Lauda Air B767 Accident Report

Prepared for the WWW by

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AIRCRAFT ACCIDENT INVESTIGATION COMMITTEE
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THAILAND

LAUDA AIR LUFTFAHRT AKTIENGESELLSCHAFT
BOEING 767-300ER
REGISTRATION OE-LAV
DAN CHANG DISTRICT
SUPHAN BURI PROVINCE
THAILAND
26 MAY B.E. 2534 (A.D. 1991)

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SYNOPSIS

Lauda Air airplane, Boeing 767-300 ER of Austrian nationality and registry OE-LAV, flight number NG 004 was on a scheduled passenger flight Hong Kong-Bangkok-Vienna, Austria. NG 004 departed Hong Kong Airport on May 26, 1991 , and made an intermediate landing at Bangkok Airport for unloading and loading of passengers and cargo. The flight departed Bangkok Airport at 1602 hours. The airplane disappeared from air traffic radar at 1617 hours about 94 nautical miles northwest of Bangkok. Local police authorities near the accident site notified the Rescue Co-ordination Centre, Department of Aviation in Bangkok of the accident. The Department of Aviation notified aviation authorities in the Republic of Austria (state of the operator and state of registry) and the United States of America (state of manufacture). The Republic of Austria and the United States of America sent their Accredited Representatives to participate in the investigation.

All times in this report are UTC.

1. FACTUAL INFORMATION

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1. Replacing the solenoid operated Hydraulic Isolation Valve (HIV) with a motor-operated Hydraulic Isolation Valve.
2. Adding a dedicated stow valve.
3. Adding new electric wiring from the electronics bay and flight deck to the engine strut. Critical wire isolation and protective shielding is now required.
4. Adding a new reverser test/reverser system maintenance indication panel in the cockpit.
5. Replacing existing reverser stow proximity targets with improved permeability material to reduce nuisance indications.
6. Adding a thrust reverser deploy pressure switch.

The original design of the B767/PW4000 thrust reverser system required multiple failures for the reverser to deploy in-flight. The changes listed above for the B767 thrust reverser system address each of possible failure modes identified as a result of the investigation. The design changes effectively should prevent in-flight deployment even from multiple failures. A diagram of the current (at the time of the accident) and new thrust reverse system is included in this report as appendix F.

Thrust reverser system reviews are continuing on other model series airplane.

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2.8 Flight Data Recorder Damage

The recording tape media within the FDR installed on the accident airplane was melted due to thermal exposure related to the post crash fire. It was impossible to extract any information from the recorder. Industry records indicate that investigative authorities have reported a similar loss of recorded data in several accidents that occurred both prior to and subsequent to the subject accident. These events are:

March 10, 1989	Dryden, Ont., Canada	F28	Air Ontario
November 27, 1989	Bogota, Colombia	B727	Avianca
December 29, 1991	Taipei, Taiwan	B747F	China Airlines
January 20, 1992	Strasbourg, France	A320	Air Inter

The Technical Standard for FDRs contains a minimum performance requirement for heat exposure from flame of 1100 degrees Celsius to cover 50% of the recorder for 30 minutes.

There were some similar circumstances in each of the above mentioned accidents in that the crash site was located off airport property. It was not possible for fire department vehicles to gain rapid access to the site. In each case, the FDR was involved in a ground fire which became well established and involved surrounding debris. There does not appear to be a way to determine the exact duration of heat exposure and temperature level for the involved FDR in any of these accidents. However, it has been recognized that ground fires including wood forest materials and debris continued in these instances for at least six to twelve hours. The thermal damage to the tape recording medium was most probably the result of prolonged exposure to temperatures below the 1100 degree testing level but far in excess of the 30 minute test duration.

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It is recommended that the airplane certification authorities and equipment manufacturers conduct research with the most modern materials and heat transfer protection methods to develop improved heat protection standards for flight data recorders. Standards revisions should include realistic prolonged exposure time and temperature levels. The revised standards should apply to newly certificated FDR equipment and where practical through Airworthiness Directive action, to FDRs that are now in service.

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3. CONCLUSIONS

3.1 Findings

1. The crew members were trained, qualified, and certificated for their respective duties according to the laws and regulations of the Republic of Austria.
2. The airplane was certificated, equipped and maintained, and operated according to regulations and approved procedures of the Republic of Austria.
3. The weather in the area was fair. There were no reported hazardous weather phenomena although lightning may have been present. It is possible that the horizon was not distinguishable.
4. The physical evidence at the crash site showed that the left engine thrust reverser was m the deployed position.
5. Examination of nonvolatile computer memory within the left EEC indicated that the engine was at climb power when the reverser deployed, engine thrust was reduced to idle with the reverser deployment, and the recorded Mach number increased from 0.78 to 0.99 after the deployment. The actual maximum speed reached is unknown due to pressure measurement and recording

uncertainties.

6. The scatter of wreckage indicated that the airplane experienced in-flight breakup at a steep descent angle and low altitude.

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7. There was no indication on the available wreckage of an in-flight fire prior to the breakup of the airplane.

8. Examination of the available wreckage revealed no evidence of damage from a hostile act, either from within the airplane or from the exterior.

9. Simulations of a 25 percent lift loss resulting from an in-flight deployment of the left engine thrust reverser indicated that recovery from the event was uncontrollable for an unexpecting flight crew.

10. From an airplane flight performance standpoint, questions remain unanswered regarding thrust reverser plume behavior at high Mach numbers and in-flight reverse induced airframe buffeting at high Mach numbers, and effects of inlet spillage caused by a reversed engine at high Mach numbers.

11. Thrust reverser system certification by the FAA required that the airplane be capable of continued safe flight and landing under any possible position of the thrust reverser (FAR 25.933(a)(2)). However, wind tunnel tests and data used in the simulation of this accident demonstrated that aerodynamic effects of the reverser plume in-flight during engine run down to idle resulted in a 25 percent lift loss across the wing. Simulation of the event disclosed that the airplane was not capable of controlled flight unless full wheel and full rudder were applied within 4 to 6 seconds after the thrust reverser deployed.

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12. Investigation of the accident disclosed that certain "hot-short" conditions involving the electrical system occurring during an auto-restow command, could potentially cause the DCV to momentarily move to the deploy position. However, no specific wire or component malfunction was physically identified that caused an uncommanded thrust reverser deployment on the accident airplane.

13. Testing identified hypothetical hydraulic system failures that could cause the thrust reverser to deploy. However, no specific component malfunction was identified that caused an uncommanded thrust reverser deployment on the accident airplane.

14. No specific Lauda Air maintenance action was identified that caused uncommanded thrust reverser deployment on the accident airplane.

15. The design changes recommended by Boeing and thereafter mandated by U.S. Federal Aviation Administration Airworthiness Directive 91-22-09 for the B767/PW4000 thrust reverser system should effectively prevent in-flight deployment even after multiple failures.

3.2 Probable Cause

The Accident Investigation Committee of the Government of Thailand determines the probable cause of this accident to be uncommanded in-flight deployment of the left engine thrust reverser, which resulted in loss of flight path control. The specific cause of the thrust reverser deployment has not been positively identified.

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4. RECOMMENDATIONS

The Aircraft Accident Investigation Committee recommends that the United States Federal Aviation Administration examine the certification philosophy of all airplane certificated with ground only engine thrust reverser systems to provide appropriate design safeguards to prevent in-flight deployment.

The Aircraft Accident Investigation Committee also recommends that the United States Federal Aviation Administration revise the certification standards for current and future airplane flight recorders intended for use in accident investigation to protect and preserve the recorded information from the conditions of prolonged thermal exposure that can be expected in accidents which occur in locations that are inaccessible for fire fighting efforts.

BY THE AIRCRAFT ACCIDENT INVESTIGATION COMMITTEE OF THAILAND

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