

**Aviation Safety Investigation Report
199501298**

**SOCATA - Groupe Aerospatiale
Tobago
Fokker B.V.
Friendship
Boeing Co
B737**

27 April 1995

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NOTE: All air safety occurrences reported to the ATSB are categorised and recorded. For a detailed explanation on Category definitions please refer to the ATSB website at www.atsb.gov.au.

Occurrence Number: 199501298 **Occurrence Type:** Incident
Location: Adelaide
State: SA **Inv Category:** 3
Date: Thursday 27 April 1995
Time: 1000 hours **Time Zone** EST
Highest Injury Level: None

Aircraft Manufacturer: Boeing Co
Aircraft Model: 737-376
Aircraft Registration: VH-TAX **Serial Number:** 23489

Type of Operation: Air Transport Domestic High Capacity Passenger
Scheduled
Damage to Aircraft: Nil
Departure Point: Melbourne Vic
Departure Time:
Destination: Adelaide SA

Aircraft Manufacturer: Fokker B.V.
Aircraft Model: F27 MK 100
Aircraft Registration: VH-CAT **Serial Number:** 10132
Type of Operation: Instructional Dual
Damage to Aircraft: Nil
Departure Point: Adelaide SA
Departure Time: 1006 EST
Destination: Adelaide SA

Aircraft Manufacturer: SOCATA - Groupe Aerospatiale
Aircraft Model: TB-10
Aircraft Registration: VH-YHG **Serial Number:**
Type of Operation: Instructional Solo
Damage to Aircraft: Nil
Departure Point: Parafield SA
Departure Time:
Destination: Parafield SA

Approved for Release: Thursday, September 5, 1996

Factual information

The F-27 aircraft had been carrying out circuit training and had landed on runway 05. The crew accepted the Aerodrome Controller's (ADC) offer to backtrack on runway 05 for further circuits and they reported ready for takeoff at 1002.32 CST.

The TB-10 aircraft was making an approach to runway 12 for a touch-and-go landing. At 1003.05, the ADC cleared the aircraft for the touch-and-go and also passed departure instructions to that aircraft.

Co-ordination between the ADC and Approach controller resulted in an agreement to sequence the F-27 so that it would land behind four jet aircraft arriving for runway 05. The ADC informed the F-27 crew of the sequencing difficulty and, at 1003.15, said there would be about a 30-second delay before he could issue a take-off clearance.

At 1003.45 the pilot of the B737 contacted the ADC whilst on approach for runway 05.

At 1004.58, the ADC cleared the F-27 for takeoff. The crew elected to hold position as they had seen the TB-10 on its approach to land but had not seen it depart after the touch-and-go. From the position of the F-27 part of runway 12 was hidden from view behind buildings. Consequently, the F-27 was held by the crew with power on and ready to commence the takeoff once the TB-10 was clear of the intersection.

The B737 crew saw the F-27 lined up on runway 05 and slowed their aircraft lowering, 40 degrees of flap to assist in the sequencing process. At 1005.04 the ADC informed the B737 crew to expect a late landing clearance.

At 1005.12 the F-27 commenced its take-off run approximately two minutes after receiving the advice of the expected delay of 30 seconds. The TB-10 was airborne but still not clear of the runway intersection and at this time, the B737 was on short final.

At 1005.30, as the F-27 was becoming airborne the ADC cleared the B737 to land. At the same time the B737 crew informed the ADC that they were commencing a go-around which they had started just prior to receiving landing clearance. The go-around decision was based on doubts that sufficient separation existed between the B737 and F-27, especially if the F-27 was to reject its takeoff.

The B737's go-around was flatter than the normal climb profile so that the captain could maintain visual contact with the F-27 and to ensure a safe manoeuvring speed.

At 1005.50, the ADC instructed the F-27 crew to maintain 500 ft and to turn left onto a heading of 300 degrees. As the F-27 was commencing its left turn, the B737 was turned right about 20 degrees to ensure continued sighting of the F-27.

Analysis

Aerodrome Controller

The ADC elected to process the F-27 by backtracking it on runway 05. The sequence chosen by the ADC was time-critical as it depended on the TB-10 crossing the intersection before the F-27 could take off, and the B737 was dependent on both these aircraft departing before it could land.

The controller realised that the sequence would be tight but he did not consider an alternative plan even though several options were available.

Although after lineup the F-27 crew were told to expect about a 30-second delay the actual delay was one minute and 43 seconds. When the crew of the F-27 were issued with their take-off clearance the TB-10 was still not clear of the runway intersection which led to a considerable erosion of the time base on which the ADC had based his original plan. Radar analysis indicates that the take-off clearance was issued to the F-27 approximately 20 seconds before the TB-10 had cleared the runway intersection.

Paragraph 23 of the Manual of Air Traffic Services (MATS) 6-3-4 specifies the separation standard applicable to a situation in which two aircraft are departing from different runways stating that aircraft B [F-27] shall not be permitted to commence takeoff until aircraft A [TB-10] has crossed the intersection.

Paragraph 26 of MATS 6-2-3 allows the controller to issue a take-off clearance prior to the prescribed separation existing if in the opinion of the controller no collision risk exists, and there is reasonable assurance that separation will exist when the aircraft commences its take-off roll. In this case, as the F-27 crew were expecting an immediate departure on

receipt of take-off clearance, the ADC could not have reasonably expected the aircraft to delay its take-off roll.

The investigation found that no uniformly accepted interpretation of the meaning of paragraph 26 existed between ATS management and some operational staff.

The B737 crew were told to expect a late landing clearance and the ADC issued this clearance between 1005.31 and 1005.33. Radar analysis indicates that the B737 was either just short of, or passing the runway threshold when the landing clearance was given. The F-27 became airborne at 1005.35. Paragraph 32 of MATS 6-3-5 states that aircraft B [B737] shall not be permitted to cross the runway threshold until aircraft A [F-27] (less than 136,000 kg MTOW) is airborne after takeoff. If the B737 was short of the runway threshold at 1005.35, then the clearance complied with the MATS instruction. If however, the B737 was passed the runway threshold at that time, the runway separation standard would have been breached.

The ADC believed that had the B737 landed, the separation standard would have been achieved and that the F-27 would be airborne prior to the B737 crossing the threshold. Radar analysis could not determine if the separation standard had been achieved.

The standard requires that an aircraft below 136,000 kg MTOW should be airborne before a landing aircraft of any size crosses the runway threshold. Therefore, as an example, an aircraft could be airborne at 70 kts and 500 ft along the runway when a landing jet aircraft crosses the threshold at up to 150 kts. The separation standard would then be breached if an unexpected event forced the departing aircraft to discontinue takeoff and reoccupy the runway. An ADC is required to take into account any unexpected manoeuvres by aircraft when issuing a clearance.

In this occurrence, there was a 2-4 second period in which the standard may have been achieved. The B737 crew doubted that the standard would be achieved.

Once the B737 had commenced its go-around, the ADC expected the climb to be similar to a normal B737 departure and believed this would solve any separation problems that may arise. However, the climb profile was more shallow than expected, and the ADC considered further action was required to guarantee separation. Instructions were issued to both crews to ensure that vertical and lateral separation were maintained.

Crew of the F-27

After lining up and holding on runway 05, the F-27 crew were given traffic information on the TB-10 which was on final approach for a touch-and-go on runway 12. They sighted the aircraft and monitored its descent and touchdown.

The ADC had asked the F-27 crew to be ready for an immediate departure as soon as the TB-10 was airborne. When the take-off clearance was issued, they increased power but held position until they had sighted the TB-10 and this delayed the commencement of their takeoff for approximately 12 seconds.

Crew of the B737

When on final approach for runway 05, the B737 crew became aware of the F-27 occupying the runway and aircraft speed was reduced as much as possible. On short final, the ADC issued a late landing clearance expectation and the crew briefed for a possible go-around.

The B737 captain was concerned that if the F-27 rejected its takeoff or had a malfunction shortly after lift-off and landed again, there would be insufficient room for the B737 to land safely.

As the B737 approached the threshold, the crew could see that the F-27 was still not airborne and well within the distance they would need to land and they initiated a go-around about the same time as they received a landing clearance. To regain safe climb speed and maintain visual contact with the F-27, the captain elected to climb at a sufficiently nose-down attitude until his aircraft was safely clear. The captain considered that the F-27 was sufficiently close to his aircraft that a risk of collision existed if he lost sight of that aircraft.

Findings

1. The ADC misjudged the time required for the TB-10 to clear the runway intersection.
2. The ADC issued a take-off clearance to the F-27 when the required runway separation standards were not met. (MATS provides the ADC with this discretion.)
3. The discretion shown by the ADC in finding 2 above, was inappropriate.
4. The F-27 crew could not see the TB-10 during the ground roll portion of its touch-and-go landing on runway 12.

5. The F-27 crew had good reason not to commence takeoff at the time the ADC issued the clearance.
6. The ADC cleared the B737 to land in the belief that the appropriate runway separation standard would be achieved.
7. The B737 crew executed a go-around manoeuvre when they judged that the runway may not be available for the safe operation of their aircraft.
8. At the time of the B737 go-around, it was unclear (to the investigation team) if the runway separation standard would have been maintained.
9. The B737 climbed at a more shallow angle than that expected by the ADC.

SIGNIFICANT FACTORS

1. The ADC placed undue pressure on himself by initiating a backtrack by the F-27.
2. The decision by the ADC to delay the F-27 until the TB-10 had completed its touch-and-go placed the three aircraft in a position whereby they each required the use of the runway intersection within a very short period of time.
3. The runway separation standard applicable in this case is such that it allowed the ADC to issue clearances whereby the B737 crew were unable to guarantee the safe landing of their aircraft.
4. The ADC did not have a fall-back plan for the sequence he initiated.

SAFETY ACTION

As a result of the investigation the following local action was taken.

Air Traffic Services management clarified the interpretation of MATS 6-2-3 para. 26 to the satisfaction of the investigation team and ensured that all Adelaide Tower staff were in no doubt as to their responsibilities in this regard.

Additionally, the Bureau of Air Safety Investigation issued the following interim recommendation to Airservices Australia on 29 May 1996.

IR960046

The Bureau of Air Safety Investigation recommends that Airservices Australia, in conjunction with the Civil Aviation Safety Authority, reviews the runway separation standards for landing aircraft in relation to departing aircraft. This review should consider what separation standards may be required to cover contingencies where slower departing aircraft may impede the safe passage of faster landing aircraft.

Airservices Australia responded on 29 July 1996.

IR 960046

Airservices, in conjunction with CASA, is currently reviewing runway separation standards for landing aircraft in relation to departing aircraft. This review includes an examination of the ICAO standards in relation to departing aircraft, as well as current international practices. The review will also attempt to assess the impact and safety benefit of the introduction of more restrictive practices on runway capacity at specific locations. It is intended that the review be completed by the end of August.

Response Status: Closed - Accepted.

The Civil Aviation Safety Authority responded on 17 June 1996.

In accordance with IR 960046 the separation standards in relation to a faster landing aircraft behind a slower departing aircraft will be reviewed. (Note: the Report states that there is a 2 - 4 second period where the standard may or may not have been achieved: were the tolerances of the radar taken into account in making that assessment?)

Response Status: Closed - Accepted

BASI Note: The radar tolerances were taken into account in the investigation.