Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation AO-2008-002

Final

Operational event
Melbourne Airport, Vic.
31 December 2007
VH-VQT
Airbus Industrie A320 - 200

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Abstract

On 31 December 2007, at about 1600 Eastern Daylight-saving Time, an Airbus Industrie A320-200 aircraft, registered VH-VQT, was being prepared at Bay C8 at Melbourne Airport, Vic. for a scheduled flight to Newcastle, NSW. The flight crew was in the cockpit preparing the aircraft for the flight, the passengers were boarding the aircraft and the ground handlers were loading and unloading baggage and other items.

The pallet loader operator reported that, after a period of normal operation, an electrical burning smell was detected in the area of the loader's engine compartment. The supervising leading hand noticed a fire in that compartment and alerted the operator to dismount the pallet loader. The pallet loader operator detached the fire extinguisher from the loader and extinguished the fire.

The ignition source for the fire was most probably intense electrical arcing within the pallet loader engine's starter motor solenoid.

As a result of this incident:

- the Aerodrome Emergency Planning Advisory Group undertook to:
  - modify its Aerodrome Emergency Plan format to include relevant on-apron emergencies
  - examine the leadership aspects of turn around operations as they might affect on-apron emergency planning.
- the ground vehicle maintenance provider issued a Service Bulletin requiring the immediate inspection of the condition and routing of the starter motor wiring loom in all similar pallet loaders.

As a result of this, and a second fire in a similar pallet loader that occurred at Adelaide Airport on 27 May 2008, the operator retrofitted all of its affected pallet loaders with a replacement starter motor that significantly reduced the risk of electrical arcing.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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

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

Sequence of events

On 31 December 2007 at about 1600 Eastern Daylight-saving Time[1], an Airbus Industrie A320-200 aircraft, registered VH-VQT, was being prepared at Bay C8 at Melbourne Airport, Vic. for a scheduled flight to Newcastle, NSW. The flight crew was in the cockpit preparing the aircraft for the flight, the passengers were boarding the aircraft through the left-forward door via the aerobridge, and the ground handlers were loading and unloading baggage and other items.

The weather conditions reported on the Melbourne Automatic Terminal Information Service (ATIS)[2] indicated an air temperature of 41° C and a moderate, northerly wind. The temperature on the tarmac was not measured but was reported to be about 43° C.

The ground-handling team consisted of a leading hand and three ground crew, one of whom also operated the pallet loader. The team was loading and unloading a number of unit load devices (ULDs) from the aircraft's right forward and aft under-floor compartments (Figure 1).

Figure 1: Example of a baggage unit load device being loaded into a similar aircraft

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

2 An ATIS provides the normal operational information required by a pilot prior to takeoff or landing, and is broadcast automatically and continuously either on a discrete frequency or on the voice channel of one or more radio navigation aids.

The refueller was refuelling the aircraft from underneath its left wing, on the opposite side of the aircraft to, and about 10 m from, the pallet loader.

The pallet loader operator reported that the loader functioned normally until he was about to commence loading the aft compartment, when the loader's engine suddenly stopped. The operator attempted to restart the engine without success, then switched the ignition OFF and paused, before intending another start. The operator recalled that, despite his selection of the ignition to OFF, the engine then started by itself. The operator detected an electrical burning smell and motioned to the leading hand, who was standing close to the loader, to look in the area of the loader's engine compartment. The leading hand noticed a fire in that compartment and alerted the operator to dismount the pallet loader.

The pallet loader operator detached the fire extinguisher from the loader and discharged its contents into the engine compartment a number of times before successfully extinguishing the fire. Simultaneously, the leading hand reported the fire to the ground-handling duty manager by radio.

The first officer (FO), who was seated in the right cockpit seat, reported catching a glimpse of smoke or exhaust fumes around the pallet loader by way of a mirror that was located in the parking bay, on the wall of the terminal building. However, the smoke quickly dispersed and by the time the FO informed the aircraft captain, was no longer visible. The captain asked the FO to continue monitoring the situation.

The refueller reported noticing the loader operator with the fire extinguisher and seeing a white cloud emanate from the pallet loader, but no flames. The refueller ceased refuelling, maintained the fuel hose connected to the aircraft, and paused to see if it was appropriate to continue refuelling. The refueller stated that he was not informed of the fire until the arrival of the Airport Safety Officer (ASO).

There was no indication of any smoke or of a fire remote from the immediate vicinity of the parking bay.

The ramp supervisor arrived at the parking bay and advised the operator's Turn-Around Coordinator (TAC) that the fire was extinguished. The TAC contacted the Aviation Rescue and Fire-Fighting (ARFF) services and the Airport Communications Centre who contacted the ASO.

The ASO arrived at the bay about 4 minutes after the fire and directed the refueller to disconnect and to vacate the area.

The ramp supervisor informed the flight crew via the aircraft's interphone[3] that there had been a fire on the pallet loader and that it was extinguished. He also informed the flight crew that:

- the ARFF and ASO had been notified of the pallet loader fire
- there was no risk to passengers
- there was no damage to the aircraft or baggage

3 Interphone communication is possible between the ground and flight crews via a connection panel on the under-nose section of the aircraft.

- there would be a slight delay loading the remaining baggage.

The flight crew considered and discounted the requirement to disembark the passengers before advising the cabin crew about the incident and that it was under control.

An examination of the pallet loader by maintenance personnel determined that the ignition source was a short circuit on the starter motor wiring loom. That short circuit was as a result of the wiring chaffing against the engine block.

ARFF callout

The airport communications centre notified the ARFF of the 'possible fire at bay C8' via a standard alert system. That alert required all crew to turn out in their vehicles. No additional information as to the nature or scope of the fire was provided to the attending fire crews prior to their arrival at the bay.

An ARFF fire tender turned out to the emergency from the main station, which was located about 150 metres on the opposite side of runway 34 to the terminal. A departing aircraft, which had already been given clearance to takeoff from runway 34, delayed the tender crossing the runway. A second tender turned out from the satellite ARFF station that was located within the airport infrastructure, but was delayed due to road traffic.

The Air Traffic Services (ATS) personnel in the control tower were not advised of the pallet loader fire. Another aircraft was issued with push-back clearance by ATS to taxi past parking bay C8 while the ARFF and safety officers were still analysing the situation in that bay.

Turn around operations

At Melbourne, the aircraft operator provided the customer services staff, and the provision of ramp and ground-handling services was via a third-party ground-handling contractor. Those ground-handling services included the loading, handling and unloading of baggage, replenishment of potable waters, etc. The provision of ground services was monitored by:

- the ramp supervisor, who had oversight of up to three separate loading activities at any one time, and
- the TAC, who maintained radio communication with all leading hands.

The ground-handling contractor indicated that, during the allocated 30-minute turn around period, the ground-handling leading hand was responsible for the conduct by ground-handling staff of a number of turn around activities. That included the ability for ground-handling personnel, normally the leading hand, to maintain communications with the flight crew.

A disparity was identified between the aircraft operator and the ground-handling contractor in regard to the authority of the ground-handling leading hand during

turn around operations. Whereas the aircraft operator indicated that the ground-handling leading hand was authorised to cease a turn around operation if an unsafe situation developed, the ground-handling contractor stated that its ground handlers were not responsible for refuelling or catering safety. More specifically, the ground-handling contractor reported that the leading hand was restricted to ceasing ground-handling activities as required, and advising other stakeholders. Moreover, the ground-handling contractor indicated that each individual contractor involved in a turn around activity was responsible for the supervision and safety of their own operation. That included the completion of emergency procedures in the case of an unsafe situation.

There was no documentation to support the contention that overall responsibility for the safety of turn around operations rested with the third-party ground handlers.

Emergency procedures

Airport Emergency Planning

Airport Emergency Plans (AEP) are developed by Australian airports to outline the emergency planning and appropriate responses for application in emergency situations at those airports. In general, each plan seeks to protect public safety and to restore the affected airport's operations as soon as possible, in keeping with the nature and magnitude of the emergency.

Civil Aviation Advisory Publication (CAAP) 891-2(0) – *Aerodrome Emergency Planning* suggests that, when developing those plans, aerodrome emergency committees should consider adopting the format suggested in the publication *Airport Emergency Planning in Australia*[4] that was produced by the National Airport Emergency Planning Committee (NAEPC) (available at the Civil Aviation Safety Authority internet web site http://casa.gov.au/aerodromes/casainfo.htm). The Melbourne Airport AEP broadly followed that format.

The Airport Emergency Planning Advisory Group (AEPAG) (formally NAEPC) is an independent national working group that seeks to:

> …promote best practice in the development, maintenance and continued improvement of Airport Emergency Plans (AEPs) and the integration of such plans, procedures and terminology into the wider community, including State and National Disaster Plans.

The objectives of the AEPAG include that it should:

- act as a forum for AEP discussion in Australia
- foster the implementation of standardised AEPs consistent with best practice
- review and revise existing AEP standards
- recommend new standards for consideration that have the potential to enhance existing AEPs

4 June 2001 – Issue 4.

- provide advice and recommendations to the Civil Aviation Safety Authority (CASA) in relation to the regulatory requirements affecting AEPs.

The Melbourne Airport AEP[5] broadly reflected the content of other airports' plans. In regard to a fire on the airport, that plan included the following relevant definitions:

- **Airport.** The term 'airport' included any buildings, installations and equipment that might be used for the arrival, departure and surface movement of an aircraft.
- **Apron.** The airport apron was described as:

  > That part of an airport to be used for the purpose of enabling passengers to board or disembark from an aircraft, loading or unloading of freight, refuelling, parking or carrying out maintenance.

- **Ground fire.** A ground fire included when there was a grass fire on the airport, or when such a fire moves onto the airport.
- **Building fire.** The term 'building fire' specifically related to a fire, or an indication of a possible fire, in an airport building.
- **Aircraft fire.** An aircraft fire was defined as:

  > …a self evident situation where an aircraft is seen to be on fire or there is an indication of fire within the aircraft. This may include a fire in the cargo hold, in the cabin or in any part of the aircraft.

The AEP also included a number of standard operational responses to emergencies, such as in the event of: an aircraft crash on and off the airport; hazardous materials incidents; aircraft, building and airport ground fires; and so on. Activation flow charts were published in support of those procedures that required the following initial actions:

- in the case of an aircraft fire, by the control tower to inform a large number of response agencies, including the ARFF
- in response to a building fire, by the first on the scene to inform the ARFF
- in the case of an airport ground fire, by the control tower to inform a number of on-airport sections, including the ARFF.

There was no specific definition in the AEP of an apron fire. Similarly, a standard operational response to an apron fire was not published, and there was no activation flow chart for application in that instance. That was consistent with the content of a number of other airport's AEPs that were examined as part of the investigation, and meant that there was no priority given to advising either the control tower or the ARFF in the case of a fire on the apron.

5 Version 30 September 2005.

Refuelling contractor

The refuelling contractor published emergency procedures for application by its company staff in the event of emergency and other incidents. In response to a fire during aircraft refuelling, those procedures required the following immediate actions:

1. Pull lanyard to close hydrant valve.
2. Stop refuelling by releasing dead-man[6].
3. Activate any refuelling Emergency Stop
4. Disconnect hose/s from aircraft if safe to do so.
5. If possible contain fire with portable fire extinguisher
6. Notify Airport Co-Ordination Centre by any means possible (e.g. Radio Shift team leader).
7. If possible, disconnect and remove fuelling vehicle from area.[7]
8. If qualified, provide first aid assistance to any injured personnel.
9. Keep clear of Airport Rescue Fire Fighting Service extinguishing fire.
10. Notify Shift team leader of incident, who is to notify the Aviation Contract Manager.

Additional information

On 27 May 2008, another loader fire occurred at Adelaide Airport during the turn around of another of the operator's aircraft. That fire occurred in the same model of loader as had been involved in the 31 December 2007 loader fire at Melbourne Airport, and commenced in the loader's engine bay shortly after the loader operator completed the pre-operational check of the loader. The loader operator attempted to extinguish the fire a number of times before it was finally extinguished.

In response to the second loader fire, the operator:

- Issued a number of interim procedures for application during turn around operations that involved the use of the affected pallet loader. Those procedures had effect until the operator established the circumstances of the fires and identified appropriate risk treatments to prevent their recurrence, and included:
  - restrictions being placed on aircraft refuelling while the loader was in use
  - additional daily inspection requirements being carried out on the loader engine
  - additional operational requirements were placed on the use of the loader.

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6 The term 'dead-man' refers to a valve that shuts off fuel-flow at the aircraft hose fitting.

7 If required, that included authority for the refueller to immediately drive the refuelling truck from the scene of any fire. In that case, the fuel hose would break at its emergency connector point.

- Consulted with two specialist fire investigators in an effort to establish the source and nature of the fire, and to propose risk treatment options for consideration by the operator.

The specialist fire investigators' reports concluded that the fire was initiated just behind the main battery supply terminal of the pallet loader's starter motor solenoid. Evidence was identified by the second of the investigators of intense electrical arcing within the solenoid, which that investigator suggested was initiated by a foreign, conductive object shorting the battery terminal to a steel plate inside the solenoid.

After an examination of the available evidence from the Melbourne Airport pallet loader fire, the first of the specialist fire investigators concluded that, rather than being initiated by chaffing of the starter motor wiring loom as initially thought, that fire had also started as a result of intense electrical arcing in the starter motor solenoid – as in the case of the Adelaide Airport pallet loader fire.

A significant finding by the second specialist fire investigator was the availability of a replacement starter motor solenoid that, as a result of its revised construction, significantly reduced the risk of electrical arcing. That replacement solenoid had been incorporated in a new starter motor that was compatible with the pallet loader's engine.

ANALYSIS

The ignition source for the fire was most probably intense electrical arcing within the pallet loader engine's starter motor solenoid. Despite the lack of a published emergency response to an apron fire, the quick action by the pallet loader operator and ground-handling leading hand to recognise, extinguish and report the fire in the engine compartment lessened the risk to the refuelling aircraft, its boarding passengers, the involved turn around contractors' personnel and the airport facilities.

The lack of a documented procedure to allocate overall responsibility for the safety of apron operations could have explained the disparity in understanding of the authority of the ground-handling leading hand, and of the responsibility for safety of the various contractors during those operations. As a result, there was an increased risk of an uncoordinated response to a common apron emergency. Alternately, differing responses to apron emergencies could be expected from the various contractors' staffs.

In either case, although the ground-handling leading hand normally maintained communications with the flight crew, the potential resolution of apron emergencies in isolation of the leading hand meant that flight crews could not be assured of being informed of those situations. That increased the risk to the aircraft, its passengers and to all personnel involved in a turn around should there be an emergency, such as the apron fire in this case.

The location of the refuelling point on the opposite side of the aircraft made it difficult for the refueller to immediately confirm the nature of the activity at the pallet loader. However, once the refueller noticed the pallet loader operator with the fire extinguisher, and observed a white cloud emanate from the pallet loader, his action to cease refuelling was appropriate. The lack of any visible flames and of a published coordinated response by all turn around personnel to apron fires could have explained the action of the refueller to not disconnect the refuelling hose from the aircraft until directed by the Airport Safety Officer.

The requirement for flight crews to obtain clearance from Air Traffic Services (ATS) to push-back from parking bays, and to taxi in proximity to those bays, would suggest that it is appropriate for ATS to be aware of relevant emergencies on airport aprons – such as apron fires. In this instance, the lack of an apron fire emergency procedure in the Airport Emergency Plan (AEP) that included the requirement to advise ATS meant that ATS was unaware of the fire in the parking bay. Had ATS been made aware of the apron fire, the taxiing aircraft might not have been cleared to push-back and taxi in proximity to the fire, and ATS would have had the opportunity to consider the need to afford greater priority to the Aviation Rescue and Fire-Fighting (ARFF) services response. That had the potential to have reduced the risk to the refuelling and taxiing aircraft, boarding passengers, the involved turn around contractors' personnel and airport facilities.

FINDINGS

From the evidence available, the following findings are made with respect to the pallet loader fire involving Airbus A320-200, registration VH-VQT, which occurred at Melbourne Airport, Vic. on 31 December 2007. They should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The ignition source for the fire was most probably intense electrical arcing within the pallet loader engine's starter motor solenoid.

Other safety factors

- There was no documented procedure to allocate overall responsibility for the safety of turn around operations. *(Safety issue)*
- The potential for the resolution of apron emergencies in isolation of the ground-handling leading hand meant that flight crews could not be assured of being informed of those situations.
- The location of the refuelling point on the opposite side of the aircraft made it difficult for the refueller to immediately confirm the nature of the activity at the pallet loader.
- There was no apron fire emergency procedure in the Airport Emergency Plan (AEP) that included the requirement to advise Air Traffic Services (ATS) of the emergency. *(Safety issue)*
- ATS was unaware of the fire in the parking bay.

Other key finding

- The quick action by the pallet loader operator and ground-handling leading hand to recognise, extinguish and report the fire in the engine compartment of the pallet loader lessened the risk to the refuelling aircraft, its boarding passengers, the involved turn around contractors' personnel and the airport facilities.

SAFETY ACTIONS

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Airport Emergency Planning Advisory Group

Apron fire emergency procedure

Safety issue

There was no apron fire emergency procedure in the Airport Emergency Plan (AEP) that included the requirement to advise Air Traffic Services (ATS) of the emergency.

Safety action by the Airport Emergency Planning Advisory Group

During this investigation, a number of discussions and meetings were held with the Airport Emergency Planning Advisory Group (AEPAG). As a result of this incident, and of those ensuing discussions and meetings, the AEPAG indicated that it would:

- include a discussion of the implications of this incident and investigation report for AEP planning at its November 2008 group meeting
- modify the AEP format suggested in the publication *Airport Emergency Planning in Australia* to include relevant on-apron emergency procedures
- adopt this investigation and report as a case study-type learning vehicle in order to disseminate its safety issues and reported action amongst its members.

Overall responsibility for the safety of turn around operations

Safety issue

There was no documented procedure to allocate overall responsibility for the safety of turn around operations.

Safety action by the Airport Emergency Planning Advisory Group

During the above discussions and meetings with the AEPAG, that group indicated that it would examine the leadership aspects of aircraft turn around operations and any safety implications affecting AEP on-apron emergency planning. Those findings and any safety implications would be highlighted to industry.

The AEPAG also indicated that it would examine the AEP format in the publication *Airport Emergency Planning in Australia* to ensure that turn around safety was adequately covered.

Ground vehicle maintenance provider

As a result of this incident, on 17 January 2008, the ground vehicle maintenance provider issued a Service Bulletin (SB) to all maintenance staff that worked on the type of pallet loader that was involved in this occurrence. That bulletin required the immediate inspection of those loaders in the area where the wiring loom connected to the starter motor to ensure that there was no contact of the loom with the engine block. Repair instructions were included that required the repair of damaged looms and/or their relocation.

A record of the completion of the requirements of the SB was retained by the maintenance provider.

Operator

As a result of advice from two independent fire investigators in regard to the most probable initiator of this and a second fire that involved the same model of pallet loader, and the availability of a replacement starter motor that significantly reduced that risk, the operator retrofitted all of its affected pallet loaders with that starter motor. That retrofit program was completed on 25 June 2008.

APPENDIX A : SOURCES AND SUBMISSIONS

Sources of information

The main sources of information during this investigation included the:

- ground-handling and supervisory personnel that were involved in the loading of the aircraft and fire-fighting
- flight crew of the aircraft
- aircraft operator
- ground-handling contractor
- involved Aviation Rescue and Fire-Fighting (ARFF) personnel
- Airport Emergency Planning Advisory Group (AEPAG)
- Civil Aviation Safety Authority (CASA).

References

The following references were quoted or referred to in this report include:

- Civil Aviation Advisory Publication (CAAP) 891-2(0) – *Aerodrome Emergency Planning*.
- National Airport Emergency Planning Committee, *Airport Emergency Planning in Australia* (June 2001 – Issue 4), available at http://casa.gov.au/aerodromes/casainfo.htm.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

A draft of this report was provided to the flight crew, the operator, the ground-handling contractor, the involved ARFF personnel, the AEPAG and CASA.

Submissions were received from the operator, the ground-handling contractor, the AEPAG and CASA. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.