Boeing Commercial Airplane Group

Air Safety Investigation

RAPIDFAX LEAD SHEET

DATE: 19 Dec 96

LEAD + 3 Page(s)

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December 18, 1996
B-B600-15914-ASI

Mr. Bob Swaim
National Transportation Safety Board
490 L'Enfant Plaza East, SW
Washington, D.C. 20594

BOEING

Subject: TWA 747-100 N93119 Inflight Explosion off Long Island, New York - 17 July 1996

References: Your letter to Party Coordinators of 12 Dec 1996, concerning Wiggins Coupling Testing

Dear Mr. Swaim:

The reference letter describes proposed electrical characteristics testing of Wiggins couplings at the Naval Air Warfare Center in Patuxent River, Maryland, and solicits party comments on the testing.

After careful consideration, Boeing is concerned that the test as proposed in reference will not contribute to evaluations of the cause of the accident under investigation because the conditions at the time of the accident are not being duplicated in the test described. The proposed test can produce misleading test results.

The test as currently planned demonstrates that a flammable fuel/air mixture can be ignited with a spark of sufficient energy. The elements of this reaction are well defined in existing literature. Boeing suggests the ignition demonstration part of the test is premature and should be done after the elements of the conditions are determined.

The following is submitted in the interest of reproducing conditions that existed at the time of the accident.

We suggest, as a preliminary to the proposed testing, that a test similar to the electrostatics test previously planned by Boeing (and now being planned as investigative party activity) be conducted to determine the amount of charging that would occur on the coupling parts under the conditions suggested in the test plan. Once that work is complete, we suggest that the values obtained be evaluated in the ignition tests planned in reference letter to determine if this level will ignite a flammable mixture. If no ignition occurs, the level of charge would be increased by factors up to ten and tried again at each new level to see if ignition occurs. If no ignition occurs in this test it will demonstrate that a factor of safety exists. If ignition occurs at the initial value,

other tests in the NTSB planned series should be performed to evaluate the character of the installed parts.

In summary, the above proposal would start with a test having a relationship to the actual airplane configuration and would indicate whether the condition under test should receive further consideration.

In regard to the testing outlined in reference, Boeing will comment further when time permits. However, we offer the following at this time.

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Mechanical Construction

We understand NTSB is asking Boeing to supply two fuel tubes and couplings for the test. Boeing no longer uses the exact same coupling used in the 747-100. We can supply couplings of the type currently used; however, they may be different than those used in the TWA 800 airplane. The O-Rings we can supply are from current stock. We do not know what O-Ring materials were in the TWA 800 airplane. These items must be made up in the shop and sent to the test site. This would take at least five working days.

The construction of the suggested test configuration is such as to establish an ideal configuration that we believe would occur infrequently in an airplane with high time parts. No shims are used in the airplane to separate the O-Ring retainers from the ferrules. Centering is provided by the O-Rings. Shimming may create the ideal condition of maximum possible separation of the parts in the coupling assembly. Shims would have to be very small. Highly accurate (and probably specially prepared) wire gauges are required to verify this condition. The dimensional tolerances of the parts permit a maximum of 0.0145 inches to occur between the O-Ring retainer and the tube ferrule when assembled and perfectly aligned axially. Nominal parts will produce less spacing, any axial misalignment decreases the gap.

In the airplane, these pieces are installed in a process that does not specify perfect alignment. The assembly is self-aligning by design and construction. However, the pieces will move around within the constraints of the assembly in a manner that will produce close fits in the coupling configuration.

Test Plan

Electrical Testing -

Capacitance Measurement:
In Para 1.1, First assemble parts normally and measure resistance and capacitance between the couplings and the tubes. Then the parts are to be assembled so that all coupling parts are electrically isolated from the tubes and ferrules. (Boeing has not developed a procedure for using shims to do

this. The parts are designed for ease of installation and electrical isolation is not a requirement).

In Para 1.2, Using an RLC meter, measure the capacitance of the couplings relative to the tubes. The original parts are anodized. If new parts are used, a connection capable of breaching this surface treatment is required.

Measure the charge bleed off using a continuously recorded and displayed DC voltage. The voltage level used will be determined by the results of the Boeing test series. The voltage will be recorded until it is no longer readable or when thirty seconds have elapsed.

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Spark Energy:
In Para 2.1, Connect one lead of a voltmeter to the coupling and the opposing lead to both tubes. Both tubes should be grounded. If the mechanical setup is successful the tubes will not be electrically bonded to each other.

When a breakdown voltage is reached and proven by three repeats, dismantle the coupling assembly being careful to preserve the orientation of the parts and determine and record where the arc occurred by inspection of the tube and other parts.

Electrostatic Charging:
This test is not required when doing this test as a result of failure of the ignition test. Charging of the coupling will be done as in the capacitance test Para 1.3.

If The Boeing Company can be of any further service, please do not hesitate to call.

Very truly yours,

for John W. Purvis
Director, Air Safety Investigation
Orgn.
Telex
Phone
Datafax

cc: Al Dickinson
Party Coordinators