

# Investigation Report

EX009-0/07  
February 2009

## Identification

Type of Event: Serious Incident  
Date: 20 August 2007  
Location: Frankfurt  
Classification: Commercial Air Transport  
Manufacturer / Type: Boeing / B 767 - 300  
Injuries to Persons: None  
Damage to Aircraft: Minor Damage  
Third Party Damage: None  
Source of Information: Investigation by BFU

After recycling the AFT CARGO HEAT switch in accordance with the Check List, the warning message remained.

The aircraft landed at its destination without further incident at 11:21<sup>1</sup>. While taxiing to the allocated parking position (gate) the pilot started the gas turbine auxiliary power unit (APU). Shortly afterwards, he received a report of smoke and smell arising in the passenger cabin. The cabin crew reported that the smoke continued to increase rapidly until the aircraft arrived at the gate.

The pilot advised the ground crew at the gate of the situation and requested attendance by the fire service and expeditious disembarkation for the passengers. As he left the cockpit, visibility in the cabin was considerably reduced.

As the fire service arrived, passengers left the aircraft quickly, some without their carry-on baggage. Some passengers left via the gate bridge and others via an external stairway at the rear exit. The fire fighters saw smoke emerge from an air vent shaft on the lower right side of the fuselage in line with seat row 26. Inspection with a thermal imaging camera was unable to locate the seat of any fire in the vicinity of seat row 26.

It was necessary to unload the rear freight hold to gain access to the void under seat row 26. A further search was then made for the cause with a thermal imaging camera. After several inner sidewall panels had been removed from the freight hold, investigation of the front bulkhead heat insulation located the site of a smouldering fire that had since gone out.

## Factual Information

### History of the flight

While taxiing to its parking position, thick smoke developed in the passenger cabin of the Boeing 767. All 158 passengers and the crew were able to leave the aircraft at the gate without further accident or injury.

The aircraft had flown a scheduled service from Chicago to Frankfurt. Five and a half hours after departure, while still in flight, the electronic monitoring system (EICAS) indicated AFT CARGO OVHT. The following circuit breakers tripped:

- BULK CARGO HEAT OVRD
- CARGO HEAT AFT CONT
- CARGO HEAT OVRD AFT
- APU BLEED PWR

<sup>1</sup> Unless otherwise stated, all times are local



Photo above: Location of the fire in cargo hold



Photos above and below: The charred insulation mats



#### Personnel information

The 57 year-old pilot-in-command (PIC) held an Air Transport Pilot's Licence (ATPL) for multi-engined aircraft above 5,700 kg, with a Type Rating as PIC for the B 757 / B 767. His total flight time was about 14464 hours, of which 1 829 were on the B 757 / B 767.

#### Aircraft information

The Boeing 767-300 was built in 1992 bearing the manufacturer's serial number 25196 and was registered in the USA. At the time of the incident the aircraft had flown a total of 66 641 hours with 10 466 landings.

#### Flight recorders

##### Flight Data Recorder (FDR)

The aircraft was fitted with a FDR (Fairchild FA 2100, P/N 2100-4043-00, S/N 00765), which logs 922 parameters for 25 hours. The unit was in good external condition. The FDR recorded a warning that had been given for the temperature monitoring system in the rear cargo hold.

##### Cockpit Voice Recorder (CVR)

The CVR (Fairchild FA 2100, P/N 2100-1020-00, S/N 000142715) makes a digital recording of cockpit crew conversations. After about 120 minutes of recording, an existing record is erased by overwriting with a new record. The CVR stopped when the power supply was cut on arrival at the gate. The recording confirmed the pilot's statements.

#### Wreckage and impact information

Because of the disruption to the power supply, it was not possible to use the rear cargo hold electrical loading/unloading system. After the freight container had been manually off-loaded and the site of the smouldering fire had been located in the heat insulation behind the cargo hold wall, further inspection located additional evidence of fire in a cable loom.



Photo above: Damage to the cable loom

On an insulated cable strap evidence was found of a short circuit between the cable strap and the current-carrying cable. The strap insulation had been abraded at two points, with evidence of fire at these points. Two cables in the loom had melted through, immediately alongside the strap.



Photos above and below: The defective cable strap



The maintenance personnel said the cable fire had affected the following systems:

- AFT CARGO HEAT SYS
- BULK CARGO HEAT SYS
- VACCUM BLOWER SYS2
- Lavatory Flush Control SYS 2
- APU Air Supply Shutoff Valve
- Aft Cargo Handling SYS
- Epli Wires for seat row 28HJ
- SATCOM System
- APU Battery Charger SYS

#### Fire

The smouldering fire in the insulation material was located below the defective strap and molten cables.

#### Additional information

Following the diagnosis on this aircraft, the aircraft operator and manufacturer were asked about the defective component:

- The aircraft manufacturer replied that the maintenance schedule for the B 767 - 300 does not specify any regular action relating to the cable strap.
- The aircraft manufacturer recommends that the cable straps and tie-wraps always be inspected following local maintenance or repair.
- The aircraft manufacturer had received one other report from another B 767 – 300 operator of a fire at the same position following maintenance.

#### Analysis

The inference is that when the AFT CARGO OVHT warning and electrical circuit breaker tripped, this was an indication of the moment in flight at which the short-circuit had occurred in the loom. The short circuit affected all those systems whose cables were bearing current at the time. Because most of these systems were in flight mode and therefore not switched on, there was only minor fire and smoke in flight.

On the ground, further systems were activated – some of which demand much higher current – at which point the short circuit generated much bigger sparks. As a result, the insulation mats behind the freight hold wall panels broke into a bigger smouldering fire with much more smoke. The circuit breakers then tripped, terminating the emission of sparks. The smouldering fire was extinguished by lack of oxygen.

Essentially, once again this incident highlights the fact that, very often, the circuit breaker circuits installed are inadequate to protect the electrical systems in question. This is not the first time there has been considerable damage and danger before the circuit breakers tripped. For this reason, a check should be made as to whether the electrical systems were adequately protected.

The primary cause of this incident was motion between the wire loom and strap (relative motion), resulting in wear to the insulation material on both parts (electrical cable/strap). The abrasion, and the fact that this was a repeat incident, could be taken as an indication that the cable straps were unsuitable for the cable straps routing in this area.

The consequences arising from wear could be avoided by limiting strap service life, by periodic inspections, or fitting a plastic strap. The preferred solution would be a design change. In this aircraft, it would be sufficient to

replace the existing cable straps at this location with plastic fittings.

## Conclusions

The immediate causes of this serious incident were:

- A short-circuit caused the circuit breakers to trip in the rear freight hold temperature monitoring circuit, and the electrical power supply circuit to the APU gas turbine.
- An electrical short circuit took place between cables, caused by abraded insulation on a wire loom strap. This was located behind the cladding on the rear freight hold forward bulkhead and resulted in fire.
- Following the landing, further electrical systems were activated automatically, resulting in a second short-circuit fire.
- This short-circuit fire started a smouldering fire in the insulation mats behind the freight hold cladding, generating a lot of smoke.

The systematic causes of the incident were:

- Since the protection of the electrical system was suboptimal a short-circuit was the result, allowing cables to melt and catch fire, resulting in damage to the electrical system and a smouldering fire in the insulation mat.
- The aircraft maintenance schedule did not specify regular inspections or a maximum service life for the insulated cable straps.

## Safety Recommendations

Recommendation no.: 01/2009

The Federal Aviation Administration (FAA) should instruct the aircraft manufacturer Boeing to conduct the following on all Boeing B767 models

- Assess the protection of the electrical system (circuit breakers) which run through the area in front of the aft freight hold and make any necessary changes.
- Exchange the existing insulated cable straps with plastic straps in the area in front of the rear freight hold.

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