

FINAL REPORT

**BREAKDOWN IN SEPARATION BETWEEN
AIRBUS A319, REGISTRATION 9V-SBE AND
BOEING B737, REGISTRATION PK-GGN
WITHIN CHANGI CONTROL ZONE
ON 6 DECEMBER 2007**

AIB/AAI/CAS.045

**Air Accident Investigation Bureau of Singapore
Ministry of Transport
Singapore**

31 July 2008

The Air Accident Investigation Bureau of Singapore

The Air Accident Investigation Bureau (AAIB) is the air accidents and incidents investigation authority in Singapore responsible to the Ministry of Transport. Its mission is to promote aviation safety through the conduct of independent and objective investigations into air accidents and incidents.

The AAIB conducts the investigations in accordance with the Singapore Air Navigation (Investigation of Accidents and Incidents) Order 2003 and Annex 13 to the Convention on International Civil Aviation, which governs how member States of the International Civil Aviation Organization (ICAO) conduct aircraft accident investigations internationally.

The investigation process involves the gathering, recording and analysis of all available information on the accidents and incidents; determination of the causes and/or contributing factors; identification of safety issues; issuance of safety recommendations to address these safety issues; and completion of the investigation report.

In carrying out the investigations, the AAIB will adhere to ICAO's stated objective, which is as follows:

"The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

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SYNOPSIS

In the afternoon of 6 December 2007, an Airbus A319 aircraft, registration 9V-SBE, took off from Singapore Changi Airport bound for Yangon, Myanmar. While the aircraft was level at 8,000 ft above mean sea level (AMSL), it was given clearance to climb to 10,000 ft. A Boeing B737 aircraft, registration PK-GGN, was approaching from the south and was level at 9,000 ft. When the aircraft were about 7 NM east of the airport, the distance between the two aircraft was 800 ft vertical and 0.67 NM horizontal separation. A breakdown of separation had occurred as the minimum separation required was either 1,000 ft of vertical separation or 3 NM of horizontal separation.

The occurrence was classified as a serious incident by the Air Accident Investigation Bureau of Singapore.

FACTUAL INFORMATION

Unless otherwise stated, all times used in this report is Singapore time. Singapore time is eight hours ahead of Coordinated Universal Time (UTC).

1.1 History of the Flights

9V-SBE

- 1.1.1 The aircraft took off from Runway 20C of Singapore Changi Airport. Under the Singapore Air Traffic Control Centre's (SATCC) Approach Controller, the aircraft was initially cleared to climb to 6,000 ft and to turn left to 090 degrees. About two minutes later, the aircraft was directed to turn to 330 degrees but the crew requested a heading of 050 degrees to avoid weather. The Approach Controller did not approve this initially but about 30 seconds later, at 1515:13 hrs, she cleared the aircraft to turn onto the requested heading and to climb to 10,000 ft. At about 1515:50 hrs while the A319 was climbing through 8,500 ft on this new heading, it came within 0.67 NM of a Boeing B737 aircraft (PK-GGN) at 9,000 ft. See **Figure 1**.
- 1.1.2 A Traffic Advisory (TA) was generated by 9V-SBE's Traffic Alert and Collision Avoidance System (TCAS)¹. The crew reported that when they saw the B737, they reduced their rate of climb slightly to avoid getting close to that aircraft and they felt that the proximity was not a cause for concern. The TCAS did not generate a Resolution Advisory (RA)² and the crew did not submit a report to Singapore Air Traffic Control (ATC).

PK-GGN

- 1.1.3 The aircraft was approaching the Changi Control Zone from the south at 11,000 ft at 1512:50 hrs. Under the SATCC Approach Controller, it was cleared to descend to 9,000 ft at 1514:15 hrs and at 1515:06 hrs, it was instructed to turn onto a heading of 360 degrees while level at 9,000 ft. The loss of separation occurred while it was in straight and level flight. Their TCAS was generating a TA and the pilot remarked that they were "*too close to the traffic*", based on the TA, at 1516:18 hrs. The crew subsequently stated in their Air Safety Report that they were operating in Instrument Meteorological Conditions (IMC) at that time and they did not see the other aircraft.
- 1.1.4 Subsequently the aircraft landed at Changi Airport and the crew attempted unsuccessfully to call the controller at Changi Tower to discuss the incident. The crew did not submit a report to Singapore ATC but they submitted an Air Safety Report to their airline's Flight Safety Department.

¹ Traffic Alert and Collision Avoidance Systems help pilots locate and avoid other aircraft by giving them Traffic Advisory (TA) of altitude, distance and bearing information of other transponder equipped aircraft.

² In addition to Traffic Advisory display, TCAS also provides Resolution Advisory (RA) when needed. The RA instructs the pilots to climb or descend to avoid collision with another aircraft.

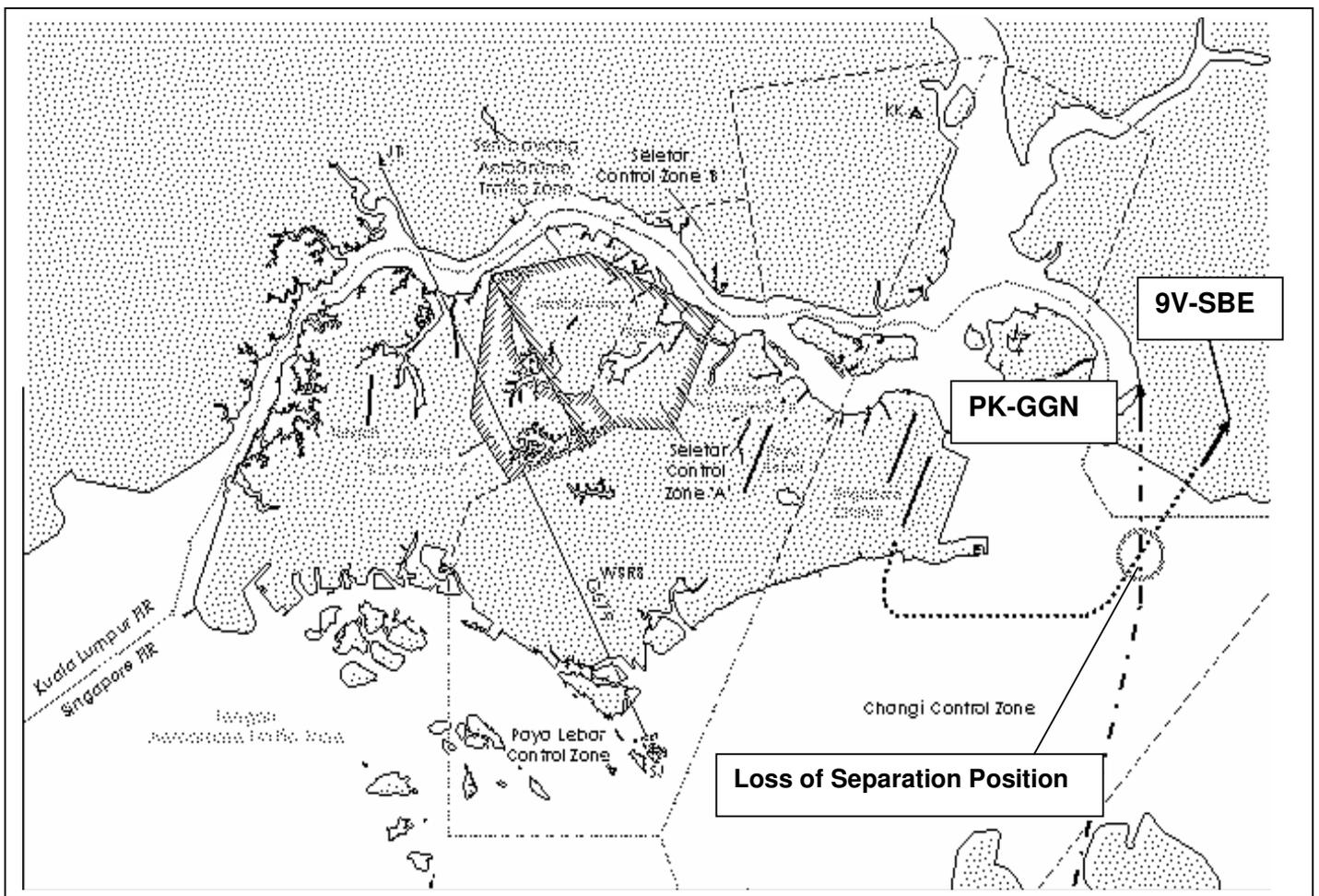


Figure 1 – Location of Loss of Separation Incident

Approach Controller Activities

- 1.1.5 At the time of the incident, the SATCC Approach Controller who controlled 9V-SBE and PK-GGN was on the third day of a 3-day 0800 hrs to 1600 hrs shift pattern cycle, to be followed by a day off. Before this 3-day shift, the Approach Controller had 2 rest days following a night shift duty. This shift system had been in place at SATCC since 1970. The incident occurred during the last hour of the 3-day shift, at about 1515 hrs. During interview, the Approach Controller said that she was tired during this last hour of her shift cycle but she could not describe the degree of fatigue. The Air Traffic Service (ATS) provider did not have a tool to gauge the fatigue level of controllers³. During the incident, staff strength was normal with 27 Air Traffic Controllers handling a total of 12 sectors and the Approach Controller said that she regarded the traffic to be of medium intensity.
- 1.1.6 At 1514:10 hrs, the Approach Controller cleared the A319 to climb from 6,000 ft to 8,000 ft and at 1514:15 hrs, she cleared the B737 to descend from 10000 ft to 9,000 ft. The controller recalled that at that time, she wanted to expedite the lateral separation between the two aircraft after they passed each other by instructing the A319 to turn onto a heading of 050

³ Various tools have been developed to assess the fatigue levels of individuals. For example, Airservices Australia, the provider of Australian Air Traffic Control services, uses the Fatigue Audit InterDyne (FAID) process for their calculations of fatigue levels. FAID was developed to account for work-related fatigue in a scientific and objective manner by a group at the University of South Australia

degrees at 1515:08 hrs after turning the B737 to a heading of 360 degrees. Her plan was to climb the A319 above 8,000 ft and to descend the B737 when both aircraft had passed each other. At 1515:13 hrs, five seconds after turning the A319 to this new heading, the controller cleared the aircraft to climb from 8,000 ft to 10,000 ft, through the B737's 9,000 ft altitude, while the two aircraft were still converging. She could not explain why she did so. Soon after, she heard the Approach Coordinator calling her attention to the A319 and she saw the loss of separation situation on her radar at 1515:47 hrs. She immediately told the A319 to maintain 8,000 ft but she did not tell the crew of either aircraft of the traffic conflict.

1.1.7 The senior Air Traffic Control Officers at SATCC who reviewed the radar playback of the incident assessed that the traffic intensity within the assigned airspace was moderate but that the control was complex in view of the poor weather conditions.

1.1.8 At the end of the shift period, at 1545 hrs, the Approach Controller verbally reported the breakdown in separation to the Watch Manager and she left the SATCC for home soon after that. She did not write an incident report and submit herself to a medical examination as required by ATS Standards and Safety Manual. The video and audio recordings were reviewed by her supervisor after she had left and the incident was subsequently confirmed. During interview, she stated that she did not report the incident immediately because she was not certain whether she had given a wrong instruction or the pilot had committed an error. She also felt that the duty controller for the next shift was about to arrive at the work station, to relieve her. The Standards and Safety Manual required her to report an incident after an occurrence so that another controller can be assigned to relieve her immediately.

1.2 Personnel Information

Approach Controller

Age:	39 (Female)
Licence:	Air Traffic Controller Licence issued by the Civil Aviation Authority of Singapore.
Licence Expiry date:	15 August 2008
Experience:	12 years
Work Schedule:	1 December 0800-1300 hrs, 2000-2400 hrs 2 December 0000-0800 hrs 3 December Day Off 4 December 0800-1600 hrs 5 December 0800-1600 hrs 6 December 0800-1600 hrs (Incident day)
Last Proficiency Check:	28 September 2007 (Approach). Overall Grade - Good
Last Medical Check:	27 July 2004 (valid from 15 August 2004 to 15 August 2008)

1.3 **MEDICAL**

The Approach Controller was medically examined at about 2140 hrs on 6 December 2007 and no abnormality was found. The incident occurred during the last hour at the end of a 3-day work cycle and she said that she was tired at that time. She stated that she did not have significant personal problems during the period and slept well.

1.4 **METEROLOGICAL DATA**

1.4.1 The weather conditions at the time of the incident are described below. This information is from the records of the Meteorological Services Division of the National Environment Agency of Singapore.

6 December 2007

General Weather: Widespread intermittent moderate/heavy rain in Singapore and southern South China Sea
Surface wind: Light and variable

Singapore Changi Airport METAR (aviation routine weather report)

The METAR at 1500 hrs reported rain at Changi Airport, with 1 to 2 oktas of cloud at 800 ft, 3 to 4 oktas of cloud at 1,400 ft, 1 to 2 oktas of towering cumulus cloud at 1,500 ft and 5 to 7 oktas of cloud at 15,000 ft.

1.4.2 The weather in the Changi Control Zone was poor during the time of the incident, with widespread cloud and rain. The radar display in **Figure 2** shows the spread of weather at Changi at the time of the incident.

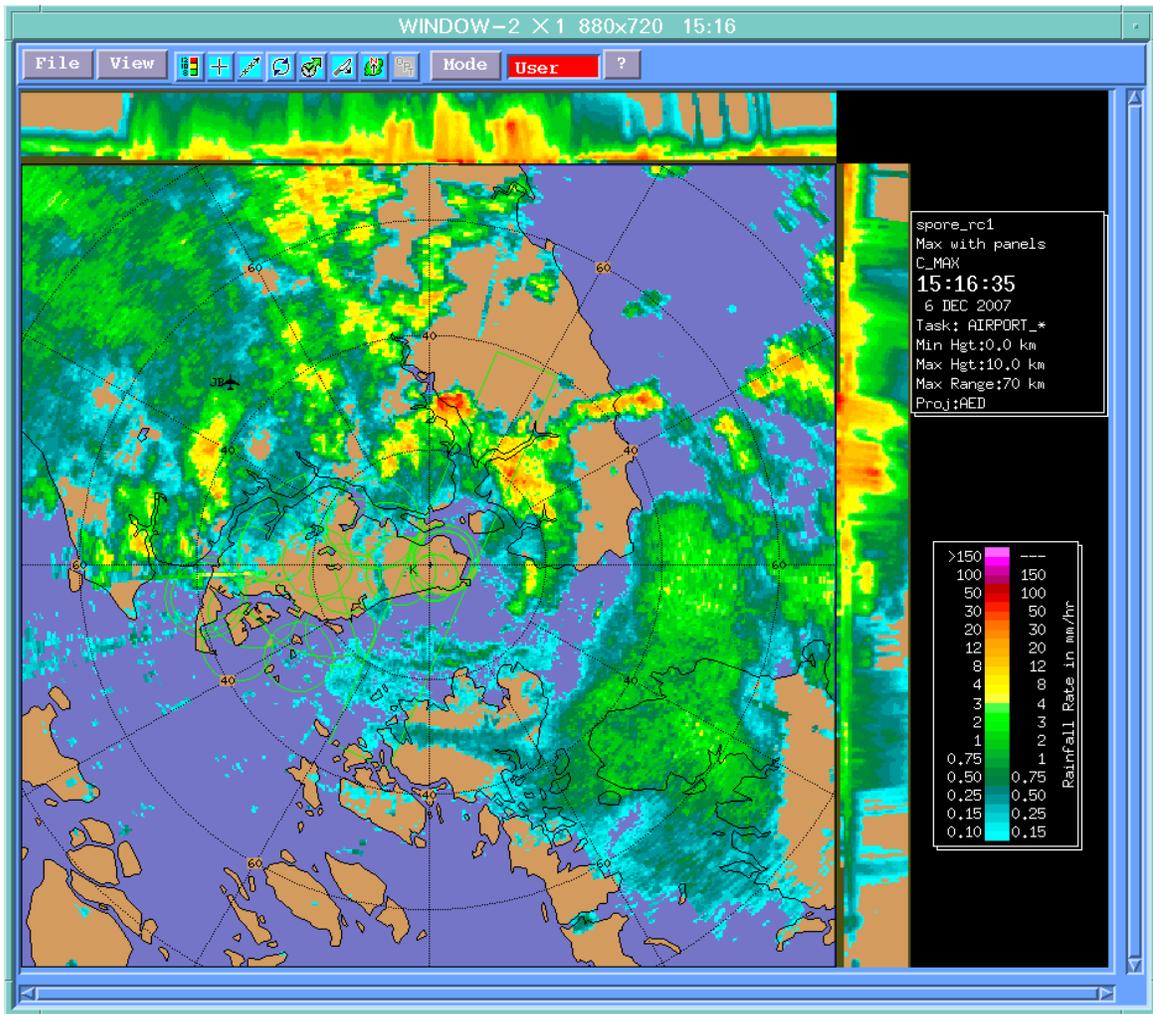


Figure 2 Weather Radar Display at 1516 hrs, 6 December 2007

2 ANALYSIS OF THE INCIDENT

2.1 The Approach Controller

- 2.1.1 The breakdown in separation between the A319 and B737 was the result of the clearance given by the Approach Controller to the A319, to climb from 8,000ft to 10,000 ft, although the B737 was at 9,000 ft and the two aircraft were about 2 NM apart on converging tracks.
- 2.1.2 At the time of the incident, the Approach Controller had a total of six aircraft under her control, a number considered 'moderate', but the widespread weather affecting many of the aircraft under her control made the traffic situation complex. A number of aircraft could not accept vectors and had to deviate from assigned tracks to avoid the weather. The Approach Controller said that she was tired at the time of the incident, but could not describe her level of tiredness.
- 2.1.3 The Approach Controller stated that she had planned to allow the A319 to climb to 10,000 feet after it had passed the B737. However, she inexplicably cleared the A319 to begin this climb at 1515:13 hrs, while the two aircraft were still converging.

3 **CONCLUSIONS**

3.1 **Findings**

- 3.1.1 The breakdown in separation between the A319 and B737 was the result of the clearance given by the Approach Controller to the A319 to climb from 8,000 ft to 10,000 ft while the B737 was at 9,000 ft as the two aircraft were on converging tracks.
- 3.1.2 The incident occurred during the last hour of the Approach Controller's three-day duty cycle and she was tired.
- 3.1.4 The Approach Controller had six aircraft under her control at the time of the incident and this was within her capacity under normal conditions. However, the weather conditions of that day entailed greater air traffic control workload.
- 3.1.5 Good situational awareness was displayed by Approach Coordinator in bringing the attention of the Approach Controller to the loss of separation situation.
- 3.1.6 The actions of the Approach Controller to recover from the loss of separation was timely and appropriate, considering the fast developing situation and the surprise she received. However, she did not provide traffic information which could have helped the pilots to locate the opposing traffic visually.

4 SAFETY RECOMMENDATIONS

- 4.1 The controller shift system at the SATCC has been in place with little change for more than 30 years and the significantly increased traffic density at Changi since then had placed greater demands on controllers. It is recommended that the air traffic services provider of Changi Airport review the controller shift system in view of the workload increase. [AAIB Recommendation R-2008-002]
- 4.2 It is recommended that the air traffic services provider of Changi Airport considers using scientific and objective tools to evaluate the fatigue levels of its controllers. [AAIB Recommendation R-2008-003]

5 SAFETY ACTIONS

- 5.1 An internal investigation by the air traffic services provider of Changi Airport resulted in the following safety recommendations:
- Controllers shall always be vigilant and alert when issuing executive instructions such as level and heading instructions
 - Controllers, when unsure whether a mistake was committed, shall immediately take appropriate actions to correct the suspected error or confirm the executive clearance so as to restore the required separation and maintain safety between aircraft
 - Controllers shall ensure that essential traffic information is passed to pilots when issuing corrective instructions to them for the purpose of avoiding action

The SATCC followed up on these recommendations by circulating them to their staff as lessons learnt and to trainees as reminders. An email detailing the incident, lessons learnt and recommendations was circulated among controllers within a week of the incident. It was followed by an updated version on 29 April 2008.