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July 2, 2008

Hon. Robert Sturgell
Administrator (Acting)
Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

Dear Mr. Administrator:

It has been more than a decade since two airliners - TWA Flight 800 and Swissair Flight 111 - crashed with the loss of four hundred and fifty-nine lives. Subsequent investigations by the National Transportation Safety Board and the Transportation Safety Board of Canada identified faulty wiring as a critical contributing cause in those crashes. Recent events lead me to question whether the Federal Aviation Administration (FAA), or the airlines, have fully learned the lessons to be drawn from those tragedies or taken adequate steps to avoid similar aviation accidents.

These two crashes provide ample evidence that wiring failures can cost lives. In 1996, TWA Flight 800 went down off the coast of Long Island because of the ignition of fuel vapors by an electrical arc or surge in the wiring.[1] This accident highlighted what many in the industry had already known, that wiring, especially in aging air fleets, could contribute to catastrophic accidents. Two years later, Swissair Flight 111 went down off the coast of Nova Scotia after a fire, thought to have been caused by wire arcing and spreading through insulation blankets above the cockpit ceiling, shut down the electronic systems that controlled the plane.[2]

Modern aircraft are threaded with hundreds of miles of wire which control every aspect of a plane's operations. In the decade since those catastrophic crashes, concerns about the safety of aircraft wiring have only increased, but there has not been an adequate response from the FAA. Planes have aged, no new technical safety measures regarding wiring appear to have been widely deployed, and the FAA's current requirements for visual inspection of wiring is based on a maintenance, training and validation system that is not fully reliable. All this adds up to a flying environment that puts the public at risk.

Questions about fire safety and wiring were again brought into stark relief by a report released by your Office of Aviation Research and Development in January 2008,

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[1] *Aviation Accident Report: In-flight Breakup Over the Atlantic Ocean*, July 17, 1996. [Washington, D.C.: National Transportation Safety Board]. Report AAR-00/03. August 23, 2000; p. 308.
[2] *Aviation Investigation Report: In-Flight Fire Leading to Collision With Water,* September 2, 1998. [Gatineau, Quebec: Transportation Safety Board of Canada]. Report A98H0003. March 27, 2003; p. 253

which examined three types of common aircraft electrical wire.[3] After evaluating the ability of these materials to withstand normal commercial airline operations, the report's authors stated that "PVC [polyvinyl chloride] and fluorinated ethylene propylene/polyimide (Kapton®) wire insulation materials should not be used in airborne applications."[4] These types of wires have been widely used in the aviation industry for four decades.

As the Chairman of the Committee on Science and Technology with jurisdiction over the FAA's research and development program, I want to know what steps - if any - you have taken to develop and deploy technologies in aging aircraft that would reduce the chances of catastrophic loss due to wire-arcing or fire, or to reduce the chance of fire propagation through wire-induced ignition of the insulation blankets used in many older aircraft. I particularly must raise questions as to why, when the military has already taken steps to address questionable wiring in its planes, the airlines, in whose craft many more persons fly, have been allowed to continue operating with wiring even FAA experts say should not be allowed.

Finally, I want to understand what steps you have taken to guarantee that the next generation of large commercial aircraft, as represented in the Boeing 787 and the Airbus A380, will be less likely to suffer from catastrophic loss due to wiring and materials decisions being designed into them today.

Wire with Kapton-type insulation became commonly used in Boeing and McDonnell Douglas planes built beginning in the late 1960s. It has many admirable qualities. However, it is known to deteriorate if exposed to moisture. Also, if two cracks occur in proximity to each other, arcing can occur, carbonizing the insulation and turning it into a conductor of current.[5]

The reaction of the U.S. military to the identified limits of Kapton is instructive. The Navy, with aircraft flying off aircraft carrier decks in high-moisture environments, replaced polyimide wiring in all areas exposed to moisture. The Coast Guard and Army systematically replaced all polyimide wiring in helicopters during maintenance cycles. The Air Force directed that polyimide would no longer be the default choice for its wiring needs and collaborated with Boeing to produce a Teflon-coated polyimide wire.

The FAA's response to concerns about the safety of Kapton and PVC wiring, however, has been to argue that "the type of wire is far less important than proper system design, installation, maintenance, and training. When those four criteria are met, any type of wire should be acceptable for use in aircraft."[6] In November 2007, your agency issued guidance in Advisory Circular 25-27 stressing "the importance of inspecting EWIS [electrical wiring interconnect systems] and promot[ing] a philosophy of 'protect and clean as you go' when performing maintenance, repair, or alterations on

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[3] Kurek, Joseph *et al. Aircraft Wiring Degradation Study.* Office of Aviation Research and Development, Federal Aviation Administration [Atlantic City International Airport, New Jersey: William J. Hughes Technical Center]. Report DOT/FAA/AR-08/2. January 2008. Hereinafter cited as "*Degradation Study.*"

[4] *Degradation Study*, Appendix C, p. 2.

[5] Appendix IV: "Case Study on Aromatic Polyimide Wire Insulation," in *AVIATION SAFETY: FAA and DOD Response to Similar Safety Concerns*, General Accounting Office Report GAO-02-77. January 22, 2002; p. 40.

[6] WTVF-TV. "How Safe is Airline Wiring? Read Statements From FAA." Last modified April 29, 2008 at 11:51 CDT. Accessed June 9, 2008 at http://www.newschannel5.com/Global/story.asp?s=8228700.

aircraft."[7] This response to reports of PVC and Kapton problems evades the question of whether, absent perfection in the four areas cited by the FAA, these are the safest wiring choices in airframes.

Nor does it appear that the airlines are consistently able to carry out the Circular's directions. Earlier this year, neither American nor Delta Airlines were able to satisfy the FAA that their wire harnesses had been properly installed, leading to the grounding of hundreds of aircraft for inspection.[8] Two weeks later, American Airlines had to repeat the special inspections because it was determined that repair work had not been done properly.[9] Evidence like this undercuts confidence that maintenance and training standards are high enough to justify the FAA's faith in maintenance alone.

Furthermore, revelations that FAA inspectors were prevented from carrying out their responsibilities to assure compliance with inspection requirements for fatigue cracks in Southwest Airlines aircraft also raises concerns about how well the agency is monitoring compliance with its wiring regulations. [10]

The FAA's Technical Center has also argued that there is technology to "mitigate the effects of arcing faults - arc fault circuit breakers, fault current management and new materials...."[11] However, the agency itself has stated that this technology is not mature enough to address all circuit types. In its comment on the November 2007 Fuel Tank Safety final rule, the FAA stated that:

> Multiple non-destructive inspection (NDI) tools and real-time monitoring techniques are being developed for use in aircraft wiring inspection. However, current NDI reflectometry technology is not yet mature enough for its use to be mandated by the FAA. Although realtime monitoring technology, such as arc fault circuit breaker technology, is further along in development, it too is not yet mature enough to address all circuit types.[12]

Cynthia Furse, one of the experts attempting to commercialize this NDI reflectometry technology, stated recently that, "This is something we would hope could be integrated starting about five years from now and that it would be relatively mainstream within the next 10 years." As for the arc-fault circuit breaker, she notes, "They are already being tested on some military planes and have been shown to be very

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[7] Federal Aviation Administration, "Subject: Development of Transport Category Airplane Electrical Wiring Interconnection Systems Instructions for Continued Airworthiness Using an Enhanced Zonal Analysis Procedure." Advisory Circular 25-27. November 23, 2007; p. 1.

[8] "The checks assessed whether American followed all procedures of a 2006 FAA order to ensure that wiring for an auxiliary hydraulic pump was properly installed and secured. The directive, affecting more than 730 aircraft in the U.S. commercial fleet, was aimed at preventing electrical shorts that could trigger a fire in the wheel well, a copy of the order showed." Crawley, John. "AMR Cancels Flights, Delta Begins New Checks." Reuters, March 26, 2008 19:35 EDT. Accessed June 10, 2008 at http://money.netscape.cnn.com/story.jsp?floc=FF-RTO-robtz&idq=/ff/story/0002%2F20080326%2F1936303580.htm&sc=robtz

[9] Bailey, Jeff. "Aging Jet Fleets an Added Strain on U.S. Airlines." New York *Times*, April 12, 2008; p. C1.

[10] Holmes, Stanley. "Airline Safety: A Whistleblower's Tale." *BusinessWeek*, February 11, 2008; p. 48.

[11] WTVF-TV (April 29), *loc. cit.*

[12] 72 *Fed. Reg.* 63371 (November 8, 2007).

effective. There is still some development yet to be done, but I would anticipate that the arc-fault circuit breakers will be relatively mainstream within about five years."[13]

FAA's Technical Center cannot argue that something that might be available in five years can address current risks posed by questionable wiring insulation materials now in place throughout the U.S. fleet.

Wiring is not the only fire safety area where the FAA's response has been inexplicably delayed. As mentioned above, government safety experts in the Swissair 111 investigation concluded that the insulation blankets in the ceiling above the cabin caught fire. In August 1999, the FAA proposed Airworthiness Directives to remove the insulation blankets implicated in the accident from McDonnell Douglas aircraft. [14] Nine months later, the directives were finalized and put into force.[15]

It took five more years for the FAA to propose Airworthiness Directives requiring removal of similar insulation blankets wrapped in a PET film called AN-26, which are mostly used in Boeing aircraft. That came only after reports of "in-flight and ground fires on certain airplanes manufactured with insulation blankets covered with AN-26, which may contribute to the spread of a fire when ignition occurs from sources such as electrical arcing or sparking." [16]

However, three years later, the FAA still has not completed evaluation of comments and issued final Airworthiness Directives regarding AN-26 insulation blankets. The comment period has twice been extended. Comments from the Air Transport Association[17] and the Boeing Company[18] are focused on convincing the FAA that these blankets in the vicinity of the flight deck and the electronics bays do not require removal if additional fire barriers are installed. Even if the Airworthiness Directives are approved as proposed, the rule contemplates a six-year implementation period. Protecting the public's safety is the FAA's primary goal, and your agency is lagging too far behind on this matter.

As a result of this delay, ten years after the Swissair accident, there is still a significant risk that planes flying today have wiring with identified susceptibility to arcing coupled with insulation blankets that even the FAA acknowledges pose a real fire

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[13] Jones, Willie D. "Wiring a Problem for All Aging Aircraft, Not Just MD-80s," *IEEE Spectrum* Online, [New York: Institute of Electrical and Electronic Engineers] April 11, 2008. Accessed June 10, 2008 at http://spectrum.ieee.org/apr08/6156/2.

[14] 64 *Fed. Reg.* 43963-43969.

[15] 65 *Fed. Reg.* 34321-34360.

[16] 70 *Fed. Reg.* 16986 (April 4, 2005). "...The results of extensive flammability testing, conducted by the airplane manufacturer and the FAA, revealed that even though AN-26 met the certification standards in place at the time of original certification in 1981, this type of insulation material will propagate a fire when subjected to electrical arcing and sparks. The FAA used the insulation blankets' response to electrical arcing and spark testing as the basis for identifying the unsafe condition with MPET and has determined that these same safety criteria are applicable to AN-26. ... Insulation blankets constructed of AN-26 installed throughout the fuselage, if not corrected, could propagate a fire that is the result of electrical arcing or sparking..." p. 16988.

[17] White, Joseph W. "ATA Comments to the Proposed Rule: 'AN-26' Insulation Blanket Film Coverage," Response to Regulatory Docket FAA-2005-20836, Doc. 40. February 23, 2006.

[18] See Regulatory Docket FAA-2005-20836, Docs. 44 and 45, for communications to discuss the hazard analysis of the proposal to leave insulation blankets in place near the flight deck and electronics compartments. The FAA responded that Boeing's analysis is not sufficient to justify the proposal.

hazard. I believe the agency needs to quickly move towards promulgating a final Airworthiness Directive on insulation blankets. That step alone will reduce the risk that the Swissair accident will be repeated, even in the absence of changes to wiring.

I must also point out that the electrical systems of the next generation of aircraft will operate at levels greater than those on today's planes. One of the design decisions Boeing made in its 787 Dreamliner to achieve a 20% reduction in fuel consumption was to employ electrical power for the environmental control system. As a result, the electrical system for the Dreamliner will operate at a power level five times greater than the Boeing 767.[19] But the inadequate regulations regarding wiring, insulation and fire risks for existing air fleets also apply prospectively in the context of larger electrical power loads and composite materials that have flammability qualities radically different from the aluminum airframes of the past. This seems like a disaster in the making.

Therefore, I ask that you provide the following answers and supporting materials to the Committee:

1. Please report to the Committee on research and development achievements in producing technologies or materials that can be used to retrofit existing aircraft to reduce the chances of wiring failures. This report should include an explanation of the extent to which these technologies have been made available to the industry and deployed in commercial fleets. Please provide this report in writing to the Committee by September 9, 2008.

2. The FAA required organizations to submit compliance plans for the preparation and distribution of instructions for continued airworthiness relating to electrical wiring interconnection systems in Part 26 of its Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety final rule (issued in November, 2007). Those plans were due by March 10, 2008. Please advise the Committee of any organization that missed this deadline or has yet to submit the required plan. Also, please advise the Committee of the process being used to review and approve these plans and the status of that review.

3. Please provide a schedule for the finalization of the AN-26 Insulation Airworthiness Directive. Also, please indicate whether removal of metalized mylar blankets has been completed.

4. Please answer the following questions regarding the Boeing 787 and the Airbus A380:

a. Are the wiring systems in the Boeing 787 and Airbus A380 free of the Kapton or polyvinyl chloride/nylon wiring insulation, as prescribed by the *Degradation Study* team?
b. How does the FAA certification process for new airliners assure that the aircraft wiring will reflect the "proper design, installation, maintenance and training" to minimize risk?
c. Are arc-fault circuit breakers employed as standard equipment in these new aircraft?

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[19] Ray, Susanna. "Boeing Says 787 Dreamliner "Power On" Test Completed," Bloomberg.com. June 20, 2008 16:22 EDT. Accessed June 21 at http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aMjh3OYacakM.

d. Are the insulation blankets to be used in the 787 made from materials consistent with the new flammability standards established by the FAA in 2003?[20]
e. How has the FAA changed its calculation of risk from fire in light of the widespread use of composite materials in new aircraft fuselages and in the cabins?
f. As electronics have come to replace mechanical cables in flight control systems, how has the FAA certification process dealt with the increased risk that wiring faults may interfere with the crew's ability to control the aircraft? What research has FAA done on the safety implications of this shift and what requirements are in place to guarantee adequate safety margins?
g. How has the certification process changed to evaluate the likely effects of aging on new aircraft designs?
h. How does the FAA assure that Airbus A380 wiring systems incorporates the same standards for safety required of new domestically-manufactured aircraft?

Please provide answers to these questions, and any other supporting materials, no later than September 9, 2008. Please contact James Paul or Dan Pearson (202-225-8772) of the Committee staff if you have any questions. Your cooperation with the Committee is appreciated.

Sincerely,

Bart Gordon

BART GORDON
Chairman

cc: Hon. Ralph Hall
Ranking Member
Committee on Science
and Technology

[20] 68 *Fed. Reg.* 45046-45084 (July 31, 2003).