY SCHEDULED PASSENGER FLIGHT FROM NEW YORK TO GENEVA, SWITZERLAND, OPERATING UNDER THE PROVISIONS OF 14 CODE OF FEDERAL REGULATIONS PART 129.

Recommendation # A-99-003

Overall Status CAA **Priority**

CLOSED - ACCEPTABLE ACTION

NTSB RECOMMENDS THAT THE FAA: REQUIRE, ON AN EXPEDITED BASIS, AN INSPECTION OF ALL MD-11 AIRPLANES FOR DISCREPANCIES OF WIRING IN AND AROUND THE COCKPIT OVERHEAD CIRCUIT BREAKER PANEL (INCLUDING THE AREA JUST AFT OF THE TUB ENCLOSURE) AND THE AVIONICS CIRCUIT BREAKER PANEL. THE INSPECTION SHOULD INCLUDE EXAMINATIONS FOR LOOSE WIRE CONNECTIONS, INCONSISTENT WIRE ROUTINGS, BROKEN BONDING WIRES, SMALL WIRE BEND RADII, AND CHAFED AND CRACKED WIRE INSULATION.

FAA	CLOSED - ACCEPTABLE ACTION	4/30/99

3/4/99	Addressee	Letter Mail Controlled 3/8/99 4:13:49 PM MC# 990210 THE FAA AGREES WITH THIS SAFETY RECOMMENDATION AND HAS ISSUED AIRWORTHINESS DIRECTIVE (AD) 99-03-02 APPLICABLE TO ALL MCDONNELL DOUGLAS MD-11 SERIES AIRPLANES CERTIFICATED IN ANY CATEGORY. THE AD BECAME EFFECTIVE 2/12/99, AND REQUIRES A ONE-TIME INSPECTION TO DETECT DISCREPANCIES OF CERTAIN WIRING AND INSULATION IN THE COCKPIT AND CABIN, AND REPAIR IF NECESSARY. THE INSPECTION INCLUDES EXAMINATION OF LOOSE WIRE CONNECTIONS, LOOSE GROUND WIRES, BROKEN BONDING WIRES, SMALL WIRE BENDING RADII, CRACKED SUPPORT BRACKETS, AND CHAFED AND CRACKED WIRE INSULATION. I HAVE ENCLOSED A COPY OF THE AD FOR THE BOARD'S INFORMATION.
4/30/99	NTSB	THE SAFETY BOARD APPRECIATES THE FAA'S QUICK ACTION AND CLASSIFIES A-99-3 "CLOSED--ACCEPTABLE ACTION."