

CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

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TRANS WORLD AIRLINES L-1649A, U S REGISTRY N-7313C
NEAR MILAN, ITALY, JUNE 26, 1959

English translation of the Report of Italian Republic Ministry of
Defense Board of Inquiry Appointed to Investigate the Accident.

AMENDMENTS TO THE REPORT OF THE BOARD OF INQUIRY ON THE
CRASH OF THE S. C. PLANE NO. 7313/C

Chapter XI

- (1) Par. 11 4.18 These tests made in a specialized laboratory, disclosed that:
- [1] On an L-1649 plane static discharges should occur at the vent outlets if the aircraft is struck anywhere by lightning and, if, it is not struck, they may occur when the aircraft flies through clouds that are charged with electricity.
 - [2] Static discharges, comparable in strength to those that can occur in flight, generated in still air in a container filled with flammable fuel vapors, cause those vapors to ignite.
 - [3] The tests mentioned in the preceding paragraph cannot, however, on the basis of the knowledge available at the present time, be taken as conclusive evidence that static discharges generated at the vent outlets of an aircraft in flight, from which (outlets) flammable fuel vapors are escaping, will necessarily cause those vapors to ignite, but they do indicate that such a danger is within the realm of possibility.
 - [4] The evidence and considerations referred to in the two preceding paragraphs indicate very definitely that adequate precautionary measures should be developed and adopted, the most important of which would be to insert anti-flame wire gauze onto the vent outlets and to have the said outlets shaped and constructed in such a way as to render them less subject to the development of static discharges.
 - [5] Static discharges can, and generally should, develop without leaving on typical aircraft metals, and therefore on the vent outlets, any normally visible evidence.

Chapter XIV

- (2) Par. 14.4.2.6 (b')
- (b') The possibility that static and nonstatic electrical discharges, under the testing conditions described in pars. 11.4.4 and 11.4.18, might ignite flammable gasoline vapors has already been tested in the United States, with positive results.

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- [1] The tests mentioned in par. 11.4.18, made in a specialized laboratory, disclose that:
 - (a) On the strength of available knowledge, it cannot be stated positively that static electricity discharges generated at the vent outlets of an aircraft in flight, from which (outlets) flammable gasoline vapors are escaping, will necessarily cause those vapors to ignite, but the indication is that such a danger is within the realm of possibility.
 - (b) The atmospheric conditions existing at the time of the crash were extremely favorable for the development, at the vent outlets of Super Constellation aircraft No. 7313/C, of static-electricity discharges entirely capable of igniting flammable gasoline vapors under the test conditions described in par. 11.4.18.
- [2] The tests referred to in par. 11.4.4, which were made in the tunnel:
 - (a) On one only of the original manifolds, located on the trailing edge of a wing contour, from whose four outlet pipes (compare par. 14.0) there was an escape of vapors containing a mixture compressed within the limits of flammability (tanks Nos. 6 and 7) and not included in said limits (tanks Nos. 3 and 4);
 - (b) At a pressure corresponding to the altitude of 1,700 feet;
 - (c) At an air flow speed of 170 knots I.A.S.;
 - (d) On the velocity of the vapors escaping from the individual pipes, corresponding to climbing speeds of 900, 600, and zero feet a minute, revealed that said vapors, as the result of suitable electric discharges of a nonstatic nature, become ignited only under conditions that would occur when the plane was climbing, and that the flame did not spread to the interior of the tanks.

In conclusion, although the evidence referred to in the aforesaid pars. 11.4.4 and 11.4.18 does not warrant the assertion that static electricity discharges generated at the vent outlets of the Super Constellation aircraft in flight can ignite the flammable gasoline vapors issuing from those outlets, it nevertheless indicates that such a danger is within the realm of possibility and that the ignition of said vapors would actually take place if the electrical discharges were of sufficient intensity and of a nonstatic nature.

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CONCLUSION

From the hypotheses listed in paragraph 14.4 and discussed in sub-paragraphs

- 14.4.1
- 14.4.2.1
- 14.4.2.2
- 14.4.2.3
- 14.4.2.4
- 14.4.2.5
- 14.4.2.6

the Board, having found in the facts under examination no significant and concrete indication or evidence that would warrant suggesting as the probable cause one or more of the hypotheses discussed in sub-paragraphs

- 14.4.1
- 14.4.2.1
- 14.4.2.2
- 14.4.2.3
- 14.4.2.4
- 14.4.2.5

points to the hypothesis dealt with in par. 14.4.2.6, namely

Explosion set off by static-electricity discharges (streamer corona)
as the probable cause of the accident.

(3) CHAPTER XVI

Remains as it now appears in the Report, except for the elimination of the last paragraph.

Elimination of the last paragraph is necessary, according to strict logic, on the basis of the following line of reasoning.

A hypothesis may be:

- (a) Impossible
- (b) Possible (insofar as there are no elements that justify classifying it as probable)
- (c) Possible and probable (if there are elements that justify classifying it as probable)

All seven hypotheses discussed in the Report are possible and, as such, each one of them could have actually occurred.

Of these seven hypotheses, the first six are possible, but the inquiry has brought out no evidence or indication suggesting that any of them is probable

Amendments to the Report

On the other hand, with respect to the hypothesis mentioned in subparagraph 14.4 2.6, there are some evidence that would make it probable.

In other words, in the discussion of the seven hypotheses considered in the Report and insofar as their probability (likelihood) was concerned, a process of elimination was adopted whereby the first six are discussed and rejected, while the last one is discussed and recognized as probable.

Signed: Lt. Col. Enrico Miglio

Signed Adelio Zanasi
Chief Inspector

For General Duilio Fanali, AF, Chairman of the Board

[/s] Col. P. Pernazza