

Australian Government Australian Transport Safety Bureau

Losses of separation assurance involving Airbus A330-243, PK-GPO and Airbus A330-341, PK-GPA

near ATMAP (IFR reporting point), Western Australia | 31 March 2012



Investigation

ATSB Transport Safety Report

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Addendum

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Safety summary

What happened

On 30 March 2012, Airservices Australia was unable to resolve two short-notice controller absences for night shift coverage of the Kimberley and Cable airspace sectors, located over north-western Australia. A contingency plan was activated and a Temporary Restricted Area (TRA) initiated for that airspace from 0015 to 0515 Eastern Standard Time on 31 March.

Two aircraft separately entered the TRA without the knowledge of Airservices personnel. An Airbus A330 registered PK-GPA, on a flight from Denpasar, Indonesia to Melbourne, Victoria, was detected at 0500 when the flight crew contacted a Melbourne Centre controller because their aircraft was at the Brisbane/Melbourne Flight Information Region (FIR) boundary after transiting the TRA. The second aircraft, an A330 registered PK-GPO, on a flight from Denpasar to Sydney, New South Wales, was detected at 0641, when the crew contacted Melbourne Centre at the FIR boundary. The aircraft had been operating in controlled airspace for 86 minutes, without the knowledge of any controllers. The minimum standards for separation from other aircraft were met, but both situations constituted losses of assurance that separation would be maintained.

What the ATSB found

Overall, Airservices had many risk controls in place to manage the situation where it was unable to provide the published air traffic services (ATS) and had to activate a TRA. In this case, a TRA had to be activated at short notice in airspace adjacent to an international ATS provider, and a range of actions by operational personnel did not conform to expectations. Airservices' risk controls were not robust enough to effectively manage this situation and ensure they would be made aware of all aircraft that were operating within the TRA.

The ATSB concluded that a number of procedures and processes were not fulfilled on the night of the occurrence and identified four safety issues: Airservices' process for ensuring that all aircraft operating in the TRA were known to ATS; selection and preparation of personnel for the Contingency Response Manager role; the contingency plan testing and review process; and the absence of a defined process for recording the actual hours worked by Air Traffic Control Line Managers.

What's been done as a result

Airservices has revised its contingency plan documentation and procedures. In addition, its updated Fatigue Risk Management Requirements have addressed the recording and monitoring of the actual hours worked by Air Traffic Control Line Managers.

The ATSB is not satisfied that Airservices has adequately addressed the identified safety issues regarding processes for managing a Temporary Restricted Area to ensure that all aircraft were known to air traffic services and contingency plan testing and review effectiveness. As a result, the ATSB has made formal recommendations to Airservices.

The operator of the A330 aircraft, Garuda International, specified that, as the use of procedures associated with TRA activation was an infrequent requirement and not practiced in daily operations, it would ensure the procedures were reviewed as part of check and training programs.

Safety message

The occurrence provides a timely reminder to all organisations operating in high reliability systems of the importance of having multiple risk controls in place to effectively manage rare combinations of events during abnormal situations, and to regularly review the effectiveness of these controls.

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The occurrence

Events leading up to the Temporary Restricted Area activation

On 30 March 2012, at 2140 Eastern Standard Time¹, an air traffic controller from Airservices Australia's Tops Group telephoned their workplace, which was located in Airservices' Brisbane Centre, Queensland, to advise that they were unable to attend for their rostered night shift. The controller was rostered to provide air traffic control (ATC) services from 2300 to 0615 on the Kimberley (KIY) and Cable (CBL) airspace sectors (see *Air traffic control information*), which were normally combined into one control position during the night shift. The short notice absence was due to a legitimate personal reason that did not afford the controller any additional time to advise their employer.

As two controllers were required to staff the KIY/CBL position during the night to allow for rest breaks, the Brisbane Centre's Systems Supervisor (SS)² started telephoning other Tops Group controllers to secure a shift replacement.

At 2155, the other controller who was rostered on the 2300 to 0615 shift on the KIY/CBL sectors telephoned their workplace to advise that they were also unable to attend for their shift. The short notice absence was also due to a legitimate personal reason that did not afford them any additional time to advise their employer.

The SS could not identify any appropriately endorsed controllers who met the organisation's fatigue management requirements and were available to accept the additional duties. The SS subsequently attempted to contact one of the two controllers who had reported that they were unable to conduct their night shift in case the personal situation might have stabilised but was unsuccessful.

The controller working the evening shift on the KIY/CBL sectors extended their duty by 2 hours, to the maximum allowed duration of 10 hours, to provide shift coverage until 0015 on 31 March 2012. Another controller, who had already agreed to conduct an additional duty shift the next morning starting at 0815, agreed to start this duty period earlier at 0515.

The SS and Operations Room Manager³ in the Brisbane Centre identified that the only viable option was to activate the Air Traffic Services (ATS) Contingency Plan for the Tops Group for the period 0015 to 0515. The SS contacted the Upper Airspace Services (UAS) Service Delivery Line Manager⁴ (SDLM) to discuss the situation and obtain their approval to activate the plan.

At about 2230, an ATC Line Manager (ALM) from UAS North, which included the Tops Group, was allocated the Contingency Response Manager (CRM) role in preparation for the activation of the contingency plan. The CRM was at home when notified of the role allocation, and arrived at the Brisbane Centre at about 2330.

Up until about 2330, Brisbane Centre supervisory personnel were still considering the possibility that one of the controllers who had reported that they were unable to conduct their night shift would become available. However, given the nature of the situation, this was very unlikely. In

¹ Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

² The primary role of a Systems Supervisor was the oversight and management of all operational facilities that support air traffic service delivery. That task required the general supervision of operational staff to ensure a safe and efficient air traffic service. A Systems Supervisor was required to be on duty at all times and supported the Operations Room Manager role.

³ An Operations Room Manager held Operational Command Authority for their respective Flight Information Region and was accountable for ensuring the safe and effective provision of the full range of air traffic services on a shift by shift basis. Each ATC Centre was required to have an Operations Room Manager on duty during such periods as was determined by an operational risk assessment.

⁴ The SDLM was the high-level manager responsible for the ATC groups within the Australian FIR that provided services for high-capacity jet aircraft operating on both short and long-haul routes over continental Australia and oceanic areas.

consideration of the pending period where there were no available controllers, the SDLM approved the activation of the contingency plan at about 2300.

Subsequent activities included:

- Airservices requested approval from the Civil Aviation Safety Authority (CASA) Office of Airspace Regulation to designate the affected airspace as a Temporary Restricted Area (TRA), with Traffic Information Broadcast by Aircraft (TIBA) procedures to apply from 0015 to 0515 on 31 March 2012, and this request was approved.⁵
- Brisbane Centre personnel developed and implemented a traffic management plan. The plan involved controllers in the Melbourne Centre accepting responsibility for a portion of the KIY airspace release on and west of air route G578, which reduced the volume of airspace in which the published ATS would not be available. Amended tracking around the TRA airspace was offered to traffic already airborne.
- A Notice to Airmen (NOTAM)⁶ for the TRA activation was published for the KIY sector at 2341 and for the CBL sector at 2351. A revised NOTAM for the KIY sector (1248/12) was issued at 0034.
- At 0001 on 31 March, Airservices' National Operations Centre (NOC)⁷ conducted a
 teleconference regarding the activation of the TRA with the two, Australia-based operators that
 were available for such a teleconference. The NOC also provided individual direct briefings to
 all of the international operators affected by the TRA activation, with the exception of Garuda
 International (Garuda), as direct contact could not be established with that operator. In lieu of a
 briefing, the NOC sent Garuda an email.
- The TRA commenced at 0015, and the CRM monitored the KIY/CBL console during the TRA period.

The main events associated with the occurrence are summarised in Figure 1 and are explained in more detail in the rest of this section.

Events associated with aircraft PK-GPA

An Airbus A330, registered PK-GPA and operated by Garuda, was scheduled to operate a passenger service from Denpasar, Indonesia to Melbourne, Victoria, departing at 0155 (2355 Denpasar time). The dispatcher did not present any NOTAMs or weather forecasts to the flight crew during the pre-flight briefing that were considered of any particular significance.

At 0127, the operator's ground handling agent received NOTAM D1248 /12 on their facsimile machine, but the dispatch personnel were not aware of the NOTAM at that time. At 0152, upon completion of passenger boarding, the flight crew requested a start clearance from local ATC. ATC asked if the flight crew had received NOTAM D1248/12. The flight crew searched through their NOTAM file and could not locate it, so they cancelled the start clearance request.

The flight crew contacted the ground handling agent and requested a copy of the NOTAM, and the dispatcher obtained a copy and proceeded to the aircraft to brief the flight crew. In subsequent discussions, the flight crew identified that their flight would be affected by the NOTAM. They discussed the TIBA procedures that they would be required to use, and the captain retrieved the

⁵ A TRA was not legally permitted to be declared by Airservices outside territorial waters .For ease of reader comprehension, the area outside territorial waters but within the Australian Flight Information Region (and the KIY/CBL sectors), has been depicted in this report as the TRA, as the same procedures applied for entry and operation in that portion of contingency airspace.

⁶ A Notice To Airmen advises personnel concerned with flight operations of information concerning the establishment, condition or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to safe flight.

⁷ The National Operations Centre was established as a central point of contact for external stakeholder communications and was based in Canberra, Australian Capital Territory.

operator's Flight Operations Notice to Flight Crew for TIBA procedures in Australian airspace from their flight bag.



Source: ATSB

Note: Red lines indicate ATC activities, blue lines indicate PK-GPA activities and green lines indicate PK-GPO activities.

PK-GPA departed Denpasar at 0237. The Australian Advanced Air Traffic System (TAAATS) automatically entered the aircraft's actual departure time into the flight data record (FDR) for the flight. The departure time was then displayed on PK-GPA's flight progress strip on the KIY/CBL console's air situation display. The CRM did not then manually process the FDR from a 'preactive' to a 'coordinated' state, and therefore the aircraft's position was not updated in TAAATS or displayed on the KIY/CBL air situation display (see *Air traffic computer system processing*).

The aircraft proceeded as per its flight plan into airspace controlled by the Indonesian air traffic services (ATS) provider Ujung Pandang (Ujung), with a planned cruise altitude of flight level (FL)⁸ 370. Based on flight planning estimates, PK-GPA exited the Ujung Flight Information Region (FIR)⁹ and entered the Brisbane FIR's KIY sector at position TARUN (Figure 2) at about 0310.

PK-GPA's flight crew reported that, during the flight through the TRA, they conducted all-stations broadcasts on frequency 128.95 as required by the TIBA procedures. The crew also advised that at a position 10 minutes prior to ENPIT, the aircraft's exit point from the TRA, they made a broadcast on frequency 128.95. However, they did not make a position report to ATC on the next ATS frequency, based in Melbourne Centre, 15 minutes prior to exiting the TRA to obtain a clearance before entering controlled airspace. Such a position report was required under TIBA procedures.





Source: Base image from Airservices Australia. Modified by the ATSB.

At 0500, the flight crew contacted Melbourne Centre ATC with a position report overhead ENPIT at FL 410. After about 20 seconds, the controller had not responded so the flight crew called again. The controller requested the flight crew confirm their position, flight level and estimate for

⁸ At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 370 equates to 37,000 ft.

⁹ Airspace of defined dimensions within which flight information service and alerting service are provided.

the next reporting point on their route, which they did. The flight crew were then issued an onwards clearance to Melbourne at FL 410.

As PK-GPA had entered controlled airspace overhead ENPIT without first obtaining the required airways clearance, there was a loss of separation assurance (LOSA).¹⁰ The Melbourne Centre controller's separation plan, in the airspace under their jurisdiction, had not considered PK-GPA, as the controller had previously been unaware of the aircraft. As no other aircraft were in close proximity to PK-GPA during that time and separation standards were maintained, there was no loss of separation.¹¹

Events associated with aircraft PK-GPO

An Airbus A330, registered PK-GPO and operated by Garuda, departed Denpasar on a scheduled passenger transport flight to Sydney, New South Wales at 0405. The flight crew had received a briefing from the Denpasar dispatcher, which included NOTAM 1248/12. The captain also reported that local ATC had notified them of the NOTAM before departure.

On departure from Denpasar, PK-GPO entered Ujung airspace with a planned cruise altitude of FL 390. As with PK-GPA, PK-GPO's TAAATS FDR remained in a preactive state and the aircraft's position was not updated or displayed on the KIY/CBL air situation display.

The entry point for the Brisbane FIR and the TRA for PK-GPO's route was ATMAP (Figure 3) where high frequency (HF)¹² radio was the only available communication with Australian ATS. At 0452, the flight crew contacted the Flightwatch International (FWI) operator on HF and provided a position report for ATMAP of 0444 at FL 390, which the operator processed as an Air Report (Airep).¹³ The FWI operator entered the Airep into TAAATS and instructed the flight crew to contact Brisbane Centre at 0520 on control frequency 133.4, which was the normal procedure for aircraft entering very high frequency (VHF)¹⁴ coverage, but not the appropriate procedure for TRA operations. The flight crew incorrectly read back a frequency of 123.4, which was not detected or corrected by the FWI operator or the flight crew.

The Airep entered into TAAATS did not update the aircraft's FDR due to the record's preactive state (see *Air traffic computer system processing*). Subsequently, the Airep message was automatically directed to the Alert Queue on the Flight Data console in the Brisbane ATC Operations Room for action by the duty Flight Data Coordinator (FDC). The FDC later reported that they had printed out the Airep and provided it to the CRM. System records showed that the Airep was actioned out of the Alert Queue but the FDR was not updated with the report's details. The CRM could not recall having received the Airep and could not locate a copy of the printed message in their documentation from that night.

The flight crew of PK-GPO reported that, during the flight through the TRA, they conducted allstations broadcasts on frequency 128.95, as required by the TIBA procedures and detailed in the NOTAM.

At 0508, the incoming KIY/CBL controller contacted the Melbourne Centre controller for the adjoining southern sectors to coordinate the TRA cessation and the resumption of airspace. This

¹⁰ A separation standard existed; however, ATC planning, or ATC or flight crew execution of those plans, did not ensure that separation could be guaranteed.

¹¹ Controlled aircraft should be kept apart by at least a defined separation standard. If the relevant separation standard is infringed, this constitutes a loss of separation (LOS).

¹² High frequency radio operates from 3000 to 30,000 KHz. It is used for long distance radio communication between aircraft and ATC in situations where normal very high frequency (VHF) radio is not available. HF communications are usually operated by personnel other than air traffic controllers.

¹³ A report prepared by the pilot during the course of a flight in conformity with the requirements for position, operational or meteorological reporting specified in the AIREP form.

¹⁴ Very high frequency radio operates from 30 to 300 MHz.

included the portion of airspace that had been released to Melbourne Centre as part of the traffic management plan.



Figure 3: PK-GPO's timeline (all times EST)

Source: Base image from Airservices Australia. Modified by the ATSB.

At 0515, the TRA ceased and the provision of ATS in the KIY/CBL sectors resumed. The KIY/CBL controller established communications with aircraft that had been operating in the TRA by means of both directed transmissions and pilot-initiated calls. There was no communication from the flight crew of PK-GPO, who were still operating on an incorrect frequency, and the controller was unaware that the aircraft was operating in their jurisdiction airspace.

On the resumption of published ATS at 0515, there was a LOSA involving PK-GPO as the aircraft was operating in controlled airspace without the knowledge of ATC or receipt of the required airways clearance. Other aircraft were operating in the KIY and adjoining southern sector airspaces and the controllers' separation plans did not consider the presence or position of PK-GPO. As no other aircraft were in close proximity to the aircraft during that time and separation standards were maintained, there was no loss of separation.

The flight crew of PK-GPO reported that they attempted to establish contact with ATC on frequency 123.4 at 0520 but there was no response. The captain reported that they thought TIBA procedures were still applicable at that time, so they did not consider it unusual to have received no response from ATC. At that stage the aircraft was still over 80 minutes away from reaching TIMMI (the exit point from the KIY sector) and the KIY/CBL controller was not aware PK-GPO was operating within their airspace.

At 0556, a handover/takeover of the KIY/CBL positions was conducted. The incoming controller identified that the flight progress strip for PK-GPO had an actual departure time from Denpasar and the aircraft could be operating in the KIY airspace at that time. The controller processed the FDR to a 'coordinated state' as per the documented procedures. That action resulted in a symbol representing a procedural flight plan track, with the aircraft's call sign and flight planned level attached as a label, appearing on the controller's air situation display. With its position based on the departure time, system estimates and the original flight plan, TAAATS placed PK-GPO within the controller's jurisdiction airspace. At 0600, the controller made a blind broadcast to the flight

crew of PK-GPO to determine if they were on frequency 133.4. As the crew were still on an incorrect frequency, there was no response.

The KIY/CBL controller contacted the Ujung controller and asked if they held flight details for PK-GPO, to which the response was 'negative'. As PK-GPO had departed Ujung's airspace about 76 minutes earlier, Ujung's computer system no longer had pending or active details for that aircraft. The KIY/CBL controller returned the FDR for PK-GPO back to a preactive state, removing the flight plan track from their display and ceasing any further system processing of the aircraft's FDR.

At 0620, a Melbourne Centre controller for the adjoining southern airspace sectors contacted the KIY/CBL controller and queried if someone had monitored the TRA during the activation period as the flight crew of PK-GPA had called unannounced at the FIR boundary. The KIY/CBL controller responded that they were not sure but thought that there had been someone at the console.

At 0641, as PK-GPO crossed position TIMMI and exited the KIY airspace, the flight crew called the Melbourne Centre controller for the adjoining southern sector. The flight crew had not made a position report to the controller 15 minutes prior to exiting the TRA as required under TIBA procedures. Unaware of PK-GPO's location, the controller asked the flight crew for their position, which was provided as overhead TIMMI at FL 390, with an estimate for the next reporting point on their flight planned route. The controller acknowledged that call, coordinated the FDR and updated the position report entries for the aircraft. About 1 minute later, in order to assure vertical separation with PK-GPO, the controller asked the flight crew of another aircraft if they could accept climb from FL 390 to FL 400. That flight crew accepted the level change. There was no loss of separation with other aircraft as the minimum standards for separation were maintained.

The LOSA situation involving PK-GPO was resolved following the Melbourne Centre controller becoming aware of PK-GPO's position, and then assuring separation with the other aircraft under their jurisdiction.

Post occurrence events

At 0644, the Melbourne Centre controller called the KIY/CBL controller to advise that the flight crew of PK-GPO had unexpectedly called on the sector/FIR boundary, and suggested that there may have been a TAAATS messaging issue between the Brisbane and Melbourne FIRs as they had not received any details. They also requested that the KIY/CBL controller conduct full voice coordination with them, in addition to the automated system messaging, until it could be ascertained as to why there had been no details received for PK-GPO.

A few minutes later, the KIY/CBL controller called the Ujung controller to request flight details for PK-GPO and advised that, as the aircraft had already transited through the KIY airspace, it would have departed Denpasar about 2 to 3 hours earlier. The Ujung controller advised that they would get the required details and called back about 3 minutes later with information that, according to their ATC computer system, PK-GPO crossed overhead position ATMAP at 0441 at FL 390.

Airservices subsequently identified that PK-GPA and PK-GPO had both operated in the TRA without clearance to do so and without the knowledge of the CRM.

Context

Air traffic control information

Kimberley and Cable sectors

Upper Airspace Services North consisted of three air traffic control (ATC) Groups, which included the Tops Group. The Kimberley (KIY) and Cable (CBL) en route airspace sectors were part of the Tops Group, and the controllers who worked on the sectors were based in the Airservices Brisbane Centre. The KIY and CBL airspace sectors were located over north-western Australia, within the Brisbane Flight Information Region (FIR) and abutted Indonesian airspace, at the Ujung Pandang FIR boundary to the north, and the Melbourne FIR boundary, from the west to the south (Figure 4).

UJUNG PANDANG FIR FIR BOUNDARY BRISBANE FIR CABLE SECTOR 20° FIR BOUNDARY Car **MELBOURNE FIR** BRISBANE 30* SYDNEY MELBOURNE AO-2012-047 AIRSPACE **OVERVIEW**

Figure 4: Airspace overview

Source: Base image from Airservices Australia. Modified by the ATSB. Note: The Kimberley sector also consisted of the airspace overlying the Cable sector.

At the time of the occurrence, KIY and CBL were mainly procedural ATC sectors. Procedural separation is required when the information derived from an air traffic services (ATS) surveillance system (for example radar) is not used or available for the provision of ATC services. Procedural separation involves the use of vertical, time, distance or lateral separation standards, and is based on the reported positions of aircraft, as advised to ATC by pilots through radio contact or Controller Pilot Data Link Communications.¹⁵ As ATC's knowledge of exact aircraft positions in the procedural control environment may be less precise than where ATS surveillance systems are available, procedural separation standards, other than vertical, are considerably larger than separation standards applied in the surveillance environment.

¹⁵ A means of communications between controller and pilot, using text-based messages via an ATC data link.

There was ATC surveillance coverage in the KIY airspace above flight level (FL) 290 within 200 NM (370 km) from the Australian coast, in the form of Automatic Dependant Surveillance-Broadcast (ADS-B).¹⁶ Neither PK-GPA nor PK-GPO was ADS-B equipped at the time of the occurrence. Australia had mandated that from 12 December 2013, all aircraft operating at or above FL 290, excluding those categorised as State aircraft,¹⁷ must be ADS-B equipped. This would result in full surveillance services being available to aircraft operating at or above FL 290 in the Tops Group airspace within ADS-B coverage.

There was very limited radar coverage at the edge of the eastern part of the KIY sector provided by the Darwin and Tindal radar feeds. The northern portion of the Melbourne FIR, where PK-GPA and PK-GPO entered, did not have radar coverage and ATC provided a procedural control service for non-ADS-B equipped aircraft such as PK-GPA and PK-GPO.

There was no VHF coverage in the airspace abutting the Ujung Pandang FIR and the northern over-water area, including the boundary positions of TARUN and ATMAP. Radio communications with Australian ATS, provided by Flightwatch International (FWI), were available via HF in those areas.

Temporary Restricted Area airspace

During the TRA activation period, Melbourne Centre agreed to assume a portion of the KIY airspace, on and west of air route G578, which reduced the size of the TRA from the standard KIY/CBL airspace dimensions. The flight planned routes of PK-GPA and PK-GPO required the aircraft to transit through the TRA (Figure 5).



Figure 5: Temporary Restricted Area airspace with aircraft routes

Source: Base image from Airservices Australia. Modified by the ATSB.

¹⁶ ADS-B is a system in which electronic equipment on-board an aircraft automatically broadcasts the precise location of the aircraft via a digital data link. The data can be used by other aircraft and air traffic control to show the aircraft's position and altitude on display screens without the need for radar. Dedicated ADS-B grounds stations receive the broadcasts and relay the information to air traffic control for precise tracking of the aircraft.

¹⁷ An aircraft or any part of the Defence Force (including any aircraft that is commanded by a member of that force in the course of his/her duties as such a member), other than any aircraft that by virtue of registration under the regulations is an Australian aircraft; and aircraft used in the military, Customs, or police services of a country other than Australia.

Use of conforming levels

One of the primary system defences for ensuring separation is through aircraft operating at, and ATC assignment of, cruising levels as defined in accordance with international standards. The application of those cruising levels was intended to minimise the possibility of aircraft tracking in opposite directions at the same level and should provide 1,000 ft vertical separation between instrument flight rules aircraft on reciprocal tracks.

Both PK-GPA and PK-GPO operated within the TRA, and then controlled airspace, at flight levels different to those in their lodged flight plans. However, it was not unusual for flight crew to vary their aircraft's actual cruising altitude due to factors such as wind or weather (with approval from ATC when operating in controlled airspace). The amended flight levels of both aircraft conformed to cruising level requirements.

Air traffic computer system processing

Arrangements at the time of the occurrence

In the Australian Advanced Air Traffic System (TAAATS), the Flight Data Record (FDR) for an aircraft automatically changed state to 'preactive' 45 minutes before the aircraft's estimated time of departure. This allowed for the flight progress strip for that aircraft to be displayed to the controller in a preactive strip window open on the controller's air situation display.

For an aircraft departing Indonesia, the Indonesian air traffic computer system electronically generated a departure message. Using this message, TAAATS automatically entered the aircraft's actual time of departure (ATD) into the FDR for the flight.

The Local Instructions for the Tops Group detailed the required controller interactions with FDRs. For the FDR of an aircraft inbound to Australia, the controller was required to visually scan the TAAATS preactive strip window for aircraft that had departed and check whether an ATD was displayed in the preactive strip (Figure 6). For aircraft with an ATD, the controller was required to manually interact with the FDR to move it to a 'coordinated' state so that the aircraft's flight plan track was displayed on their air situation display. That track would be shown as a square symbol with a label displaying information including the aircraft's call sign and planned flight level. Once in a coordinated state, the aircraft's position could be updated by radar or ADS-B (if available), by an 'Airep' submitted by Flightwatch, or manually by the controller based on a position report from the flight crew or another controller. For an aircraft subject to radar or ADS-B surveillance (but not for aircraft subject to procedural separation), a symbol representing the aircraft's position, uncorrelated with its relative FDR, would still be displayed even if the FDR was not coordinated.



Figure 6: Flight progress strip showing actual time of departures (ATD)

Source: Base image from Airservices Australia. Modified by the ATSB.

At the time of the occurrence, ATC coordination for aircraft operating from Indonesia to Australia was done by verbal communication between controllers, conducted via direct speech circuits or telephone. Under normal operations, the coordination would typically be initiated by Ujung ATC after the aircraft had departed. During the TRA period, however, coordination on aircraft positions and estimates was not conducted between the CRM and Ujung. Airservices advised that if the CRM had accepted coordination from Ujung, there might have been confusion about the CRM then providing an ATC service, which was not allowable under the requirements associated with TRA activation. During the TRA period, Ujung ATC continued to coordinate with other Australian ATC sectors.

The CRM remained at or near the KIY/CBL console during the TRA activation period. However, they were not aware of the requirement to manually coordinate the FDR. The controller who resumed ATS on the KIY/CBL sectors at 0515 did not notice the ATD displayed in the flight progress strip for PK-GPO. As previously noted, the controller who took over the sectors at 0556 did notice the ATD and manually coordinated the aircraft's FDR, but then processed the FDR back to a preactive state, after initial discussions with Ujung ATC.

The operational controllers on duty after the TRA period reported that they were not aware of the reduced level of human-machine interface (HMI) input by the CRM and assumed that the CRM had kept the system updated to the operational standards. In addition, those controllers had not been aware of any problems occurring during the TRA activation.

Arrangements up until December 2011

Up until 15 December 2011, there was boundary and estimate ATS Inter-facility Data Coordination (AIDC) messaging enabled between the Indonesian and Australian ATC computer systems (both Eurocat¹⁸ system platforms). The AIDC messaging allowed for TAAATS to automatically coordinate flight plans, which meant that a controller did not need to manually interact with the FDR to change it from a preactive to a coordinated state. In addition to the AIDC messaging, there was voice coordination from Ujung on aircraft taxying, their proposed tracking and estimate for the FIR boundary, which the Tops controller would then approve or renegotiate. At that point, the Tops controller would also verify that the coordinated flight plan in TAAATS correlated with the flight's progress.

The AIDC messaging between Indonesian and Australian ATC was conducted as a trial. Airservices commenced an internal Request for Change (RFC) process on 3 November 2011 to cease the boundary and estimate AIDC messaging component of the trial due to ongoing errors. The RFC documentation stated that Ujung were having continuous problems with the processing of AIDC messages. The boundary and estimate AIDC messaging was planned to resume once Ujung had resolved their system messaging issues. The documentation also noted that AIDC messaging between the agencies was not required for normal operations as voice coordination was still conducted. The trial was continued for other types of messages.

The RFC documentation did not provide details of the level of unreliability of the boundary and estimate AIDC messages. Some Tops Group controllers reported that they considered that the messaging between the Indonesian and Australian Eurocat systems was about 95 per cent accurate. Occasionally, a departure message would not be sent but the required voice coordination would address that situation. Controllers advised that they were not made aware of any formal change process for the AIDC messaging being disabled. They had been advised verbally that the AIDC messaging would be inhibited and they reportedly worked through the change themselves. The local instructions were subsequently updated.

¹⁸ Eurocat was the system platform for the Australian Advanced Air Traffic System (TAAATS).

Contingency management arrangements

ATS contingency plans

Airservices' National ATS Contingency Plan defined an ATS contingency as:

a situation whereby a failure or non-availability of staff, facilities or equipment (ie Operational Restrictions) results in an inability to provide all Air Traffic Services as detailed in the ATS Providers' Certificate. An ATS Contingency commences at the time that the situation is first recognised and continues until the provision of all ATS services are restored.

The national plan provided high-level information, procedures and guidance for the management of contingencies, from which more specific plans for each ATS area were developed. When a variation in service level appeared likely, the appropriate Service Delivery Line Manager (SDLM) was to be notified to determine the appropriate course of action and whether the contingency plan needed to be activated.

The ATS Contingency Plan: Tops Group provided more specific procedures and guidance for the response to and recovery from contingency events within the Tops Group. The Tops Group plan included:

- notification checklists for the CRM, ORM and other relevant personnel
- briefing sheets for various ATS functions, including adjoining FIRs, adjoining sectors, and Flightwatch International (FWI)
- a briefing sheet for pilots or operators
- NOTAM templates
- advice notices for other affected organisations such as airport operators.

Operational hazard assessment

Airservices' National ATS Contingency Plan required the SDLM to ensure that a Variation to Published Services: Operational Hazard Assessment form was completed prior to a variation of published services. The form was used to provide evidence that a risk assessment had been conducted, covering the effect on operations and staff, and consideration of available mitigations.

The first page of the five-page document contained areas to document the reason for the variation to published services, the expected traffic levels, forecast weather and possible agencies affected. In addition, there was an area to enter the name of the CRM appointed and a small space to enter a response to the question 'CRM able to perform HMI?' as either 'yes' or 'no'. The form for the 30 March 2012 activation on KIY/CBL sectors was marked 'yes'.

The next three pages of the form were pre-populated with a list of 12 'potential failures' and associated columns labelled as 'consequences' (which were further delineated into 'effect on ATS' and 'effect on external agencies') and 'controls', which required completion. The pre-populated 'potential failures' included:

- surrounding sector staffing levels being insufficient to accept additional workload (of diversions and metering)
- staff not being familiar with published contingency procedures
- diversion routes breakdown in coordination due to unfamiliar contingency procedures
- violation of controlled airspace resulting from pilots not calling ATC for clearance from the TRA airspace 15 minutes prior to entering controlled airspace.

When the contingency plan was implemented on 30 March 2012, the hazard assessment form was completed by the CRM after the commencement of the contingency period. The first three 'potential failures' listed above were ticked as applicable on the hazard assessment form on 30 March 2012, with limited details completed regarding the consequences or controls in place for these hazards. The potential for pilots to not call for clearance, 15 minutes before leaving the TRA and entering controlled airspace, was not identified as being applicable.

Contingency Response Manager

Role of Contingency Response Manager

In accordance with the Airservices' procedures, the activation of a contingency plan required the SDLM to appoint a CRM to oversee and coordinate the ATS response. The CRM could be an SDLM, an ATC Line Manager (ALM), an off-duty Operations Room Manager or an off-duty Systems Supervisor. The CRM's responsibilities were:

- ensuring that appropriate notifications were completed
- managing the contingency response
- evaluating the situation and escalating the response if required
- managing the return to published ATS.

Qualifications and experience

The CRM selected for the 30 March 2012 TRA was employed as an ALM in Airservices' Brisbane Centre. They had been involved with ATC for about 31 years and had last worked as a Tops Group controller in 2000 and as an operational line controller in another ATC Group about 4 years before the occurrence. They became an ALM in 2007 and moved to an ALM role in Upper Airspace Services North in 2009.

The CRM reported that they had not been provided with initial or refresher training for the CRM role. They considered that training for contingency situations was required, particularly for the CRM role.

The CRM advised that they had learnt how to manage a contingency situation through experience. They had undertaken the role several times, with the last time being in February 2009. They advised that on previous contingencies, they had significantly more preparation time available than on this occasion, in which they arrived at the Brisbane Centre 45 minutes prior to the start of the TRA period.

The National ATS Contingency Plan stated that a CRM could update TAAATS if they held an ATC license with a current rating and had relevant HMI experience for the generic function, such as procedural en route or radar en route. If a CRM did not meet those criteria, they were limited to the verbal relay of reported flight information to controllers on adjacent sectors.

The CRM selected on 30 March 2012 was considered to have met the required criteria. They reported that TAAATS HMI had changed significantly in the period since they had last worked as a Tops Group controller. They also advised that their HMI skills had diminished and they were unclear as to what level of interaction they should have with TAAATS in the CRM role to keep it updated. Accordingly, they had to seek assistance from surrounding controllers to update TAAATS on the night of the contingency situation.

Recent history

From 27 to 30 March 2012, the CRM attended a work-related training course in Melbourne, Victoria. On 30 March 2012, after a sleep period of about 8 hours, they woke at 0530 to prepare to attend the final day of the training, which commenced at 0830. The CRM arrived back in Brisbane at about 1930 and then proceeded to their home.

After preparing to go to bed, the CRM received a phone call at about 2230 from Brisbane Centre, advising that they were required to attend the workplace to fulfil a CRM role as there was no one else available and the activation of a TRA was imminent. The CRM reported that they were not asked if they felt fatigued. They did not raise the issue at the time as they wanted to support the organisation and considered that there was no alternative for the fulfilment of the CRM role.

The CRM reported that they felt very tired during the contingency period. At about 0300–0330, they started to experience micro-sleeps and had to stand up and walk around to try to stay awake. At other times, they were falling asleep at the console as they were fulfilling a monitoring role, rather than performing an active role.

The CRM handed over to the incoming KIY/CBL controller at about 0500, then completed some required forms before leaving work between 0545–0600 to drive home.

Contingency management activities

Communication with pilots and operators

The Tops Group contingency plan stated:

The first priority is the notification to pilots and other airspace users. The primary method is by directed and broadcast transmissions to affected aircraft, followed by NOTAM.

Following initial advice of the activation of the contingency plan, the National Operations Centre will coordinate any notifications in accordance with checklists provided by the responsible business groups.

For aircraft operating in an affected sector just prior to a TRA activation, the relevant controller was required to contact all the flight crews and advise them of the situation. For other aircraft, Airservices National Operations Centre (NOC) was required to notify aircraft operators to 'relieve the communication burden from operational units and to allow focus on primary duties'. The NOC was located in Canberra, Australian Capital Territory, and was staffed at all times.

During TRA activations, the NOC was required to identify affected flights and coordinate with the operators and affected Australian ATC areas. This process required determining the intentions of each flight, such as whether they would re-route to avoid the affected airspace or operate through it. The NOC was also required to convene a teleconference with the affected parties and contact other operators/pilots to advise them of the details of the service contingency. The NOC maintained a stakeholder contact list that was managed as a controlled document.

In the lead up to the TRA activation on 31 March 2012, the outgoing and current duty Systems Supervisors were both in the Brisbane Centre Operations Room. Prior to the CRM's arrival, they had been liaising with the organisation's NOC, but requested that the CRM then undertake that liaison role. The CRM advised them that they were unable to do so as the time period available was very limited and they had many other tasks to complete. The NOC also requested that the CRM conduct the briefing of operators, but the CRM advised the NOC that they did not have time to conduct that task.

As previously noted, the NOC conducted a teleconference regarding the activation of the TRA with two Australian operators. It then provided individual briefings to all of the international operators affected by the TRA activation except Garuda International (Garuda). NOC personnel reported that Garuda was unable to be contacted by telephone, so the NOC dispatched the briefing information to the operator via email. The NOC received no acknowledgement of receipt of the email, and Garuda reported that they did not receive any notification prior to or during the TRA period, apart from the NOTAM.

The pilot briefing sheet in the Tops Group contingency plan that was meant to be provided to all operators included the following information regarding clearances:

- A current airways clearance authorises access to the TRA
- The terms of an airways clearance previously issued to an aircraft do not apply to that portion of flight within contingency airspace...
- Where an airways clearance has not been issued before departure, the pilot-in-command is
 responsible for contacting the relevant ATC sector for clearance frequency management
 details and access arrangements will be determined during the pre-flight briefing.

The template also included the following information regarding frequency management:

The pre-departure briefing will include details of arrangements for frequency management and clearance issue.

Pilots transiting contingency airspace should establish communications with the next available ATS sector or unit 15 minutes prior to exiting the contingency airspace.

Monitoring affected aircraft

The NOC was required to review all available sources of information to update the list of affected aircraft and contact the relevant operators as required. The NOC could not produce a list of identified aircraft affected by the TRA to the ATSB.

The CRM maintained a 'scratch pad' with details of the aircraft that they identified as being affected by the TRA. The list included 28 aircraft, mainly involving international operators but not including PK-GPA and PK-GPO. Most of the affected aircraft had either been operating in Australian airspace, and were therefore known to Australian ATC, or were ADS-B equipped and therefore visible on a controller's air situation display, when operating within ADS-B coverage. The majority of the aircraft diverted around the TRA airspace.

The CRM reported that, on some occasions, they only became aware of aircraft transiting the TRA when they received position reports from the domestic HF operator or when ADS-B equipped aircraft were visible on the air situation display. The CRM reported that they observed a flight progress strip in TAAATS for one of the Garuda A330 aircraft involved in the occurrence, but thought it was tracking around the TRA like most of the other affected aircraft.

The contingency plan documentation contained no guidance on the management of the TRA access authority system and there were no procedures as to who should be notified when an access authority was granted, or a requirement for a list of granted access authorities to be maintained.

Notices to Airmen

The CRM used the NOTAM templates in the Tops Group contingency plan to prepare the NOTAMs that were issued prior to the TRA period. The decision to release a portion of the affected airspace volume in the KIY sector to Melbourne Centre was finalised after the publication of the initial NOTAMs for the KIY and CBL sectors. Consequently, NOTAM D1248/12 (Figure 7) was issued at 0034, 19 minutes after the TRA activation. While the contingency plan documentation mentioned that traffic management plans should be considered, it did not contain guidelines or procedures for releasing volumes of airspace.

NOTAM D1248/12 stated that a map of the contingency airspace was available via a website link. This map did not accurately display the TRA dimensions as it did not depict the airspace release to Melbourne Centre on and west of air route G578.

The NOTAM stated that 'pilots/operators considering' operating in the TRA 'shall' contact the Duty Operations Manager by telephone for 'access authority'. Garuda's dispatch personnel, the flight crews of PK-GPA and PK-GPO, and Ujung ATC did not identify that the TRA access requirement was applicable to the two Garuda aircraft.

Traffic Information Broadcast by Aircraft procedures

Aircraft operating within TRA airspace were required to use Traffic Information Broadcast by Aircraft (TIBA) procedures, which were documented in the Australian Aeronautical Information Publication (AIP). The procedures required pilots to provide advisory traffic information via radio broadcasts to other aircraft in their vicinity and to arrange mutual segregation. The frequency for use by pilots operating in a TRA at or above FL 200 was 128.95 MHz, and this procedure was published in the AIP and relevant NOTAMs.

Pilots transiting a TRA were required to maintain a listening watch on the TIBA frequency from 10 minutes before entering the designated airspace up until the point they exited the TRA. Pilots were required to make broadcasts:

- 10 minutes before entering the designated airspace
- 10 minutes prior to crossing a reporting point
- 10 minutes prior to crossing or joining an ATS contingency route
- at 20 minute intervals between distant reporting points
- 2 to 5 minutes, where possible, before a change in flight level
- at the time of a change in flight level
- at any other time considered necessary by the pilot.

The TIBA procedures also required pilots to provide a position report to ATC 15 minutes prior to exiting the designated airspace to obtain a clearance before entering controlled airspace. The relevant ATS frequency was that associated with the next airspace sector adjoining the TRA, on the flight planned route.

Garuda had issued a Notice to Flight Crew in July 2008 outlining the TIBA procedures to be used in Australian airspace, in accordance with the Australian AIP. The Notice was current at the time of the occurrence and contained all the relevant procedures from the AIP.

TIBA communications employed 'line of sight' VHF frequencies not associated with ground-based stations. Consequently, the TIBA frequencies could not be monitored by the CRM or other controllers and the transmissions on those frequencies were not recorded.

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Figure 7: Notice to Airmen D1248/12
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D1248/12 NOTAMN
Q) YBBB/QRTCA/IV/NBO/E/000/999/
A) YEER
B) 1203301415 C) 1203301915
E) TEMPO RESTRICTED AREA ACTIVE
IN CTA CLASS A AIRSPACE EXCLUDING OCEANIC CTA (OCA A).
ATS ARE NOT AVAILABLE IN OCEANIC CTA (OCA A) AIRSPACE.
ATS IN THE YEBE FIR SUBJECT TO CONTINGENCY DUE TO OPERATIONAL
RESTRICTIONS.
BRISBANE CENTRE 132.1 BALGO HILL, 132.9 DOONGAN, 133.4 DERBY, 134.2
LIMBUNYA AND 134.65 BROOME. DAH SECTOR VOLUME NAMES AFFECTED ARE:
KIMBERLEY.
CONTINGENCY MAP IS AVAILABLE AT
HTTP://WWW.AIRSERVICESAUSTRALIA.COM/NOTAMMAPS/INDEX.ASP
THE CARRIAGE AND USE OF TWO RADIOS IS REQUIRED FOR ENTRY TO THE
RESTRICTED AREA.
PILOTS/OPERATORS CONSIDERING OPR IN THIS TEMPORARY RESTRICTED AREA
SHALL CTC THE DUTY OFERATIONS ROOM MANAGER BY TEL ON +617 3866 3224
FOR ACCESS AUTHORITY.
AUTHORISATION TO ENTER THIS TEMPORARY RESTRICTED AREA DOES NOT
CONSTITUTE CLEARANCE TO ENTER ANY ADJACENT OR EMBEDDED RESTRICTED
AREAS.
ATC SER NOT AVEL IN CLASS & AIRSPACE.
TRAFFIC INFORMATION AND SURVEILLANCE INFO SER NOT AVBL IN CLASS G
AIRSPACE.
PILOTS/OPERATORS CONSIDERING OPR IFR IN CLASS G AIRSPACE SHALL CTC
THE DUTY OPERATIONS ROOM MANAGER BY TEL ON +617 3866 3224 FOR FURTHER
INFO.
FILOTS-IN-COMMAND ARE SOLELY RESPONSIBLE FOR COLLISION AVOIDANCE
WITHIN THE AFFECTED AIRSPACE.
APPROX AREA: NORTHERN WESTERN AUSTRALIA
VERTICAL LIMITS: FL285 - FL600 AND IN OCA AIRSPACE SFC - FL600 ANY
TWR, TCU AND MILITARY AREAS WITHIN THE ABOVE AIRSPACE CONTINUE TO
OPERATE AS PER ERSA UNLESS SPECIFIED OTHERWISE.
MAJOR ATS ROUTES:
A339 BTN POKOS AND 555W
IDOTO A576 BIN TIMMI AND AIMAP
A587 BTN DEENO AND ONOXA
G222 BTN GULUM AND METUM
G326 BTN ONOXA AND 60NW BOYDI
G578 BTN EGATU AND TAYER
J151 BTN ZAMMI AND SAFIR
J72 BIN ARG AND 70NE KU
J93 BTN SNAPA AND KU
L511 BTN TARUN AND BRM
L514 BTN EGATU AND LILLY
067 BTN ERM AND DONDI
8592 BTN PUPIT AND METUM
T11 BTN LEESA AND BRM
T20 BTN ENPIT AND BRM
T27 BTN KU AND RASKY
T28 BTN ARG AND MOCHO
T29 BTN SCHEE AND CIN
T63 BTN POTIP AND ARG
W257 BIN CIN AND OSVOL
Y88 BTN LATUV AND BRM
ZZ781 BTN 853E SATNA AND GEKKO
VHF FIS AND SAR ALERTING ARE NOT AVEL ON THE FREQUENCIES LISTED
ABOVE. LIMITED FIS AND ALERTING SERVICE MAY BE AVAILABLE ON REQUEST
FROM ADJACENT ATS UNITS OF HF. TRAFFIC INFO IS NOT AVEL.
ADS-C/CPDLC LOGON: YEBB SER NOT AVEL THIS AIRSPACE. AIRCRAFT MAY
REMAIN LOGGED ON BUT POSITION REPORTS MUST BE BROADCAST ON THE
APPROPRIATE FREQUENCY.
TRAFFIC INFO BCST (TIBA) PROCEDURES AS DETAILED IN AIP GEN 3.3 APPLY.
TIBA FREQUENCIES: AT OR ABOVE FL200 128.95 MHZ. BELOW FL200 126.35
MHZ, EXCEPT IN DOMESTIC CLASS G AIRSPACE WHERE THE FIA FREQUENCY
SHALL BE USED.
TCAS AND TRANSPONDER EOFT MUST BE SELECTED ON AT ALL TIMES.
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Source: Airservices Australia

Communication with Ujung Padang

The Tops Group contingency plan included a two-page briefing sheet for Ujung and other adjoining ATS agencies. Prior to the TRA activation, the CRM contacted the ATC Operations Supervisor at Ujung to explain the contingency airspace. That briefing included advice that aircraft that were already airborne at the time of the TRA activation were authorised to continue flight into the TRA. The briefing sheet stated that:

Aircraft are authorised to continue flight into contingency airspace...

The CRM reported that they started to read out the details from the briefing sheet but there were communication difficulties as English was not the primary language of the Ujung supervisor, who subsequently requested that the CRM provide a hard copy of the briefing sheet.

The contingency plan documentation did not contain contact details for Ujung to enable the CRM to provide a hard copy of the briefing sheet. The CRM also identified that there was no facsimile number for Ujung as that agency did not have a facsimile machine, so the CRM arranged for the NOTAM and a free text message, detailing suggested air routes for aircraft to avoid the TRA, to be sent to Ujung via the Aeronautical Fixed Telecommunication Network.¹⁹

In a section on clearances, the briefing sheet that was meant to be provided to adjoining ATS agencies stated:

Instruct aircraft inbound to contingency airspace to contact HF no later than 30 minutes prior to the EST for the FIR boundary and provide a boundary estimate and flight level.

The briefing sheet also stated a requirement for adjacent ATS agencies to instruct flight crews entering the contingency airspace to contact the Flightwatch International (FWI) operator 30 minutes prior to the Brisbane FIR boundary, with their aircraft's estimate for the FIR boundary and flight level. As Ujung ATC was not made aware of the requirement, they did not advise the flight crews of PK-GPA and PK-GPO to contact the FWI operator 30 minutes before the FIR boundary. The requirement was also not duplicated in the NOTAM template or in the pilot briefing sheet.

Consistent with normal operations, Ujung ATC provided both PK-GPA and PK-GPO with airways clearances through to their destinations, which included routes through the TRA. Ujung ATC were not aware that, in the case of a contingency plan airspace on an adjacent sector, they should limit the clearance to the FIR boundary for aircraft that were not already airborne at the commencement of the TRA activation. There was no documented requirement for adjoining ATS agencies to notify Airservices of aircraft that were in receipt of an airways clearance through the TRA volume, or for pilots to advise adjoining ATS agencies if they had an access authority to enter the TRA.

The briefing sheet for adjoining ATS agencies stated that 'This template is also published in Letters of Agreement'. There was an ATS Operational Letter of Agreement (LoA) between the Australian and Indonesian ATS providers that outlined procedures and processes for a number of subjects, including separation, communication systems and inter-ATS unit requirements. There was no information regarding TRA procedures or requirements contained within the LoA. A representative from the Ujung Pandang ATC Centre reported that there was no documented agreement or procedures between the agencies for TRA activations.

Notification to Flightwatch International

The Australian Flight Information Centre (AusFIC) was operated by Airservices and provided a range of services, including the provision of aeronautical data and information, briefing and flight notification processing, and communications relay. AusFIC delivered domestic and international

¹⁹ A worldwide system for the exchange of messages and data between aeronautical fixed stations having the same or compatible communication characteristics.

HF services, and the international HF services component was known as Flightwatch International (FWI).

The CRM reported that they called the AusFIC Operations Supervisor and explained the contingency arrangements verbally. AusFIC did not receive a hard copy of the relevant briefing sheet for the TRA activation.

The AusFIC briefing sheet noted that aircraft inbound to the TRA were required to contact HF 30 minutes prior to the FIR boundary. It also stated that, on receipt of contact from an aircraft, the FWI operator was required to coordinate the information with the CRM by telephone. In addition it required the FWI operator to advise pilots that they had to contact the next available ATC sector 15 minutes prior to exiting the TRA.

Other CRM activities

The CRM was required to issue the NOTAMs and provide briefings to various ATS agencies. This involved reviewing the NOTAM templates and briefing sheets contained in the contingency plan, amending them as required and then arranging for their dissemination to the stakeholders. The CRM noted that the NOTAM templates and briefing sheets were fairly generic and their completion required a level of familiarity with the airspace and adjoining sectors which the CRM did not have, so they had to reference the airspace charts for the required information. The CRM also noted that it was difficult to complete the briefing sheets in the short period of time available before the TRA activation and some were not able to be completed.

The CRM was required to keep an electronic version of a log for the duration of the contingency plan, accessed through a computer terminal in the middle of the aisle of consoles. During the contingency period, they recorded log details on a piece of paper and periodically moved from the console to the computer to update the electronic log. The log only contained details of the aircraft identified as being affected by the TRA. It did not record the times of briefings or other events that occurred.

Additional information

Previous contingency plan activations

In a 24-month period from 1 August 2010 to 17 July 2012, 10 TRA activations were reported to the ATSB, inclusive of the event on 31 March 2012. All of the other TRA activations were for ATC sectors that were wholly contained within the Brisbane and Melbourne FIRs and not located adjacent to a foreign FIR boundary. In addition, there had been a greater period of time available between the decision to activate a TRA and the TRA activation time, than that available on 30–31 March 2012. There had not been any reported previous incidents similar to the TRA activation and the losses of separation assurance that occurred on 31 March 2012.

Contingency plan testing and review

The National ATS Contingency Plan stated that SDLMs were to ensure that contingency plans be reviewed every 3 months for contact list accuracy and currency. In addition, at 6-monthly intervals, contingency plans were required to be reviewed for accuracy and relevance with reference to operational environment and organisational changes. It was required that plans be reviewed annually for standardisation and consistency with the national plan and sub-plan templates. The annual review was to include plan testing, either by table top exercise or simulated contingency scenario.

The last annual review of the Tops Group contingency plan occurred on 28 August 2011 as a desktop exercise with no time pressure on the participants. Neither external nor internal stakeholders, such as AusFIC or Ujung ATC, were involved, and the participants did not test if the contact details documented for Ujung were valid. The checklists in the contingency plan had been used but no faults had been identified at that time. Airservices reported that it could not determine

if the required 3- and 6-monthly period reviews had been completed and there were no documented results from the desktop exercise available

Aeronautical review of Tops Group

In July 2011, the Civil Aviation Safety Authority (CASA) Office of Airspace Regulation conducted an Aeronautical Review of Upper Airspace Services (Tops Group) with the final report published in October 2011. It noted that Tops Group controllers were experiencing a higher than normal workload due to changes relative to the transitional phase of implementing the Service Delivery Environment, but that Airservices had managed the issue by introducing mitigation strategies that addressed controller workload.

The Review conducted an evaluation of the data contained within 356 airspace related Aviation Safety Incident Reports for occurrences within the Tops Group airspace from 1 January 2009 to 1 July 2010. In addition, the review evaluated 530 related Electronic Safety Incident Reports²⁰ for airspace related occurrences within Tops Group airspace from 1 January 2009 to 31 August 2010. The report stated that the majority of reported incidents were categorised as either a loss of separation or a failure to comply with ATC instructions or procedures. Sector controllers had reported various reasons for those incident rates including:

- international pilots not understanding or being familiar with Australian airspace procedures
- location of the Australian–Indonesian FIR boundary
- breakdown of coordination between Australian and Indonesian controllers.

²⁰ Electronic Safety Incident Reports (ESIRs) are an electronically submitted air safety occurrence report which form part of the ESIR system maintained by Airservices Australia, which permits systemic analysis and trend monitoring.

Safety analysis

Introduction

On 31 March 2013, there were two losses of separation assurance (LOSAs) associated with Airservices Australia's withdrawal of air traffic services (ATS) and implementation of a Temporary Restricted Area (TRA) from 0015 to 0515 Eastern Standard Time in the Kimberley (KIY) and Cable (CBL) airspace sectors.

As the Melbourne Centre air traffic controller was unaware of the first A330 aircraft, PK-GPA, until the flight crew called at the Flight Information Region (FIR) boundary, there was a LOSA with aircraft in that controller's airspace. Because the second A330 aircraft, PK-GPO, had operated in controlled airspace without the knowledge of the relevant controller from 0515, after the provision of control services in the KIY and CBL air traffic control (ATC) sectors had resumed, there was also a loss of separation assurance. However, no other aircraft were in close proximity to the second A330 during that time, and there was no loss of separation.

With no published ATS available in the affected volume of airspace during the TRA activation, and therefore no ATC separation provided between aircraft operating in the TRA, flight crews were solely responsible for collision avoidance. Even though a Contingency Response Manager (CRM) was monitoring the ATC console and airspace for the duration of the TRA activation, the only risk controls available to flight crews to ensure separation with other aircraft were all-station broadcasts by pilots, conforming flight levels, the aircraft's on-board traffic collision avoidance System (TCAS)²¹ and 'see and avoid'.

Situations requiring the activation of a contingency response plan and a TRA will occasionally occur and need to be managed effectively to ensure safe operations. In this case, Airservices was dealing with a situation where two controllers from the same air traffic control (ATC) group, at short notice, had legitimate reasons for not conducting their rostered shifts. It could not be reasonably expected that an operational ATC roster would be staffed to provide reserve coverage for two positions in the same group. Extending the evening shift and commencing the morning shift earlier than rostered, in accordance with the organisation's Fatigue Risk Management System (FRMS) for the controllers involved, was a sound means of limiting the period of time that published ATS could not be provided. In addition, the release of a portion of the affected airspace to Melbourne Centre controllers reduced the volume of airspace in which published services were not available. However, lack of ready access to appropriate maps, and the lack of guidelines for releasing volumes of airspace documented in the contingency plan, increased the complexity of plan activation requirements and associated procedures arrangements.

High-reliability systems have many layers of risk controls to minimise the risk associated with hazards such as the temporary removal of normal services. Airservices had many risk controls in place to ensure relevant parties were aware of the situation, so that they could take the necessary actions to ensure that Airservices was made aware of when flight crews were intending to enter the TRA and enter controlled airspace after exiting the TRA. However, these risk controls were rendered ineffective in the case of PK-GPA and PK-GPO by a large number of factors, including many actions by a significant number of operational personnel and inherent weaknesses in the design of some of the risk controls. This analysis first briefly discusses the actions involved, and then focusses on the underlying safety issues that influenced or did not effectively mitigate these actions.

²¹ Traffic collision avoidance system (TCAS) is an aircraft collision avoidance system. It monitors the airspace around an aircraft for other aircraft equipped with a corresponding active transponder and gives warning of possible collision risks.

Missed opportunities

Any one of many different actions by a range of operational personnel could have led to Airservices being made aware of one or both of the Garuda aircraft operating in the TRA. In most cases, the personnel either had not been made aware of a requirement to complete an action or process, or did not comprehend a required action or process. These included:

- Airservices' National Operations Centre (NOC) personnel did not provide timely or appropriate communication with the operator of PK-GPA and PK-GPO (Garuda) on the Temporary Restricted Area activation, contingency plan requirements or traffic management plan.
- The CRM did not provide Ujung Pandang (Ujung) ATC with an effective briefing or documentation on the procedures and requirements associated with the Temporary Restricted Area activation.
- The CRM did not provide Flightwatch International (FWI) with an effective briefing or documentation on the procedures and requirements associated with the Temporary Restricted Area activation.
- The flight crews and operator of PK-GPA and PK-GPO did not apply for an access authority prior to entering the TRA.
- The CRM did not manually process the flight data records for PK-GPA and PK-GPO from a
 preactive state to a coordinated state, which removed an opportunity to identify the presence of
 the aircraft in the TRA.
- Ujung ATC provided both the flight crews of PK-GPA and PK-GPO with an airways clearance to their destination, instead of a clearance limit to the FIR boundary, and did not instruct the flight crews to contact FWI 30 minutes prior to the TRA boundary.
- When the flight crew of PK-GPO contacted the FWI operator after entering the TRA, the FWI operator did not provide the correct contact instructions to the flight crew, as the operator was not aware of the associated TRA procedures.
- A frequency transfer instruction provided by the FWI operator to the flight crew of PK-GPO was incorrectly read back by that flight crew. The discrepancy was not detected by the FWI operator.
- The Air Report (Airep) for PK-GPO submitted by the FWI operator was not processed at the ATC console for the TRA airspace.
- The flight crew of PK-GPO attempted to establish contact with ATC on an incorrect frequency and did not check their documentation for the correct frequency when no response was received, or identify that the TRA period had ceased by that time.
- The flight crews of PK-GPA and PK-GPO did not contact ATC 15 minutes prior to exiting the TRA airspace as required by the Traffic Information Broadcast Area (TIBA) procedures.
- After ATS resumed at 0515, the first KIY/CBL controller did not identify that PK-GPO had an actual departure time displayed in the aircraft's flight progress strip.
- The second KIY/CBL controller identified that PK-GPO had an actual departure time displayed in the flight progress strip but did not effectively resolve the aircraft's actual position at that time with Ujung ATC.

Although some of these actions, in isolation, may not have resulted in undesired or adverse events, in this occurrence the combination of actions increased risk. High reliability systems need to have effective processes in place to reduce the likelihood of such actions and mitigate their consequences. The remainder of this analysis focusses on a set of underlying, interrelated reasons why some of these actions were not effectively managed.

Identifying and monitoring affected aircraft

Airservices' processes for identifying flights that would be potentially affected, prior to the TRA activation, based on information regarding aircraft already airborne and flight plan information, appeared to be effective. This process identified that Garuda had two flights that would potentially be affected by the TRA and that the operator needed to be provided with a briefing, which ultimately was not done effectively (see below). However, the subsequent processes to identify aircraft actually operating in the TRA were not effective.

Flight crew communications with ATC for TRA operations

Fundamentally, Airservices' processes for identifying aircraft operating in the TRA relied heavily on three communication procedures:

- flight crews (or operators) obtaining an access authority from Airservices prior to entering the TRA
- flight crews contacting the FWI operator 30 minutes prior to entering the TRA
- flight crews contacting ATC 15 minutes prior to exiting the TRA.

The requirement for flight crews to contact the FWI operator prior to entering the TRA was contained in the briefing sheet for adjacent ATS agencies, which ultimately was not provided to Ujung ATC. Without that communication requirement then being duplicated on the NOTAM or pilot briefing material, the integral elements of an adjoining ATC agency and flight crew could not be made aware of the communications requirement and therefore could not comply.

The NOTAM did contain the requirement for pilots (or operators) to obtain an access authority. However, Garuda's dispatch personnel, the flight crews of PK-GPA and PK-GPO, and Ujung ATC did not identify that the access requirement was applicable to the two Garuda aircraft. This could have been associated with the complex nature of the NOTAM and the limited time period the relevant personnel had to study the document.

The wording of the NOTAM was also potentially ambiguous in some respects. For example, it would have been clearer and more definitive to state that 'prior to entering the TRA, pilots/operators must obtain an access authority' rather than using the phrase 'pilots/operators considering...'. There must be due consideration that English is often not the native language of foreign flight crew and other personnel. Although foreign flight crew and controllers have been tested and met English language proficiency requirements for aviation operations, they are prepared for situations with standard phraseology and standard, concise NOTAM text. The presentation of TRA information in a long, complex NOTAM with multiple details has the potential to introduce an additional hazard to contingency operations, with operational personnel possibly not identifying all of the information relative to their operations. NOTAM templates for such contingencies need the key procedures to be clearly highlighted and concise.

In addition, the flight crews were cleared by Ujung ATC to their destinations. As such, it was reasonable to expect that they could have interpreted this clearance to have included approval to access the TRA.

Regardless of the exact reasons, the fact that both flight crews did not understand the requirement indicates that there were problems with this aspect of the communication system. As the majority of the other aircraft affected by the TRA diverted around the affected airspace, there was no evidence to indicate that other flight crews at the time had read and correctly understood the requirements in the NOTAM on this occasion.

The requirement to contact the next ATC sector prior to exiting the TRA was included in the TIBA procedures, but not on the NOTAM or other documents. Exactly why both crews understood and applied some of the TIBA procedures, such as mandatory all-station broadcasts, but not this requirement, was not clear. Operations within a TRA and the application of the associated TIBA procedures are a rare situation for pilots, and there would be a low level of familiarity with the procedures for all stakeholders. Again, the fact that both flight crews did not understand this requirement suggests that the requirement needs to be communicated more clearly and effectively.

In summary, the three key communication requirements for flight crews to advise ATS personnel on entering or exiting the TRA were ineffective on this occasion for both Garuda aircraft. The three procedures were distributed across multiple documents, and were not clearly summarised or integrated for flight crews or operators.

Other processes for identifying aircraft operating in the TRA

In addition to the communication procedures, Airservices personnel could identify aircraft entering or operating in the TRA through other means. If the aircraft had been ADS-B equipped, this would have been presented to the CRM on the KIY/CBL air situation display, when the aircraft were within 200 NM (370 km) of the Australian coast. However, at the time of the occurrence, aircraft were not required to be equipped with ADS-B, and PK-GPA and PK-GPO were not ADS-B equipped.

Nevertheless, if the CRM had manually processed the flight data records for both aircraft from a preactive to a coordinated state, they would have identified that aircraft had flight planned through the TRA and had an opportunity to determine if those aircraft had access authorities granted or were diverting around the TRA. However, the CRM was not aware of the human-machine interface (HMI) requirements contained in the Tops Group Local Instructions for processing departure times in the Advanced Australian Air Traffic System (TAAATS).

One of the KIY/CBL controllers responsible for the airspace after the TRA cessation did not notice that PK-GPO had an actual time of departure in the relative flight progress strip and another noticed but did not effectively resolve the situation with Ujung ATC. These controllers were not aware of the CRM's reduced HMI interaction with TAAATS and assumed that the CRM had kept the system updated to an operational standard. Consequently, there may have been reduced vigilance as to the identification of the unusual situation of an aircraft operating in controlled airspace without the knowledge of ATC.

Another opportunity occurred for Airservices to become aware that PK-GPO was operating in the TRA when the flight crew contacted the FWI operator upon entering the TRA. However, through a series of communication errors involving the flight crew of PK-GPO, FWI and other personnel, this opportunity was not realised.

Overall, the technology existed for Airservices to become aware through flight plan data and Air Traffic Services Inter-facility Data Communications that the two Garuda aircraft were intending to fly through the TRA, and that they did actually enter the TRA. However, this process was rendered ineffective by many factors, primarily that the person selected to do the CRM role was not aware of the required procedures to make this aspect of the aircraft monitoring system work.

Monitoring and managing relevant aircraft

Although Airservices had stated in the NOTAM that flight crews or operators were required to contact them to gain authority to access the TRA, there was no documented process for managing the access approvals. No one was responsible for developing and maintaining a list of aircraft with access authorities and disseminating or providing access to the list to integral positions, such as the CRM and FWI.

As previously noted, Airservices had initially identified that Garuda aircraft were potentially affected by the TRA based on their flight plans. However, these aircraft were not included on a centralised list and passed to the CRM. If such a list existed, the CRM or other personnel could have regularly reviewed the identified aircraft to ensure Airservices was aware of the aircrafts' actual route or the intentions of the respective flight crews or operators.

The CRM kept a list of the aircraft that they had identified as operating in or around the TRA. However, there was no defined means to ensure that the CRM was aware of the movements of all such aircraft. While some aircraft subsequently tracked on amended routes around the TRA, updated details were not available to the CRM or communicated to them by adjoining controllers or agencies. There was some likelihood that additional aircraft could have entered the TRA without authorisation and without the knowledge of the CRM if those aircraft either departed from, or terminated their flight, within the TRA, and did not cross the boundary between Brisbane and Melbourne FIRs.

Communicating with key stakeholders

The successful outcome of a contingency response plan activation of a TRA is heavily reliant on the participants, including major stakeholders such as international operators and ATS providers, having a clear understanding of the procedures with which they must comply. The complete dissemination of information and procedures to stakeholders is fundamental to the successful operation of essential risk controls, such as flight crew reporting, particularly in a procedural ATC environment, where ATC have no surveillance contact with the aircraft to determine both their presence and position.

Airservices' NOC had limited time available in which to identify affected flights and contact the operators. The time of night of this activity may also have added to the difficulty that they experienced in contacting foreign operators by telephone. However, in sending Garuda an email, with no confirmation that it was either received or read within a period close to it being sent, the NOC did not ensure that timely or appropriate communication with the operator was completed to the level required. In addition, there was no opportunity for the NOC to clarify any potential confusion or queries about the TRA or required procedures, or highlight the requirement to gain approval for entry into the TRA.

Due to time restrictions and the CRM's workload, other major stakeholders, including Ujung ATC and FWI, were not provided with a written copy of the required processes and procedures relevant to the TRA, and as a result could not comply with the requirements. The CRM was required to provide a pre-defined briefing sheet to Ujung ATC, which outlined relevant requirements, including the requirement to advise flight crews of the need to contact FWI 30 minutes prior to entering the TRA. The CRM had limited means available to send the hard copy information to Ujung in the time available as Ujung did not have a facsimile machine, and Ujung ATC was provided with no prior advice of the contingency arrangements.

On the night of the occurrence, the TRA activation was required at short notice, which significantly limited the period of time available for Airservices personnel to comply with the documented procedures, including stakeholder communication and dissemination of information. However, the communication processes were also significantly hampered by a lack of appropriate contact details for Garuda and Ujung ATC, an issue that should be identified in contingency plan reviews (see below).

Overall, Airservices' communication processes with key stakeholders did not work effectively during the TRA activation. These limitations weakened Airservices' ability to identify and manage aircraft that had the potential to operate within the TRA.

Selecting and preparing contingency response managers

The CRM performs a critically important role during a contingency response. Consequently, careful consideration needs to be given to the process of selecting the individual to perform the role and the prior preparation and training they have been provided.

As noted above, the CRM did not have the required level of knowledge to successfully perform the HMI tasks for the KIY/CBL sectors. Their last experience in using the Eurocat system as an operational line controller for the Tops Group was about 12 years prior to the occurrence, which resulted in their level of system and HMI knowledge being below that required to effectively interface with and update Eurocat to the extent required of the CRM for that TRA. This limitation was not identified during the process of selecting the CRM. The *Variation to Published Services: Operational Hazard Assessment* form required to be completed for any variation to published services did specifically ask whether the CRM was able to perform HMI tasks. However, the form contained no guidance on the level of HMI skills required for a CRM role or how to make such an assessment for different sectors.

There was no requirement for ALMs to hold current endorsements for the sectors under their management jurisdiction. In addition, a range of personnel could be appointed to a CRM role for sectors for which they had no current endorsement. Airservices personnel also advised that there were other ALMs and Shift Managers with no recent TAAATS experience that might have been required to fulfil a CRM role. Neither the National ATS Contingency Plan nor the ATS Contingency Plan Tops Group provided guidance to a CRM for TAAATS interface requirements. The key HMI tasks required of a CRM needed to be clearly identified in the group's plan, and if the CRM was unable to perform such tasks then appropriate mitigators needed to be developed and included.

In addition to the HMI task, there are also other important aspects to consider when preparing personnel for the CRM role. Airservices reported that the Brisbane Centre ATC personnel who were directly involved in the TRA activation had completed the National ATS Contingency Plan Training in 2009 and two had completed the training again in 2011. It also noted that staff indicated they were not familiar with all aspects of the contingency plan requirements. Airservices advised that AusFIC personnel, including FWI operators, had not completed any contingency plan training and had little awareness of the contingency plan documents and requirements that pertained to them.

The CRM reported that they had never received any initial or refresher training, and had developed their abilities through on the job experience. None of this experience had prepared them for performing the initial tasks for the role in such a short time frame. The ATSB interviewed several other personnel in positions designated as suitable for them to be considered to conduct the CRM role. Many of them reported that they had received limited training or preparation for the role and that they had not been provided with any refresher training for contingency management or the CRM role.

In summary, the CRM role is critically important during the activation of a contingency response. The processes for ensuring that a CRM had adequate skills for performing key parts of the role were limited, and many staff that performed that role were provided with limited preparation.

Fatigue management of management personnel

In addition to the selection of a CRM based on their skills and experience, consideration also needs to be given to other factors such as fatigue. The International Civil Aviation Organization (ICAO 2011) defined fatigue as:

A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties.

Fatigue can have a range of adverse influences on human performance, such as slowed reaction time, decreased work efficiency, reduced motivational drive, increased variability in work performance, and more lapses or errors of omission (Battelle Memorial Institute 1998). In addition, most people generally underestimate their level of fatigue.

It is generally agreed that most people need at least 7–8 hours of sleep each day to achieve maximum levels of alertness and performance. A review of relevant research (Dawson and McCulloch 2005) concluded:

...we can make broad assumptions from existing literature that obtaining less than 5 h [hours] sleep in the prior 24 h, and 12 h sleep in the prior 48 h would be inconsistent with a safe system of work. Furthermore, wakefulness should not exceed the total amount of sleep obtained in the prior 48 h.

Recent research looking at errors performed by flight crews (Thomas and Ferguson 2010) and road vehicle drivers' involvement in accidents (summarised by Williamson et al. 2011) has provided support for these prior-sleep proposals, or indicated even more sleep would be appropriate.

On 30 March 2012, at 2330 when the ALM allocated the CRM role commenced duty, they had been awake for about 18 hours. During the TRA period, the CRM reported that they felt very tired and had difficulty staying awake. When the CRM ceased duty the following morning between 0545 and 0600, they had been awake for a period in excess of 24 hours, with a total of about 8 hours sleep in the prior 48-hour period. Accordingly, they were probably experiencing fatigue during the TRA period at levels known to have at least a moderate effect on performance. The extent to which this fatigue influenced the CRM's actions contributing to the occurrence is unclear, as these actions were explained by other factors such as limited relevant HMI knowledge and time pressure to complete briefing tasks.

Airservices had a fatigue risk management system (FRMS) to ensure that the levels of fatigue were managed to an acceptable level. The FRMS documentation stated that managers were responsible for fatigue management awareness training, rosters that provided sufficient recuperative sleep opportunity between shifts, and work and shift management strategies that moderated fatigue accumulation. Controllers were responsible for managing their lifestyle and recuperative sleep opportunities to enable them to attend scheduled shifts fit for duty, and to disclose when they were impaired due to fatigue.

Airservices' FRMS included processes for allocating an additional duty shift, and these applied to controllers and other personnel conducting operational shifts, which included ALMs when they were conducting a CRM or a Shift Manager duty at short notice. In the case of managing the contingency on 30/31 March 2012, the provisions of the FRMS were applied to the controllers who extended their shift period that evening and the controllers who commenced work earlier the next morning. However, the FRMS was not applied in the selection of the CRM or the subsequent management of that individual's fatigue. Airservices' internal investigation report noted that this 'was considered to be an oversight that resulted from the significant workload and time constraints that existed with the activation of the contingency plan.' In a recent investigation, the ATSB identified that Airservices' FRMS did not effectively manage the fatigue risk associated with allocating additional duty periods to controllers.²²

It was standard practice within Airservices for personnel in ALM roles in the Brisbane and Melbourne ATC Centres to also hold Shift Manager endorsements and provide operational supervision of controllers and airspace. A Shift Manager was responsible for the overall provision of ATS by one or more ATC groups during a shift. The Shift Manager provided general supervision of operational staff, as well as managing the published rosters and staffing requirements.

²² ATSB investigation AO-2011-144 <u>www.atsb.gov.au/publications/investigation_reports/2011/aair/ao-2011-144.aspx</u>

Although ALMs could perform operational duty periods in a Shift Manager or CRM role, most of their time was reportedly spent conducting administrative tasks. Rosters covering their scheduled administrative duties and Shift Manager shifts were developed in accordance with strategic FRMS requirements. A number of ALMs reported that in order to fulfil the ALM role requirements, they worked additional hours, outside of the rostered periods, including working on rostered days off. There was no defined process to track the actual hours worked by ALMs, outside of their Shift Manager and occasional CRM duties, although some ALMs reported that they would update the computer-based roster after the hours worked to better reflect their duty periods. In addition, some ALMs reported that, as managers, it was a prerequisite to work additional hours, on an 'as required' basis, to complete tasks, and that they were obligated to demonstrate the ability to manage their own fatigue.

In summary, Airservices did not have a defined process for recording the actual hours worked by its ALMs. Therefore it could not accurately monitor the potential fatigue of those personnel when allocating additional duties such as a CRM role.

Operational hazard identification and assessment

Airservices had a defined process for assessing and documenting the operational hazards associated with a variation to published air traffic services. As discussed above, the *Variation to Published Services: Operational Hazard Assessment* provided limited guidance to consider the selection of a CRM. The form could have but did not include prompts for considering the proposed CRM's potential fatigue level. In terms of other types of hazards, the form provided some 'potential failures' and columns to list consequences and controls. However, the form provided limited guidance on how the fields should be completed.

The form was required to be completed before the commencement of the contingency period, which was not achieved on the night of the occurrence due to time limitations. Ultimately, limited details were included in the form due to the time pressure associated with the event.

Overall, the operational hazard identification process was not thoroughly conducted for the TRA activation, and the situation was managed as best as possible by the staff concerned relying on the pre-defined materials available.

Contingency plan testing and review

Established and well-reviewed procedures, tested during exercises involving major stakeholders or at least a regular review of their contact details, can act as integral risk controls against potential communication and comprehension issues during actual contingency plan activations. The activation of a contingency response plan must be able to be effectively achieved within a limited period of time, as the nature of an event disrupting the provision of published ATS, such as equipment failure or evacuation of the ATS facility, may be sudden and require immediate action. Although Airservices had a limited period in which to implement the contingency plan on 30 March 2012, the developed procedures should have been robust, appropriate, able to be quickly enacted, and have been thoroughly reviewed on a regular basis to ensure that those expectations could be met.

Prior to the TRA activation on 31 March 2012, Airservices' recent experience of TRA activations had mainly been restricted to airspace sectors confined within Australian airspace and not abutting foreign ATS providers' airspace. In addition, the organisation had been provided with sufficient periods of time in which to effectively activate the contingency response plans in accordance with their documented procedures. As a result, Airservices had not identified through operational processes that their Tops Group contingency procedures could not be effectively activated.

Airservices required that various aspects of its contingency plan documents be regularly reviewed, and that the contingency plans be tested. The contingency plan for the Tops Group was documented as having been reviewed and tested on 28 August 2011, but there was no evidence available to the ATSB relating to the outcome of that review. Further, it could not be ascertained if the reviews required at the 3 and 6 month periods had been completed. Nevertheless, it is apparent that none of the above reviews and tests identified the problems with contact details for key stakeholders.

Airservices' testing and review process of their contingency plans did not incorporate coordination or communication with Ujung, which resulted in that agency having no prior exposure to, or knowledge of, the Australian TRA procedures and requirements. It also adversely effected the dissemination of integral information to Ujung on 30 March 2012, with no valid, established means by which a hard copy briefing sheet could be provided. The CRM was then required to verbally brief a foreign ATS provider, for whom English was not their native language, without the benefit of standard phraseology for the TRA situation, which introduced the potential for miscommunication. In addition, the testing and review process did not identify that TRA information had not been included in the Letter of Agreement with Ujung, even though that was stated in the contingency plan documentation.

As flight operations are conducted at all hours, Airservices needed to regularly and effectively review the contact details for each operator to ensure that they were both current and would provide an available point of contact outside of normal business hours. In the case of Garuda, effective and appropriate contact details were not available.

The potential for communication difficulties with overseas agencies was not unexpected. The review of incident reporting data, conducted by the Civil Aviation Safety Authority (CASA) Office of Airspace Regulation, noted that the Tops Group controllers attributed a number of occurrences to issues such as international pilots being unfamiliar or not understanding Australian airspace procedures and breakdowns in coordination with Indonesian controllers. Given this knowledge, the significant potential for communication problems should have been considered in the development and review of the Tops Group contingency plan.

During the period 2009 to 2012, CASA issued eight non-compliance notices to Airservices relating to contingency plan issues. These primarily related to plans not being tested or reviewed or content being incorrect or out of date. Accordingly, the problems identified in relation to the contingency plan for the Tops Group did not appear to be isolated.

Additional comments

Overall, Airservices had many risk controls in place to manage the rare situation where it was unable to provide published ATS and had to activate a TRA. In this case, a TRA had to be activated at short notice in airspace adjacent to an international ATS provider, and a range of actions by operational personnel did not conform to expectations. Airservices' risk controls were not robust enough to effectively manage this situation, and ensure they would be made aware of all aircraft that were operating within the TRA. The occurrence provides a timely reminder to all organisations in high reliability systems of the importance of having multiple risk controls in place to effectively manage rare combinations of events during abnormal situations, and to regularly review the effectiveness of these controls.

Findings

From the evidence available, the following findings are made with respect to the losses of separation assurance on 31 March 2012, when:

- an Airbus A330 registered PK-GPA exited a Temporary Restricted Area (TRA) and entered controlled airspace without an airways clearance, and
- following the cessation of the TRA and resumption of published air traffic services (ATS), an Airbus A330 aircraft registered PK-GPO operated within controlled airspace without the knowledge of ATS or an airways clearance.

The findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

Contributing factors

- The flight crews and operator of PK-GPA and PK-GPO were not cognisant of the requirement to obtain an access authority to enter the Temporary Restricted Area.
- The Contingency Response Manager was not aware of the requirement to manually process the flight data records for PK-GPA and PK-GPO, which removed an opportunity to identify the presence of the aircraft in the Temporary Restricted Area.
- The flight crews of PK-GPA and PK-GPO did not contact the Flightwatch International operator 30 minutes prior to entering the Temporary Restricted Area as they had not been requested to do so.
- The flight crews of PK-GPA and PK-GPO were not cognisant of the requirement to contact air traffic control 15 minutes prior to exiting the Temporary Restricted Area.
- A series of errors by several personnel, including the flight crew of PK-GPO, the Flightwatch International operator and controllers who took over the relevant sectors after the cessation of the Temporary Restricted Area, resulted in the presence of PK-GPO within the affected airspace not being detected.
- Airservices Australia did not provide timely or appropriate communication with the operator of PK-GPA and PK-GPO on the Temporary Restricted Area activation, contingency plan requirements or traffic management plan.
- Airservices Australia did not provide the international air traffic services provider Ujung Pandang and Flightwatch International with an effective briefing or documentation on the procedures and requirements associated with the Temporary Restricted Area activation, so these agencies could not provide relevant information to the flight crews of PK-GPA and PK-GPO.
- Airservices Australia's processes for managing a Temporary Restricted Area did not effectively ensure that all aircraft operating in the Temporary Restricted Area were known to air traffic services. [Safety issue]
- Airservices Australia's processes for selecting and preparing personnel for the Contingency Response Manager role did not ensure they could effectively perform that role. [Safety issue]
- Airservices Australia's processes for reviewing and testing contingency plans did not effectively ensure that all documented contingency plan details were current and that its contingency plans could be successfully implemented at short notice. [Safety issue]

Other factors that increased risk

- Airservices Australia did not observe the requirements of their Fatigue Risk Management System in the selection of a Contingency Response Manager or subsequent management of that person's fatigue.
- Airservices Australia did not have a defined process for recording the actual hours worked by its Air Traffic Control Line Managers and therefore could not accurately monitor the potential fatigue of those personnel when they were performing operational roles, such as a Shift Manager or Contingency Response Manager. [Safety issue]

Other findings

• The contingency plan for the Kimberley and Cable airspace sectors needed to be activated because there were two legitimate, short-notice controller absences for the sectors.

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and 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.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Temporary Restricted Area management processes

Number:	AO-2012-047-SI-01
Issue owner:	Airservices Australia
Type of operation:	Aviation – Air traffic services

Safety issue description:

Airservices Australia's processes for managing a Temporary Restricted Area did not effectively ensure that all aircraft operating in the Temporary Restricted Area were known to air traffic services.

Proactive safety action taken by Airservices Australia:

Airservices Australia (Airservices) advised that:

In order to improve its management of Temporary Restricted Areas during contingency situations Airservices completed a review of its National Air Traffic Service (ATS) Contingency Plan documentation.

The following actions were undertaken as part of the review:

- The revised National ATS Contingency Plan template was developed and trialled. It is expected that affected air traffic control units will update their local contingency plans to align with the revised template by the end of March 2014.
- A Contingency Airspace- Aircraft Tracking Form has been included as part of the ATS Contingency Plan template. The form provides additional assurance that all aircraft operating in Temporary Restricted Areas are known to ATS.

In response to an ATSB request for further supporting documentation of the safety actions undertaken, Airservices advised that:

The Aircraft Tracking Form provides an explicit instruction to record aircraft transiting the contingency airspace and coordinate with the downstream controller to ensure situational awareness. The completion of this form will ensure that all aircraft operating in the Temporary Restricted Areas are known to ATS.

ATSB comment/action in response:

The ATSB is not satisfied that the action proposed and already taken by Airservices has adequately addressed the safety issue. Although the implementation of an Aircraft Tracking Form provides a means for recording known aircraft transiting the contingency airspace, the revised National ATS Contingency Plan template does not document any enhanced processes for ensuring that potentially relevant aircraft become known to relevant personnel. In order to track an aircraft, it must be known to ATC in the first place, and that was the process that was not effective in this occurrence.

ATSB safety recommendation to Airservices Australia

Action number: AO-2012-047-SR-031

Action status: Released

The Australian Transport Safety Bureau recommends that Airservices Australia take further safety action to address the processes for managing a Temporary Restricted Area to effectively ensure that all aircraft operating in a Temporary Restricted Area are known to air traffic services.

Current status of the safety issue:

Issue status: Not adequately addressed

Justification: Airservices have not considered in their safety action the documentation of the processes associated with the identification of affected aircraft to ensure that all aircraft operating in a Temporary Restricted Area are known to air traffic services and can be recorded on the Aircraft Tracking Form contained in the National ATS Contingency Plan.

Contingency Response Manager selection and preparation processes

Number:	AO-2012-047-SI-02
Issue owner:	Airservices Australia
Type of operation:	Aviation – Air traffic services

Safety issue description:

Airservices Australia's processes for selecting and preparing personnel for the Contingency Response Manager role did not ensure they could effectively perform that role.

Proactive safety action taken by Airservices Australia

Airservices Australia reported the following actions in response to this safety issue:

- A Variation to Published Services: Operational Hazard Assessment Form has been published that
 references a CRM Selection Worksheet to ensure risks associated with a contingency event are
 appropriately identified and managed. The CRM Selection Worksheet requires potential CRMs to
 be assessed for suitability through the consideration of previous CRM experience, humanmachine interface (HMI) capability and fatigue levels assessed by Airservices Fatigue Risk
 Management System.
- Training Needs Analysis (TNA) has been completed in order to prepare incoming CRMs to
 effectively perform their role. From July 2012 'CRM Awareness' has been included in the Air
 Traffic Control Line Manager (ALM) induction program. In addition, a CRM Computer Based
 Training (CBT) training module is currently being developed by Airservices Learning Academy to
 enable assigned CRMs to familiarise themselves with the roles and responsibilities of the role
 once appointed.

Action number: AO-2012-047-NSA-029

Current status of the safety issue:

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the safety action satisfactorily addresses the safety issue.

Contingency plan testing and review effectiveness

Number:	AO-2012-047-SI-03
Issue owner:	Airservices Australia
Type of operation:	Aviation – Air traffic services

Safety issue description:

Airservices Australia's processes for reviewing and testing contingency plans did not effectively ensure that all documented contingency plan details were current and that its contingency plans could be successfully implemented at short notice.

Response to safety issue by Airservices Australia:

In response to this safety issue, Airservices Australia (Airservices) advised the following:

Airservices considers that the established process currently in place for reviewing and testing contingency plans for currency and effectiveness is robust and fit for purpose.

Airservices reported that the National ATS Contingency Plan documented the requirements for routine review and testing of contingency plans, in addition to the requirement for a Post Activation Review to be completed following the activation of an ATS contingency (either live or test) and that report was 'reviewed by Airservices Management to ensure appropriate corrective action is taken and lessons learnt.'

In addition, Airservices advised:

However, Airservices acknowledges that closer consultation with Indonesia in relation to contingency arrangement notification is necessary. This matter will be addressed under the guidelines of the ICAO Asia Pacific Regional Contingency Plan Task Force (RACP/TF) and the bi-annual Australia/Indonesia ATS Coordination Group (AUSINDO).

ATSB comment/action in response:

The ATSB is not satisfied that Airservices has adequately addressed the identified safety issue. Although there was an established schedule for the routine review and testing of contingency plans, the processes associated with those reviews was not effective in ensuring that the plan could be effectively implemented within a limited period of time, including through the ability to contact key stakeholders. There was no documented evidence of the completion of some reviews and no documentation of the outcomes of the annual review of the Tops Group contingency plan that was completed 7 months prior to the occurrence. The ATSB acknowledges the existing contingency plan review schedule, but remains concerned that the processes associated with those reviews allowed contingency plan elements to contribute to this occurrence.

ATSB safety recommendation to Airservices Australia

Action number: AO-2012-047-SR-030 Action status: Released

The Australian Transport Safety Bureau recommends that Airservices Australia takes safety action to address the processes for reviewing and testing contingency plans to ensure that they are effective in ensuring that all documented contingency plans are current and can be successfully implemented at short notice.

Current status of the safety issue:

Issue status: Not adequately addressed

Justification: The ATSB is not satisfied that the established processes for the testing and review of documented contingency plans are satisfactory.

Fatigue monitoring of Air Traffic Control Line Managers

Number:	AO-2012-047-SI-04
Issue owner:	Airservices Australia
Type of operation:	Aviation – Air traffic services

Safety issue description:

Airservices Australia did not have a defined process for recording the actual hours worked by its Air Traffic Control Line Managers and therefore could not accurately monitor the potential fatigue of those personnel when they were performing operational roles such as a Shift Manager or Contingency Response Manager.

Response to safety issue and proactive safety action taken by Airservices Australia:

Airservices Australia (Airservices) advised that the procedures for monitoring and assessing fatigue related risk amongst employees was described in Airservices' updated Fatigue Risk Management System (FRMS) requirements (commonly referred to as FRMS 2) and more specifically in Fatigue Risk Management Air Traffic Service Procedure (effective from 30 July 2012). All Air Traffic Control (ATC) Line Managers' rosters were subject to the strategic roster planning process and any changes to the published work-cycle were subject to the tactical roster management process, in accordance with the FRMS procedure/rule-set. In addition, it was advised that:

The current process requires the duty hours (from both operational and administrative shifts) of ATC Line Managers who perform an operational role be recorded and tracked via the ATC rostering system incorporated in Airservices updated FRMS 2. The recorded duty hours form part of the input used to determine an individual's FRMS level which is in turn recorded in the Variation to Published Services: Operational Hazard Assessment Form. As previously mentioned this form is used to determine the suitability of potential CRMs [Contingency Response Managers] through the consideration of several factors including an individual's level of fatigue.

Action number: AO-2012-047-NSA-028

Current status of the safety issue:

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the safety action satisfactorily addresses the safety issue.

Other safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action relevant to this occurrence.

Flight crew awareness of associated procedures

Although no safety issues were identified in respect of the general conduct of flight crew training, the following safety actions were reported by the operator of PK-GPA and PK-GPO.

Proactive safety action taken by Garuda Indonesia (Garuda):

The aircraft operator conducted a comprehensive internal investigation into the occurrence involving PK-GPA and made a number of findings and safety actions.

The operator identified that the Denpasar Airport briefing office, responsible for the issuing and dissemination of NOTAMs, did not inform the operator's ground handling agent that a new NOTAM had been released, close to the scheduled departure time of affected PK-GPA, nor had the briefing office verified that the handling agent had received it. The dispatcher for PK-GPA had not been aware of the new NOTAM until queried by the flight crew.

The operator determined that the discussion between the flight crew and dispatcher had not been thorough as the section of the internal Notice to Flight Crew regarding the requirement to provide a position report on the next appropriate air traffic services frequency, 15 minutes prior to leaving the TRA airspace, had not been reviewed on the ground or in-flight by the flight crew, nor had they complied with the requirement.

The operator identified that as the use of Temporary Information Broadcast by Aircraft (TIBA) procedures was an infrequent requirement and not practiced in daily operations by their flight crew, the operator would ensure that the procedures were reviewed by their check pilots as part of their programs. In addition, coaching was provided to the flight crew of PK-GPA through ground based training and revision of TIBA procedures and the requirement to thoroughly review any relevant local procedures prior to conducting their flight.

Regulatory oversight

Airservices Australia (Airservices) has been undergoing a number of change management processes in recent years, including the implementation of the Service Delivery Environment infrastructure. In 2012, the Civil Aviation Safety Authority (CASA) conducted a national Civil Aviation Safety Regulation (CASR) Part 172 surveillance of Airservices. CASA made a number of recommendations to the organisation, including three recommendations specific to Contingency Plans and TRA/TIBA activations.

CASA recommended that Airservices regularly review and test Contingency Plans at a local and national level 'to ensure that they are fit for purpose in an operational environment'. In addition, CASA noted that Contingency Plan documentation, procedures and requirements were complex and at times, had been unsuccessful in ensuring that acceptable levels of safety were maintained, and as such, Airservices should review the way that TRA activations were managed. It was also recommended that Airservices develop a staffing strategy to provide continued ATS, without the need for TRA activations, 'for non-catastrophic events such as staff illness or injury'.

Safety action taken by Airservices Australia

On 23 July 2012, Airservices released a Temporary Local Instruction (TLI) titled 'Guidance for the Release of Airspace' to its ATC personnel. The TLI stated that on occasions, issues arise at short notice which result in the need to vary the published ATS level. The intent of the TLI was documented as to provide additional guidance where airspace releases were enacted 'to reduce the requirement for, or impact of, Contingency Procedures (TRA/TIBA)'. The TLI stated that if a portion of airspace was released prior to TRA activation during a contingency situation, the CRM must ensure that the contingency NOTAM and associated maps were correct and the portion of released airspace was removed from the TRA dimensions depicted.

In response to CASA's recommendation that they develop a staffing strategy relative to TRA activations for 'non-catastrophic events', Airservices advised CASA that they were developing a 'contingency endorsement' for controllers.

General details

Occurrence details

Date and time:	31 March 2012 – 0515 EST	
Occurrence category:	Incident	
Primary occurrence type:	Aircraft separation	
Location:	Near ATMAP (IFR reporting point), Western Australia	
	Latitude: 12° 00 00.00' S	Longitude: 118° 15 18.00' E

Aircraft 1 details

Manufacturer and model:	Airbus A330-341
Registration:	PK-GPA
Serial number:	1075
Type of operation:	Air transport high capacity
Damage:	None

Aircraft 2 details

Manufacturer and model:	Airbus A330-243
Registration:	PK-GPO
Serial number:	1288
Type of operation:	Air transport high capacity
Damage:	None

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the aircraft operator
- Makassar Air Traffic Services Centre (MATSC)
- Contingency Response Manager
- Operations Room Managers
- Airservices Australia (Airservices)
- Civil Aviation Safety Authority (CASA).

References

Battelle Memorial Institute 1998, *An Overview of the scientific literature concerning fatigue, sleep, and the circadian cycle*, Report prepared for the Office of the Chief Scientific and Technical Advisor for Human Factors, US Federal Aviation Administration.

Dawson, D & McCulloch, K 2005, 'Managing fatigue: It's about sleep', *Sleep Medicine Reviews*, vol. 9, pp. 365-380.

Federal Railroad Administration 2010, *Procedures for Validation and Calibration of Human Fatigue Models: The Fatigue Audit InterDyne Tool*, DOT/FRA/ORD-10/14.

International Civil Aviation Organization 2011, *Fatigue risk management systems (FRMS): Implementation guide for operators*, 1st edition.

Independent Transport Safety Regulator 2010, Transport Safety Alert 34 - Use of biomathematical models in managing risks of human fatigue in the workplace. Available from <u>www.transportregulator.nsw.gov.au</u>.

Submissions

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

A draft of this report was provided to Airservices Australia, the Contingency Response Manager, involved Operations Room Managers, the Civil Aviation Safety Authority, Airnav Indonesia – Makassar Air Traffic Services Centre and Garuda Indonesia. A submission was received from Airservices Australia. The submission was reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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 identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, 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 initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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vestigation

ATSB Transport Safety Report Aviation Occurrence Investigation

Losses of separation assurance involving Airbus A330-243, PK-GPO, and Airbus A330-341, PK-GPA

AO-2012-047 Final – 28 February 2014