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ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Report – 200605999
Final

APU event – Darwin Airport, NT
11 October 2006
VH-ZXE
Boeing Co 767-336

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Abstract

On 11 October 2006, at approximately 1420 Central Standard Time, a Boeing Co 767-336 was departing from bay 3 at Darwin Airport, NT for Brisbane Airport, Qld. Just prior to taxi, an auxiliary power unit (APU) fire warning activated with associated indications. The crew carried out the APU FIRE checklist items and the APU fire warning message extinguished and the aural APU fire warning ceased.

Company engineering and Aviation Rescue and Fire Fighting (ARFF) personnel performed an external visual inspection of the APU area and advised the crew that there were no signs of a fire from the APU. The aircraft was returned to the departure gate.

The aircraft was returned to service under the provision of the B767 minimum equipment list item applicable for the operation of the aircraft with an inoperative APU.

During overnight maintenance in Sydney, company engineering staff found the remnants of a significantly-charred cloth rag located on top of the aircraft's APU.

A number of safety actions were carried out or proposed by the operator as a result of this incident, including:

- amendments to the maintenance documentation for clearance closure inspections
- action to reinforce the responsibility and importance of the clearance closure inspections and to remind maintenance staff of the company's 'Safety over Schedule' principles
- the review of the suitability of equipment to gain access to all areas of the APU compartment
- a review of relevant licensed aircraft maintenance engineer training.

In addition, as a result of this incident, the ARFF changed its procedures to include that, until an ARFF response was called to a 'STOP', either an aircraft engineer or ARFF member was required to inspect the relevant aircraft compartment or area where a fire had occurred, an aircraft's fire warning system had activated, or an onboard fire extinguisher had been activated.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

Reported information

The report presented below was prepared principally from information supplied to the Bureau.

History of the flight

On 11 October 2006, at approximately 1420 Central Standard Time[1], a Boeing Co 767-336, registered VH-ZXE (ZXE) was departing from bay 3 at Darwin Airport, NT on a scheduled passenger service to Brisbane Airport, Qld. Just prior to taxi, an auxiliary power unit (APU) fire warning activated with associated indications. The crew carried out the APU FIRE checklist items, which included activating the APU FIRE SWITCH (shutting off combustibles, shutting down the APU and discharging the fire extinguisher bottle). The APU fire warning message extinguished and the aural APU fire warning ceased.

The flight crew advised Air Traffic Control (ATC) of the APU fire warning and Aviation Rescue and Fire Fighting (ARFF) personnel were requested to attend the aircraft.

The dispatch Licensed Aircraft Maintenance Engineer (LAME) performed an external visual inspection of the APU area and advised the crew that there were no signs of a fire. ARFF personnel confirmed that there were no visible signs of smoke, or of a fire on the exterior and surrounding area of the APU compartment. The flight crew advised the ARFF personnel that a tug would tow the aircraft back to the terminal building and requested the ARFF services to standby.

Another company Boeing 767 was required to wait for ZXE to clear bay 3 as there was no other suitable bay at Darwin for use by 767 aircraft. In addition, the time was approaching at which ZXE's crew would be unable to crew the flight due to flight and duty time limitations specified by the Civil Aviation Safety Authority (CASA).

The aircraft was returned to service and the minimum equipment list (MEL) was amended to allow for the operation of the aircraft with an inoperative APU. The aircraft departed on its original flight to Brisbane and on to Sydney Airport, NSW.

During overnight maintenance in Sydney, company engineering staff found the remnants of a significantly-charred cloth rag located on top of the aircraft's APU.

1 The 24-hour clock is used in this report to describe the local time of day, Central Standard Time (CST), as particular events occurred. Central Standard Time was Coordinated Universal Time (UTC) + 9.5 hours.

Maintenance history

The aircraft recently underwent heavy maintenance at the company's Brisbane Heavy Maintenance facility. The scheduled passenger flight from Brisbane to Darwin was the first flight since that maintenance. As the aircraft was just out of heavy maintenance, a 'travelling' LAME was on board the aircraft.

Operator's investigation

The operator's investigation into the circumstances of the occurrence identified two areas of concern:

- the aircraft was dispatched from Darwin without an internal inspection of the APU compartment
- a cloth rag was left in the APU compartment after the completion of a heavy maintenance inspection.

The operator carried out two Maintenance Error Decision Aid (MEDA)[2] investigations, one for each concern.

Dispatch of the aircraft from Darwin

The APU had been operated for at least 9 hours after the heavy maintenance inspection.

A LAME from an adjacent bay at Darwin reported that he did not see any indications of fire, smoke or flames from the aircraft's APU. The ARFF personnel who attended the aircraft advised the crew that, on arrival, they had seen smoke from the APU exhaust but indicated that it had ceased.

The operator reviewed the maintenance documentation associated with the occurrence and found that:

- in regard to the checks and inspections required in response to a special or unusual situation, the aircraft manufacturer's Aircraft Maintenance Manual Chapter 05-51 'Conditional Inspections' did not contain any checks or inspections to be carried out in response to the activation of a fire warning, or if a fire bottle was discharged
- the aircraft manufacturer's Aircraft Maintenance Manual Chapter 49-11-00-206-013 'Inspection after an APU fire' was not completed by the maintenance staff in Darwin
- the existing MEL item did not require an inspection of the APU compartment after the activation of an APU fire warning or if the APU fire bottle was discharged.

2 MEDA is a tool that was developed by the aircraft manufacturer and provided to operators to assist them conduct consistent investigations, to identify some of the factors that lead to an error, and to make suggested improvements to reduce the likelihood of future errors.

Heavy maintenance inspection

The operator’s investigation was unable to determine when the cloth rag was left in the APU compartment. However, it was determined that the clearance inspection after the conduct of heavy maintenance within the APU compartment was not adequate to detect the presence of the cloth rag.

ANALYSIS

Dispatch of the aircraft from Darwin

The decision by the operator to dispatch the aircraft from Darwin without a physical inspection of the aircraft's auxiliary power unit (APU) compartment may have been based on the assumption that the APU fire warning was a false indication. That assumption may have been influenced by the knowledge that:

- the APU had operated successfully for at least 9 hours after its recent heavy maintenance inspection
- independent observers confirmed that there was no residual smoke or other external sign of a fire in the APU compartment
- the maintenance organisation's documentation did not require any checks or inspections in response to the activation of the fire warning or if the APU fire bottle was discharged
- there was pressure to resolve the incident, including that:
  - the crew was approaching its limiting duty time
  - another aircraft was waiting to use the bay.

The lack of an internal inspection of the APU compartment by either the licensed aircraft maintenance engineer or the Aviation Rescue Fire Fighting personnel in response to the fire warning meant that the charred cloth rag was not located. That could have further strengthened the misconception of a false fire warning.

Heavy maintenance inspection

Despite being unable to determine when the rag was left in the APU compartment, the operator's investigation concluded that the rag had most likely previously been located above the APU before dislodging from that position and landing on top of the APU during the intervening up to 9 hours of operation.

SAFETY ACTION

A number of safety actions were carried out by the operator and Aviation Rescue and Fire Fighting (ARFF) services as a result of this incident. Those safety actions are outlined in the following discussion.

Operator

Dispatch of the aircraft from Darwin

In regard to the dispatch of the aircraft from Darwin, the operator:

- developed a proposed change to the relevant chapters of the aircraft manufacturer's Aircraft Maintenance Manual to reflect the requirement to inspect the relevant compartment where a fire warning had activated or where a fire bottle has been discharged
- drafted a proposed change to the relevant sections of the aircraft manufacturer's Dispatch Deviation Guide and the applicable minimum equipment list (MEL) to include a note that, if a fire warning has activated, or an aircraft's fire bottle has been discharged, then the relevant compartment or area must be accessed and an inspection carried out
- distributed a Maintenance Memo to all company Licensed Aircraft Maintenance Engineers (LAMEs) reiterating the importance of conducting a thorough visual inspection of the compartment or area in which a fire warning activated or in which a fire extinguisher bottle had been discharged
- distributed a staff notice to all LAMEs reminding them of the company's 'Safety over Schedule' principles, and of the need for a thorough investigation to ensure that the correct defect has been identified before invoking an MEL item. The notice also reiterated LAMEs' signature responsibilities and emphasised the risks of operating under commercial pressure
- proposed a review of its LAME training to incorporate computer-simulated events such as occurred in this incident.

Heavy maintenance inspection

As a result of its examination of the requirements of the heavy maintenance inspection, the operator:

- proposed a number of amendments to enhance its maintenance task cards. As a result of those amendments, tasks will be allocated to the individual crews working on specific areas, and the cards will clarify that a comprehensive clearance check is to be performed before each area is closed
- proposed a review of the suitability of equipment used to gain access to all areas of the auxiliary power unit to ensure that it maximises LAMEs' ability to inspect the compartment
- proposed action to reinforce the responsibility and importance of the clearance closure inspection to all LAMEs, and the importance for all maintenance staff to control the tools and materials used in performing maintenance

- proposed action to ensure that LAMEs understand their responsibilities when delegating tasks for which they will certify as being complete and correct
- implemented changes to the company's Engineering Procedures Manual to include a policy statement on the conduct of inspections, including clearance inspections
- issued a Quality Alert to all staff regarding foreign object damage.

Aviation Rescue and Fire Fighting (ARFF) safety actions

The ARFF changed the relevant section of its Standard Operating Procedures to reflect the need for either an aircraft engineer or ARFF personnel to inspect the relevant aircraft compartment or area where a fire had occurred, in which a fire warning had activated, or in which an onboard fire extinguisher had been activated. That involvement by ARFF personnel would cease once an ARFF response was called to a 'STOP'.