Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Investigation – 200606874
Final

Runway incursion
Brisbane Airport, Qld – 15 November 2006
VH-VYK
Boeing Company 737–838
Car 22
Airside operations vehicle

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT

Aviation Occurrence Investigation
200606874

Final

Runway incursion
Brisbane Airport, Qld – 15 November 2006
VH-VYK
Boeing Company 737–838
Car 22
Airside operations vehicle

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6440
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

ISBN and formal report title: see 'Document retrieval information' on page iii.

DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
200606874	31 January 2008	21	978-1-921165-75-7

Publication title

Runway incursion – Brisbane Airport, Qld, 15 November 2006, VH-VYK, Boeing Company 737–838, Car 22, Airside operations vehicle

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Reference No.

Jan2008/Infrastructure 8012

Acknowledgements

Figure 1 satellite image overlaid with aircraft flight path – Google Earth

Figure 2 extract from Brisbane Aerodrome Chart – Airservices Australia

Figure 3 satellite image of Brisbane runway 01 threshold area – Google Earth

Abstract

On 15 November 2006, a Boeing Company 737-838 (737) aircraft was established on a visual approach to runway 01 at Brisbane, Qld. The Brisbane aerodrome controller (ADC) had issued a clearance for a vehicle driver to enter runway 01 to locate and remove debris that had been blown onto the runway strip. The ADC subsequently issued the pilot of the 737 with a landing clearance while the vehicle was still on the runway, anticipating that the vehicle would vacate prior to the 737 landing.

The ADC reported that he may have momentarily forgotten about the vehicle. An unidentified transmission, believed to have been made by the pilot of another aircraft waiting for departure, warned the ADC of the vehicle's presence. The ADC instructed the vehicle driver to vacate the runway and reissued a landing clearance to the pilot of the 737. There was a runway incursion.

Recent thunderstorm activity had resulted in unidentified debris being blown onto the active runways, requiring multiple entries for airside operations vehicles into the runway strip to locate and remove the debris.

The thunderstorm activity led to a situation where the ADC experienced a busy and complex workload for an extended period of time without a rest break. The ADC did not initially issue instructions to the vehicle driver, or adequately monitor the situation, to ensure that the vehicle vacated the runway strip so that separation was assured with the 737.

The investigation found a common misconception about the classification and reporting of runway incursion events. The ICAO runway incursion definition of an 'incorrect presence' does not preclude a presence being incorrectly authorised by an air traffic control clearance.

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 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.

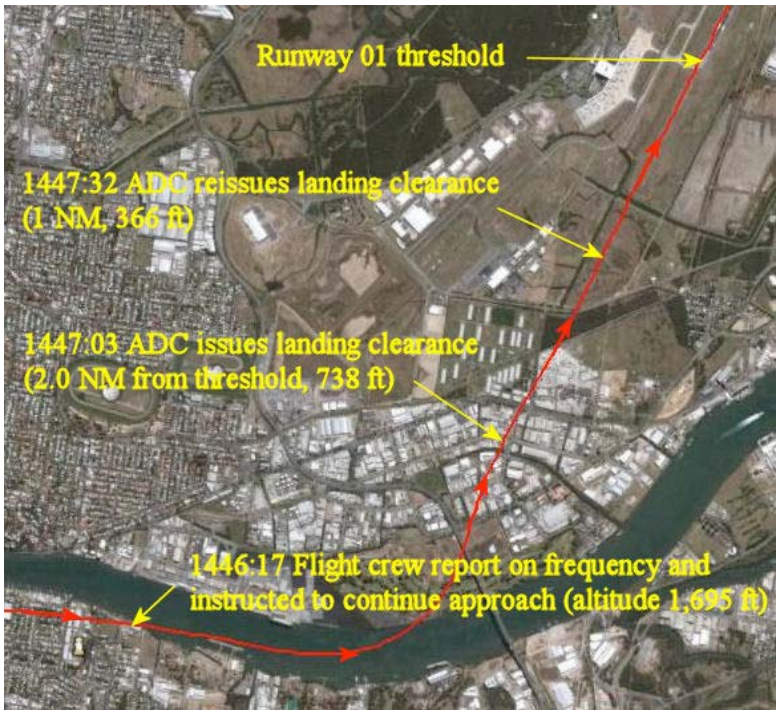
About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

Sequence of events

At 1446 Eastern Standard Time[1] on 15 November 2006, a Boeing Company 737-838 (737) aircraft, registered VH-VYK, on a scheduled passenger service from Cairns, Qld was established on a visual approach to runway 01 at Brisbane, Qld (Figure 1). At 1446:01, the Brisbane aerodrome controller (ADC) issued a clearance for an airside operations vehicle driver (Car 22) to enter runway 01, an active runway, to locate and remove debris (FOD[2]), which had been observed within the runway strip by a pilot of another aircraft. At 1446:17, after transferring from the approach control frequency, the pilot of the 737 made the first report on the ADC's frequency, and was instructed by the ADC to continue the approach. After attending to a number of other controlling tasks, at 1447:03 the ADC issued the pilot of the 737 with a landing clearance, which was acknowledged. At 1447:20, an unidentified transmission warned the ADC that a vehicle was on the runway. That transmission was thought to have been made by the pilot of another aircraft waiting on an adjacent taxiway for departure. The ADC immediately instructed the driver of Car 22 to vacate the runway. After observing that the vehicle had vacated the runway strip, the ADC reissued the landing clearance to the pilot of the 737. There was a runway incursion.

Figure 1: Flight path of 737 on visual approach to runway 01



1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 FOD - Foreign-object damage [or debris] *The Cambridge Aerospace Dictionary 2004*.

During the investigation, a number of discrepancies between the perceptions of the distances and altitudes from those directly involved in the incident were evident. It was considered that this resulted mainly from their respective locations and visual frames of reference. In providing an overview of the sequence of events, primacy was given to the information gathered from the 737's flight data recorder and recorded radar information where this differed from the reported visual observations and recollections of those involved.

Meteorological information

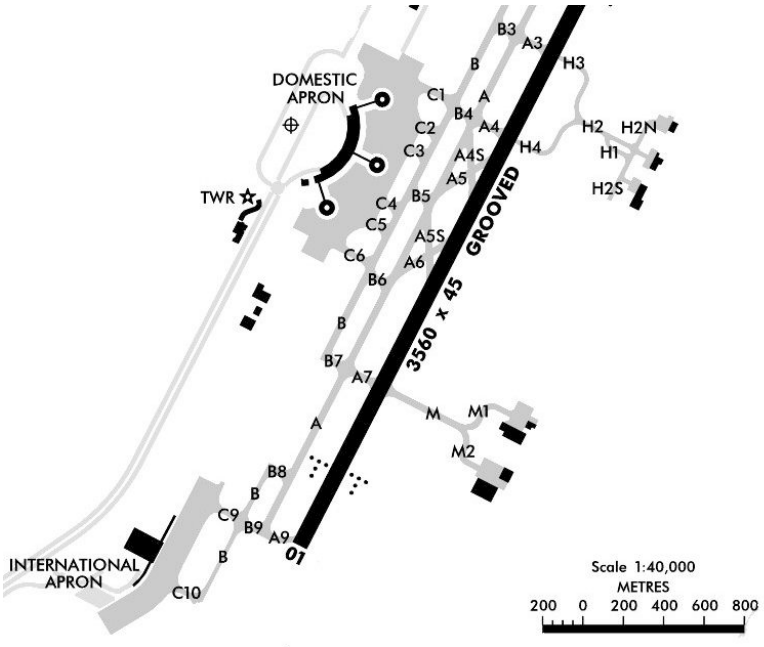
About an hour before the occurrence, unforecast severe thunderstorms had moved rapidly through the Brisbane suburbs and across the airport. Weather associated with the passage of these storms included heavy rain, hail and 60 kt wind gusts.

The thunderstorms significantly affected aircraft movements at the airport. A number of aircraft were required to be held away from the airport area by the approach controller until the storms had passed to the east of the airport. Airline company ground staff had ceased all operations on the apron areas because of the hazard presented by lightning strikes. Aircraft that had commenced taxiing were also required to remain on the ground and wait for the storms to clear.

The storm was reported to have caused significant damage around the airport area, including overturning baggage carts and moving cone markers. The reported FOD was thought to have been barrier material that originated from works that were in progress on the international apron near taxiway Charlie 9 (C9) (Figure 2). The reported FOD was not subsequently located by the driver of Car 22.

While the weather improved significantly after the passage of the storms, multiple runway changes, together with the processing of the backlog of arriving and departing traffic created an ongoing complex and busy environment for the tower and approach controllers.

Figure 2: Extract from Airservices Australia Brisbane Aerodrome Chart



Air traffic services

The Manual of Air Traffic Services (MATS) described the objectives of air traffic services and in part specified that they shall be to 'prevent collisions between aircraft on the manoeuvring area and obstructions on that area'. The MATS also provided advice about the issuing of aerodrome clearances. In part it stated:

> Aerodrome control towers [controllers] shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between… aircraft and vehicles operating on the manoeuvring area…

Brisbane Tower ATC Operations Manual Volume 2 (Local Instructions) also specified that:

> Any vehicle or aircraft that requires entry to a runway to conduct operations, as opposed to crossing a runway, must be on the Aerodrome Controllers (ADC) frequency.
>
> Controllers shall establish positive separation between all aircraft and vehicles approved to operate on a runway by the issue of information and clearances in accordance with the requirements of MATS.

The MATS required controllers to complete a visual check of the runway before issuing a landing clearance. In part is stated:

> A visual check of the landing path shall be made to ensure no obstructions exist before clearing an aircraft to land, and immediately before the aircraft crosses the threshold.
>
> The clearance shall be withheld or cancelled until an obstruction no longer exists, unless in the opinion of the controller no collision risk exists and there is reasonable assurance that separation will exist when the aircraft crosses the runway threshold to land.

The MATS also advised:

> When the landing area is occupied by another aircraft or is obstructed, arriving aircraft may be issued with a clearance to:
>
> a. continue approach if there is no immediate assurance that the landing areas will become available. This shall be followed by the appropriate clearance; or
>
> b. go around, or orbit if in a position to do so, should the landing area not be available. When required, a clearance to commence a second approach or hold shall follow these instructions. The nature of the obstruction shall be advised if not apparent to the approaching aircraft.

Aerodrome controller (ADC)

The ADC reported that as a result of the significant weather conditions, the workload had been both very busy and complex since he commenced his shift at 1200. The workload had included issuing clearances for vehicles to enter the runways on a number of previous occasions to pick up FOD.

The ADC recalled that when the driver of Car 22 called for a clearance, he had issued a clearance to enter the runway, but to remain to the south of the Alpha 7

(A7) intersection. This allowed the ADC to continue with aircraft departures from the runway north of A7 while the vehicle remained within the runway strip.

At Brisbane Airport, separation and situational awareness of traffic moving on the aerodrome was provided predominantly to tower controllers by visual observation. The airport was not equipped with any supplementary form of surveillance of the runways and taxiways such as surface movement radar. Tower controllers utilised printed paper flight progress strips (FPS) to provide them with information relating to aircraft arrivals, departures and movements on the aerodrome. The ADC position also had available pre-prepared FPS to highlight other movements that might occur within the active runway strip such as runway inspections normally undertaken by an airside operations vehicle driver. The ADC reported that an FPS for Car 22 was correctly annotated and placed into the sequence bay to highlight the fact that the runway was occupied by a vehicle.

The ADC reported that he always conducted a visual inspection of the runway before clearing an aircraft to land. In issuing the landing clearance to the pilot of the 737, he used what he described as the 'anticipatory' section of the MATS. He had observed Car 22 as part of his scan of the runway, but he had expected the vehicle to be clear of the runway strip well before the 737 crossed the runway threshold. The ADC reported that, in attending to other control tasks, he may have momentarily forgotten about Car 22 and did not immediately 'scan back' to check the vehicle had vacated the runway strip.

The ADC also reported that his experience with airside vehicle drivers was that they were always listening out on the frequency and were usually proactive in vacating a runway. When an ADC issued a clearance to land they would normally go straight to the side of the runway and report that they were clear without being instructed to do so. However the ADC acknowledged that it was the ADC's responsibility to issue instructions to the vehicle driver and to ensure the vehicle was clear of the runway strip.

The ADC also stated that using the 'anticipatory' clearance, while perfectly acceptable and commonly used, may have been a 'bit of a short cut' to keep things moving and to minimise radio transmissions. He rarely used the instruction 'continue approach' unless the relative distances were close. On reflection, the ADC considered that the best option would have been to withhold the landing clearance until he had issued an instruction to the driver and observed the vehicle vacate the runway strip, given the distances involved in this instance. The ADC also stated that he would be more reluctant to use the 'anticipatory' clearance in the future. Other controllers later reported that while they considered the 'anticipatory' clearance was a sound and valid procedure, it was rarely used and 'was the exception, rather than the rule'.

Airservices Australia (Airservices) reported that the controller providing the ADC function was correctly licensed, rated and endorsed. It also reported that the controller was current and recent at the time of the occurrence and that fatigue levels for the controller were later calculated to be in the standard range.[3] Airservices also advised that staff numbers within the tower at the time were

3 Airservices used the Fatigue Audit InterDyne (FAID) process for their calculations of fatigue levels. A standard score represents fatigue levels up to the maximum score produced by a Monday to Friday 0900h to 1700h standard work week.

'normal' and included an additional staff member to enable breaks to be provided to other controllers.

The ADC reported that due to the traffic and weather conditions he considered the shift had been busy and stressful. He had not had a break since commencing his shift, but had considered taking one about 20 minutes prior to the incident. His perception was that the shift had been short-staffed for the period between 1400 and 1500, so he had elected to continue working until he could be relieved by a staff member who was due to commence duty at 1500. He reported that he had been feeling 'pretty weary' and believed that this contributed to the occurrence.

Flight crew

The pilot in command (PIC) reported that the flight crew were operating on the last of four sectors flown for the day. They had been scheduled for an 11 hr 40 min duty time, which included about 6 hrs flying time. The PIC was the pilot flying (PF) for the sector into Brisbane and the copilot was the pilot not flying (PNF).

On descent to Brisbane, the pilots had to divert around thunderstorms, but on arrival were able to conduct a visual approach in visual flight conditions. The PIC reported that the crew had encountered a tailwind of around 20 kts on the base leg, which made the visual approach difficult to fly, especially because they were tired.

The PIC remembered hearing a vehicle driver ask for a clearance to enter the runway to get rid of some FOD and the ADC clearing the driver onto the runway. The crew were issued with a landing clearance while they were on final approach, and the PIC recalled that he and the copilot had turned to each other and stated something like 'is there a vehicle on the runway still'. Before they could query the ADC, a pilot of another aircraft transmitted 'vehicle on runway'. The PIC recalled that the ADC immediately told the driver of the vehicle to vacate onto the grass, before reissuing the landing clearance.

The PIC reported that as he was the PF, he had not sighted the vehicle up to that point as he had been concentrating on flying. The copilot later reported to him that all he had seen of the vehicle was the orange flashing light, as the vehicle was white and was located on one of the white touch down zone markers at that time (Figure 3). The PIC reported that in the ambient conditions, it was difficult to see the vehicle from their position and it took a little more mental 'processing' when 'fatigued'.

The PIC recalled they were established on a stable approach and were prepared for a go around below 500 ft if required. He believed that as they were aware of the vehicle, there was little likelihood of them landing with the vehicle still on the runway. The PIC considered that it may have been better for the controller to use the phrase 'continue approach, runway occupied', or to tell the pilot of an approaching aircraft that there was a vehicle on the runway, to improve pilot situational awareness.

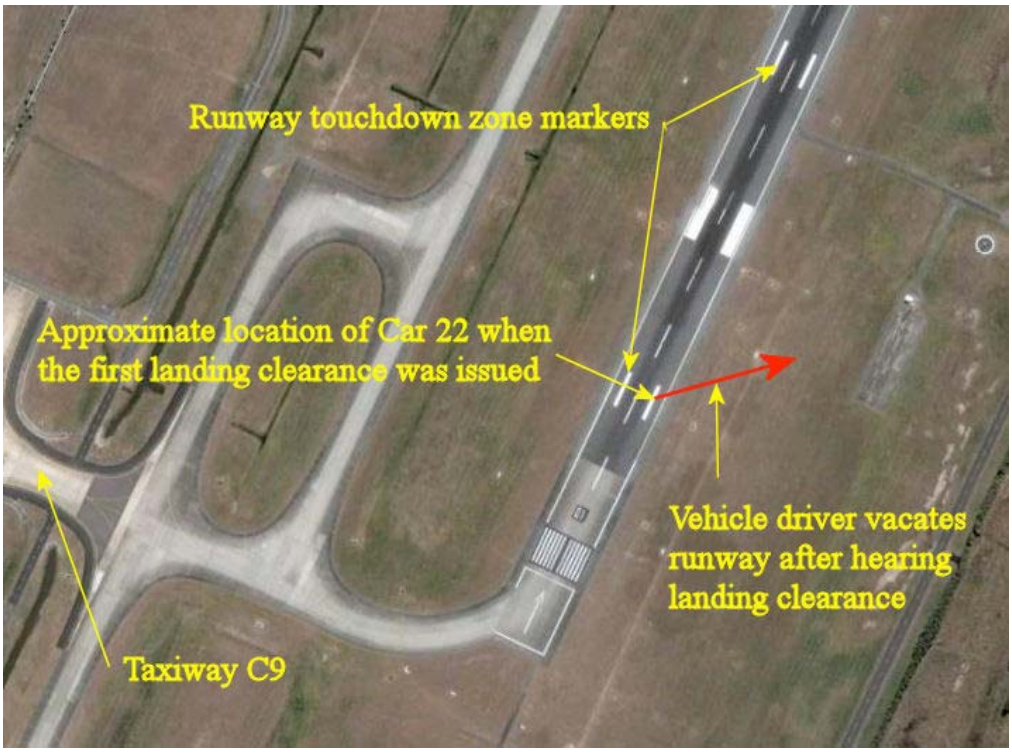
Airside operations vehicle driver

The driver recalled that after receiving a clearance from the ADC to enter the runway, he looked for any approaching or landing aircraft prior to proceeding onto runway 01 but did not sight the 737 on final approach. He later heard the ADC

issue the landing clearance to the pilot of the 737. The driver reported that after hearing that clearance on the vehicle's radio he immediately commenced vacating the runway, prior to the warning to the ADC that there was a vehicle on the runway (Figure 3). He believed that he had vacated the runway strip by the time the ADC issued the instruction for him to vacate.

The safety vehicle was white in colour and was appropriately equipped for airside operations with a very high frequency (VHF) radio, external speaker and hazard lighting. The driver reported that he had been operating all those lights including rotating lights, strobes and fog lights.

Figure 3: Approximate location of vehicle on runway 01



International Civil Aviation Organization

In 2001, the International Civil Aviation Organization (ICAO) Air Navigation Commission, in conjunction with other organisations, took action to address the increasing problem of runway incursions, which it defined as:

> Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take off of aircraft.[4]

The definition only stated that it involved 'the incorrect presence' and did not differentiate between an authorised or unauthorised presence. In 2006, ICAO

4 Procedures for Air Navigation Services – Air Traffic Management (ATM/501, Doc 4444) - International Civil Aviation Organization

published a *Manual for Preventing Runway Incursions*.[5] That document contained information on runway incursions, how to establish prevention programmes and recommendations for the prevention of incursions. In describing air traffic control factors that may result in runway incursions it in part stated that, 'one of the most common controller-related actions identified in several studies is momentarily forgetting about a vehicle on the runway.'

As part of this investigation, interviews and discussions were conducted with all of the involved parties, as well as a number of other air traffic controllers, operations staff and managers. While most regarded the incident as serious in nature because of its potential outcome, few initially considered that the incident constituted a runway incursion and some expressed concern that it was being classified as such. This viewpoint resulted from the perception that because the vehicle driver had been issued a clearance, and was therefore authorised to be on the runway, it was not an incursion. An incursion was generally considered as an unintentional or unauthorised act.

Airservices Australia

In 2002, Airservices decided to take similar action to ICAO to mitigate the risk of runway incursions and conducted a runway incursion survey at Sydney Airport, NSW. An outcome of that survey was that a Runway Incursion Group (RIG)[6] should be established to take a national perspective on runway incursions and to facilitate greater awareness among operators and users. The group was formed in 2003 and operates under the terms of reference provided by the Airservices Safety Panel.

Airservices reported that some Airservices personnel had been directly involved in the working group that drafted some parts of the ICAO runway incursion manual. It reported that the working group had discussed scenarios similar to this incident and had agreed that the vehicle could be authorised to be on the runway, but at the point that a controller 'forgot' about it and cleared an aircraft to land on the same runway, the authorised vehicle took the status of an incorrect presence. The RIG therefore considered that such scenarios should be treated as runway incursions and had previously provided some advice to Airservices staff about reporting these incidents as runway incursions.

The controller who submitted the Airservices electronic safety incident report (ESIR) relating to this incident later reported difficulties in assessing and categorising the incident within the Airservices safety management system. This resulted in the incident initially being incorrectly submitted as an event report[7], rather than an incident report.

---

5 Manual for Preventing Runway Incursions (AN/463, Doc 9870) - International Civil Aviation Organization.

6 More information relating to ICAO runway incursion safety developments and the Airservices Runway Incursion Group is contained in the ATSB aviation occurrence report 200602099 available at www.atsb.gov.au.

7 The event reporting system allowed staff to report an event which they felt did not come within the meaning of an incident, yet early reporting of the information may be useful in controlling risks by helping to anticipate failures and errors.

Local safety management staff at Airservices preferred to categorise and record this incident as a Loss of Separation Assurance (LOSA), which Airservices defined as:

> A separation standard existed, however planned separation was not provided or separation was inappropriately or inadequately planned.

Airservices reported that some additional clarification about the issue would be provided to staff as part of an upcoming ESIR enhancement project.

Advanced surface movement guidance and control system

Airservices had previously reported that it is in the early stages of a project to procure an Advanced Surface Movement Guidance and Control System (A-SMGCS) for Brisbane and other major airports. Airservices believes that the installation and use of such a system should lower the risk of runway incursions occurring by providing additional system defences such as conflict alarms and improved surveillance of the airport.

Fatigue management

In September 2004, Airservices presented a report to the National Consultative Council Occupational Health and Safety Sub Committee on Fatigue Management within Airservices Australia Air Traffic Services.

That report drew on a number of sources to document the impact of fatigue, including a paper prepared for the US Federal Aviation Administration by the Battelle Institute[8]. The report identified a number of symptoms that indicated the presence of fatigue including:

> increased anxiety, decreased short term memory, slowed reaction time, an increase in time taken to complete tasks, reduced motivational drive, decreased vigilance and attention narrowing, increased variability in work performance, reduced audio-visual scan, increased errors of omission, which lead to increased errors of commission when time pressure is added to the task, and increased lapses in performance occurring in both quantity and time.

The Airservices report also identified that rest periods during a shift were a significant issue. Studies had indicated that 'when workload was high, a rapid increase in fatigue was observable after two hours of continuous work'. The Fatigue Management Working Group (FMWG) made a number of recommendations to mitigate fatigue, including the following relating to rest breaks:

> Provide all staff with rest breaks to mitigate the effects of work related fatigue and to attend to personal needs
>
> Define a rest break as "a period free from operational duty for workers to overcome the fatigue arising from work and to attend to personal needs"
>
> In single person towers rest breaks should be provided at least every 4 hours and more often in high workload circumstances. For other ATS staff, rest breaks should be provided from operational duty at least every 2 hours and more often in high workload circumstances.

---

8 An overview of the Scientific Literature Concerning Fatigue, Sleep, and the Circadian Cycle – Battelle Memorial Institute, JIL Information Systems, January 1998.

Rest breaks should be 20 to 30 minutes or more and should be consistent with the need to balance handover risk

The work and activity level on operational shifts should be reviewed regularly to ensure adequate opportunities exist for them to rest and to attend to personal requirements.

ANALYSIS

Weather aspects

The thunderstorms that moved through the airport area prior to the incident were not forecast, were severe in nature, and moved rapidly. While the occurrence of unforecast storms at that time of year would not be considered unusual, the severity of the activity was unusual. The associated weather caused a degree of chaos both on and off the airport. The distribution of debris (FOD), together with other storm damage, could reasonably be expected from such an event. As the reported FOD was never recovered and identified, the investigation was unable to consider whether materials around the apron works site were appropriately secured or not. However, the presence of any potential FOD around movement areas is in itself a serious safety concern. Securing or removing any materials that could be blown onto these areas should minimise the need for vehicles to enter the active runways in response to reports of FOD.

The storms and their resulting aftermath, including the backlog of traffic, created a very busy and complex work environment for the approach and tower controllers. It was likely that the aerodrome controller (ADC) was experiencing some degree of mental fatigue after working for 2 hr 45 min in the circumstances; however, the level was not able to be quantified. While he reported that he believed his fatigue contributed to the incident, it was also difficult to establish whether this led to him issuing the 'anticipatory' landing clearance and a failure to adequately monitor the vehicle on the runway. However, common symptoms of fatigue include slowed reaction times, decreased vigilance and a change in the level of acceptable risk an individual will tolerate. While the ADC later mentioned that he thought he needed a break before the incident occurred, there was no evidence that he requested one, or indicated that he was feeling fatigued to other staff, including the tower supervisor. While research has shown that people are often unable to accurately assess their own fatigue, there was also little available evidence of any proactive strategy to ensure sufficient breaks were made available, and taken, by staff.

Air traffic control procedures

The ADC had complied with the requirements of published documents including the use of a flight progress strip within the active bay to show that the vehicle was within the runway strip. The *Manual of Air Traffic Services* (MATS) allowed for the use of 'anticipatory' clearances if in the opinion of the controller there is a reasonable assurance that separation will exist when the aircraft crosses the runway threshold to land. It was clear from discussions that was what the ADC intended. His previous experience with vehicles vacating the runway without prompting may have led to his presumption or expectation that the driver would do so again in this instance. The ADC stated that he did a visual check of the runway when issuing the landing clearance and would have done another one again as the aircraft approached the threshold, as required by MATS. It was considered likely that the ADC would have identified the vehicle at, or prior to, this point and if necessary issued a go around instruction to the crew of the 737.

Under the circumstances, the ADC should have probably instructed the pilot of the 737 to continue the approach in accordance with the MATS, which stated that:

> The clearance shall be withheld or cancelled until an obstruction no longer exists, unless in the opinion of the controller no collision risk exists and there is reasonable assurance that separation will exist when the aircraft crosses the runway threshold to land.

That statement requires two conditions to be met. The fact that the vehicle was on a runway, to be used by an arriving aircraft, created a situation were the ADC could not reasonably consider that 'no collision risk exists'. To meet that criteria the vehicle would have had to have been not operating on the runway surface. It might also be considered that the second criteria had not been met, as there was no 'reasonable assurance that separation will exist when the aircraft crosses the runway threshold…' as the ADC had not instructed the driver to vacate the runway before issuing a landing clearance to the pilot of the 737.

That view is supported by the ADC's comment that while the 'anticipatory' clearance was commonly used, he would be reluctant to use the procedure in future and would withhold a landing clearance until after he had instructed, and observed a vehicle vacate a runway strip.

This was also considered to be better procedure by other controllers who considered the 'anticipatory' clearance to be a valid, but rarely used procedure. They considered that it was more appropriate to instruct an aircraft to continue approach if there was no immediate assurance that the landing area would become available. If, as suggested by the pilot in command (PIC) of the 737, controllers issued a clearance to 'continue approach' together with a reason such as 'vehicle on runway' or 'runway inspection' it would have the additional benefit of improving the situational awareness of the flight crew and allowing them to monitor or assist in the separation solution.

Flight crew awareness

The PIC of the 737 reported that the crew had heard the driver of the vehicle being cleared onto the runway by the ADC. After being issued a landing clearance, the crew were in the process of challenging the vehicle presence when the other aircraft warned the tower about the vehicle. The PIC considered that the crew's reaction time and assessment may have been slowed a little as a result of fatigue after a long flying day. However, he also believed that appropriate actions were taken well in advance of a landing decision, while the aircraft was established in a stable approach, and that the crew were prepared for a go around if necessary.

As stated by the PIC, given the circumstances of this occurrence, it would have been unlikely for the crew to have continued with the landing with the vehicle still on the runway. However, the ADC had issued the clearance for the vehicle driver to proceed onto the runway just before the 737 crew had first reported on the ADC's frequency. It was probable that the crew were waiting for a break in radio transmissions in order to make that first report. Had the crew not heard that transmission, they would have been unaware of the vehicles presence. Given their difficult approach, stated fatigue and difficulty in sighting the vehicle on the runway, it would have been possible for the crew to continue with their landing in the absence of that one overheard transmission.

Airside operations vehicle

The airside operations vehicle was appropriately equipped for airside operations. The vehicle driver was operating all the vehicles lights, including rotating lights, strobes and fog lights. While the atmospheric conditions at the time may have made the vehicle difficult to sight, the flight crew did observe the vehicle's rotating light. Initial analysis considered that the white colour of the vehicle may have may have constituted a safety hazard when located on the white runway markings, but it was accepted that the vehicle was unlikely to remain stationary in that position for any length of time. In the absence of any other reported safety issues, no further analysis was made in respect to the vehicle colour.

The vehicle driver complied with all requirements, which were considered appropriate. While the driver reported looking for any aircraft before proceeding onto the runway, the 737 was still on a base leg at that point and would have been difficult to sight. On hearing the landing clearance being issued to the pilot of the 737, the driver was proactive in vacating the runway strip.

Other pilot's warning

The transmission to warn the ADC about the vehicle still on the runway was thought to have originated from the pilot of an aircraft waiting on an adjacent taxiway for departure. The pilot displayed good situational awareness and was proactive in warning of an unsafe situation.

FINDINGS

From the evidence available, the following findings are made with respect to the runway incursion event and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The aerodrome controller issued the flight crew of the 737 with a landing clearance with a vehicle operating within the active runway strip.
- The aerodrome controller did not initially issue instructions to the vehicle driver, or adequately monitor the situation, to ensure the vehicle vacated the runway strip so that separation was assured with the 737.

Other safety factors

- Severe thunderstorm activity resulted in unidentified debris being blown onto the active runways that required multiple entries for airside operations vehicles into the runway strip to locate and remove the debris, to ensure the continued safe operation of aircraft.

Other key findings

- Severe thunderstorm activity led to a situation where the Brisbane aerodrome controller experienced a busy and complex workload for an extended period of time without a rest break.
- The investigation found a common misconception about the classification and reporting of runway incursion events. The ICAO runway incursion definition of an ‘incorrect presence’ does not preclude that such a presence might have been authorised.
- An unidentified transmission warning of a vehicle on the runway alerted the aerodrome controller and pilots of the 737 about the unsafe situation.

SAFETY ACTION

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.

ATSB safety action

The ATSB is currently reviewing the *Transport Safety Investigation Regulations 2003*. The review includes an assessment of the definition of a runway incursion.