

AVIATION INVESTIGATION REPORT

A02P0299

RISK OF COLLISION

NAV CANADA

VANCOUVER CONTROL TOWER

VANCOUVER, BRITISH COLUMBIA

20 NOVEMBER 2002

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

Pacific Coastal Airlines Flight PCO361, a Shorts SD 360, was on final approach to Runway 12 at the Vancouver International Airport, British Columbia, at the same time as a Japan Airlines Flight JAL17, a Boeing 747-400, bound for Narita, Japan, began its take-off roll from Runway 26 right (26R). A risk of collision occurred at approximately 1153 Pacific standard time when PCO361 crossed 0.5 nautical mile in front of and below JAL17. PCO361 had been cleared to land on Runway 12, and JAL17 had been cleared for take-off from Runway 26R. The two aircraft were being controlled by different controllers in the Vancouver Tower.

Ce rapport est également disponible en français.

Other Factual Information

During the incident, the Vancouver Tower was staffed with five controllers: tower south, ground south, tower advisory, clearance delivery, and the combined tower north and ground north . The shift supervisor was performing the tower north duties. The tower south controller had been qualified in the Vancouver Tower since May 2002. The traffic level and complexity were light to moderate. Some technical work was in progress in the Vancouver Tower, and a Transport Canada inspector was observing the air traffic control (ATC) operations as part of a scheduled Transport Canada audit of the Vancouver Tower.

Controller Position	Tower South	Tower North	Tower Advisory
Licence	ATC	ATC	ATC
Experience			
- as a controller	21.5 years	28.5 years	5.5 years
- in present unit	6 months	27.3 years	17 months
Hours on duty prior to occurrence	5	5	5
Hours off duty prior to work period	15	66	15

The tower advisory controller and the tower south controller are normally positioned adjacent to each other on the south side of the Vancouver Tower cab to facilitate coordination between these two functions. On the evening before the occurrence, equipment installation work could not be completed because of technical difficulties. Consequently, at the time of the occurrence, the tower north controller was operating from the normal tower north location adjacent to the ground north location, and the tower advisory controller was operating from the normal ground north location . Except in the case of a missed approach from Runway 26R, the tower north and tower advisory controllers would not normally be required to coordinate air traffic movements with each other.

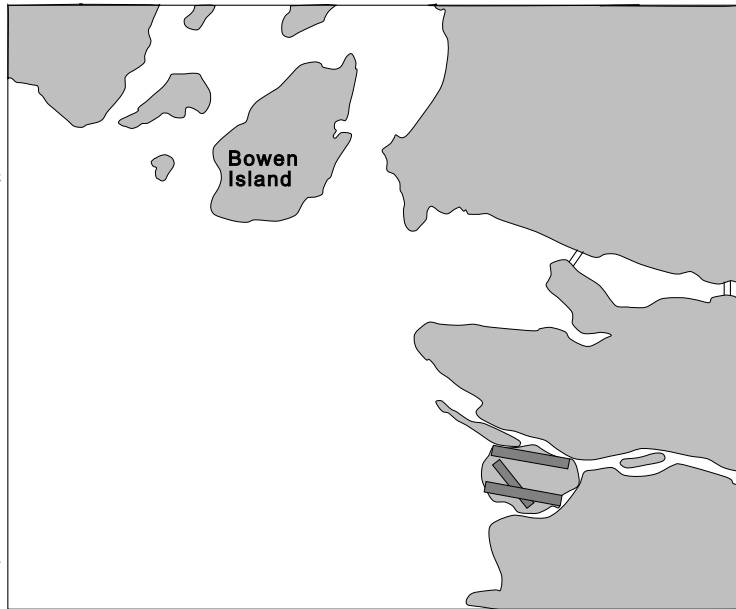
At 1129,¹ Runways 26R and 26L became the active runways. With Runway 12 already active, three runways were in use at the time of the incident. The tower south controller controlled Runway 26L (the primary runway used for departing and some arriving aircraft) and Runway 12 (used for arrivals). The tower north controller controlled Runway 26R (normally used for arriving aircraft only). Runway 26R was not to be used as a departure runway without specific permission from the Vancouver International Airport Authority. However, a construction project beyond the departure end of Runway 26L required two cranes to be set up in this area. As a result, some large aircraft were authorized to depart from Runway 26R, under specified conditions.

NAV CANADA's Operations Bulletin 02-61, "Localizer Antenna and Bypass Pier Construction," published on 07 November 2002, described, for controllers, the extent of the airport construction project at the end of Runway 26L and included ATC operating limitations. The bulletin stated that runways 08R and 08L were to be the "preferential/calm wind runways" and that the cranes would be operating (with booms raised) between 0700 and 1700 daily. When runways 26R and 26L were active, the cranes would stop operating (booms lowered) at 1200. When aircraft were too heavy to use Runway 26L for departure with the cranes operating, these aircraft

¹ All times are Pacific standard time (Coordinated Universal Time minus eight hours).

would be allowed to use Runway 26R for departures before 1200. A second bulletin, Operations Bulletin 02-62, "ILS and PAPI 08R and VALIDIS 26L/R," published the day after the occurrence, stated that controllers were required to obtain a departure clearance validation for every aircraft departing Runway 26R. No guidelines were issued for the coordination and use of Runway 12 when Runway 26R was being used for departures.

PCO361 was a visual flight rules (VFR) flight from Comox to Vancouver. The pilot contacted the tower advisory controller at 1147 at the GOWER reporting point (Figure 1), squawking 4500² and indicated that the aircraft was in descent out of 2000 feet above sea level. The tower advisory controller identified PCO361, cleared it for the Point Grey arrival for Runway 12 and issued traffic information on a de Havilland DHC-8 that was conducting a visual approach to Runway 12. PCO361 was instructed to follow the DHC-8. The tower advisory controller also passed additional traffic information on two helicopters, flying toward Point Grey, that were to remain east of the approach path for Runway 12. He then instructed PCO361 to contact the tower south controller at Point Grey. There was no coordination between the tower advisory controller and the tower north controller for Runway 12 arrivals: local procedures did not require such coordination.



At 1151, PCO361 passed Point Grey and contacted the tower south controller, who issued traffic information on the two opposite-direction helicopters. At 1152, he cleared PCO361 to land on Runway 12 and instructed PCO361 to hold short of Runway 26L. No information was given to PCO361 about the departure of JAL17 from Runway 26R.

At 1123, JAL17 had obtained a clearance to destination, from clearance delivery, to depart Vancouver via the Vancouver 3 standard instrument departure. At that time, runways 08R and 08L were still active. At 1136, the tower north controller advised JAL17 that the departure runway had changed to Runway 26L, and the taxi clearance was changed to taxi to Runway 26L. On being advised of the cranes operating off the end of Runway 26L, the pilot of JAL17 requested and received a revised taxi clearance for a departure from Runway 26R.

² 4500 is a common transponder code given to VFR aircraft operating in the Vancouver VFR terminal area.

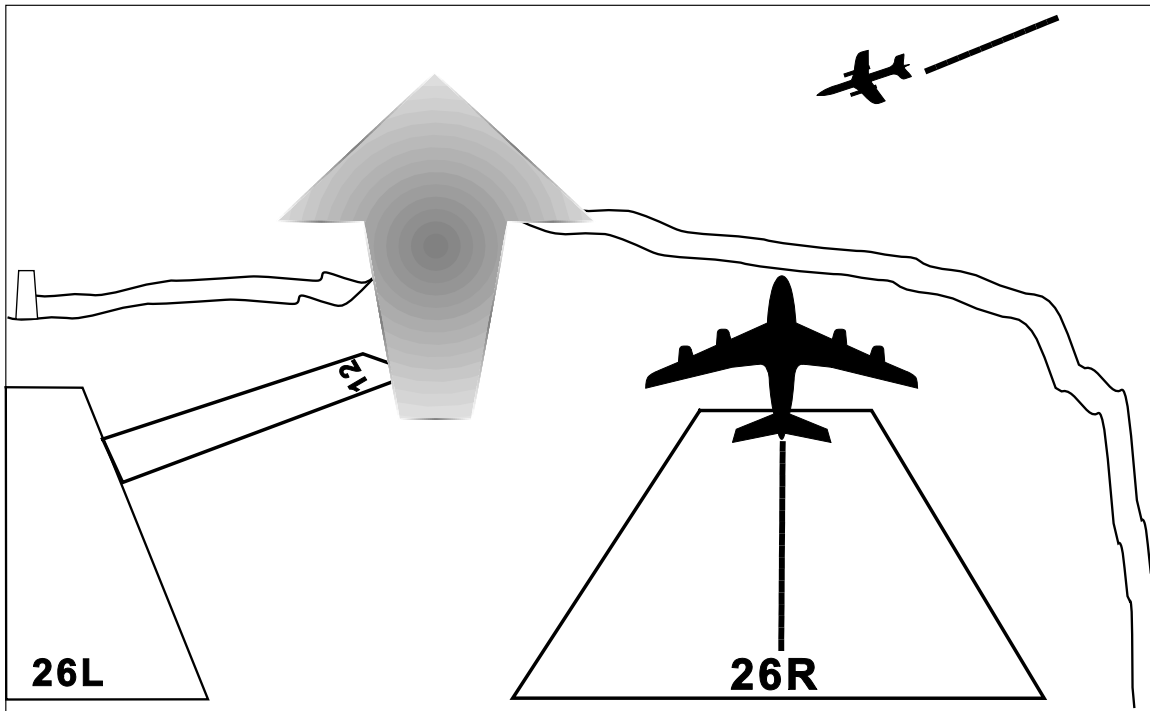
After clearing JAL17 to taxi for Runway 26R, the tower north controller walked across the tower cab to the tower south location and advised the tower south controller that there would be a departure from Runway 26R in about five minutes. The tower south controller indicated that there was traffic for Runway 12 but did not mention any specific flights. At the time, one aircraft, a DHC-8, was on approach to Runway 12. PCO361, about six miles behind the DHC-8, was not within the range selected on the tower south controller's radar display and was still on the tower advisory controller's frequency. The conversation between the tower south and tower north controllers was not recorded because they did not use the available hotline connecting the two positions. It is common practice for tower south and tower north controllers in Vancouver Tower to coordinate with direct voice rather than using the hotline.

At approximately 1149, the tower north controller asked the tower south controller if there was any instrument flight rules traffic departing Runway 26L. The tower north controller was aware of a DHC-8 on approach for Runway 12, because this flight was showing on his radar display as a correlated target with flight number, altitude, and speed. Behind the DHC-8, he saw another radar target with a triangular target symbol, for which only a limited data block³ was displayed, that is, altitude and speed but no flight number. The tower south controller had not made specific reference to a second aircraft on approach, and the tower north controller concluded that this second aircraft was not on approach to Runway 12.

At 1151, the tower north controller received a validation from terminal to allow JAL17 to depart. He then authorized JAL17 to taxi to position and wait on Runway 26R. Thirty seconds later, he cleared JAL17 for take-off from Runway 26R. At the time, PCO361 was 3.1 nautical miles (nm) northwest of the departure path for Runway 26R. The tower north controller did not inform the tower south controller that he had cleared JAL17 for take-off.

After the tower north controller cleared JAL17 for take-off, he attempted to manipulate the electronic flight progress strip on the extended computer display system to show that the aircraft had departed. This system is linked to all Vancouver tower positions and the terminal control unit and cuts down on verbal communications. While JAL17 was still on the take-off roll, the tower north controller saw an aircraft inbound from the northwest. He queried the tower south controller, who advised that it was a Pacific Coastal flight inbound for Runway 12. The tower south controller asked the tower north controller what action to take. The tower north controller recommended instructing the inbound aircraft to keep the speed up, because it now appeared that the inbound aircraft would cross the departure path of Runway 26R ahead of JAL17 (Figure 2).

³ Controllers can select the information to be depicted on the radar display. However, at least the altitude and vertical movement indicator must be selected for display on all targets. This is termed a limited data block. If an aircraft is under the jurisdiction of a controller, then the following information must be selected for display (if available): aircraft identification, aircraft wake turbulence category, special function indicator, present altitude, vertical movement indicator, and ground speed. This is termed a full, or jurisdictional, data block.



At 1153, the tower south controller advised PCO361 to keep the speed up and that there was traffic rolling on Runway 26R. Both pilots of PCO361 observed the Boeing 747 coming toward them and just lifting off Runway 26R. They immediately banked the aircraft to the right, increased the rate of descent and increased the engine power settings. As soon as the pilots observed that they were clear of the departing traffic, they turned toward Runway 12 again and landed the aircraft without further incident. PCO361 had crossed the Runway 26R departure path 0.5 nm in front of and about 100 feet below the take-off profile of the departing JAL17. There was no indication that the crew of JAL17 saw the other aircraft.

The NAV CANADA *Air Traffic Control Manual of Operations*, paragraph 138.1, states that controllers shall “maintain close coordination at all times between positions of operation within ATC units and between these positions and other ATC units, Flight Service Stations, and other concerned agencies.” Paragraph 352.5 specifies that controllers shall “[s]eparate a departing aircraft from an aircraft using ... a nonintersecting runway if flight paths intersect by ensuring that the departing aircraft does not begin its take-off roll until ... a preceding arriving aircraft has crossed over the departure runway.” The NAV CANADA *Air Traffic Services Administration and Management Manual*, paragraph 204.1, states that managers are responsible for issuing “direction and information required for the efficient administration and operation of the unit in the form of an operations letter, for long term items related to the provision of air traffic services (e.g. control, coordination, communication...)”. No specific guidance was published to guide Vancouver Tower controllers on procedures to follow when using Runway 26R for departures.

The radar display showed a small triangle for the target symbol for PCO361 and a limited data block associated with the radar target, because the target was not correlated with any flight plan information stored in the ATC computer system. The tower advisory procedures do not require the controller to manually add the aircraft’s flight number to the inbound aircraft’s radar target

to create a full data block. Vancouver Tower does not have procedures in place to indicate, through a special function indicator code or some other method, the aircraft's intended operation in the control zone (such as overflying or the landing runway). Other NAV CANADA units across Canada employ special function indicator codes to indicate an aircraft's intention to other controllers and, thereby, eliminate potential confusion and reduce the requirement for verbal coordination.

At the end of January 2003, the cranes that were used for the Bypass Pier Construction Project at the end of Runway 26L were removed.

Analysis

Runway 26R was rarely used to depart aircraft. Consequently, not all controllers in the Vancouver Tower had witnessed this type of operation. The initial coordination between the tower north and tower south controllers was deficient in the areas of specific traffic information and follow-up coordination prior to the departure of JAL17. Neither controller ensured that the other had the complete traffic picture. Since the arrival flight path for Runway 12 and the departure flight path for Runway 26R intersect, and operations on these runways are controlled by different controllers, the tower north and tower south controllers both had the responsibility to ensure that the complete traffic picture was relayed to the other. The coordination between the tower north and tower south controllers was not completed in a manner sufficient to prevent a risk of collision between two aircraft.

Because of equipment reconfiguration activities in the Vancouver Tower, the tower advisory controller happened to be sitting next to the tower north controller in the time leading up to the incident and knew of arriving traffic to Runway 12 that would have been of use to the tower north controller. The tower advisory controller coordinated primarily with the tower south controller for Runway 12 arrivals and overflights and did not normally bring the tower north controller into the information loop. The Vancouver Tower did not have procedure in place to ensure that all control positions were aware of unusual activities, such as Runway 26R departures.

Operations Bulletin 02-61 and 02-62 were silent on coordination requirements for an unusual situation such as a Runway 26R departure during the construction involving Runway 26L. Controllers were left to rely on their own experience and judgement to ensure safe and efficient operations. Several factors resulted in both controllers having deficient situational awareness: the lack of specific guidance material for managing departures from Runway 26R; the imprecise and incomplete coordination of relevant traffic; and an assumption by both controllers that the other knew what was going on. These factors resulted in a take-off clearance being given to JAL17 at the same time that PCO361 had a clearance to land on Runway 12, without any form of separation being applied. A subsequent operations bulletin corrected this deficiency for the period that the cranes were in operation at the end of Runway 26L.

The generic information—namely altitude and speed but no flight number—on the radar displays in the Vancouver Tower for several of the aircraft in the control zone resulted in a misinterpretation of the information relating to PCO361. PCO361's radar target and displayed flight information did not indicate what type of aircraft it was or where it was going. No procedures require airport controllers to add aircraft identification or intention onto the radar-

displayed targets of aircraft under their control. It may therefore be more difficult to distinguish arrivals to the airport from transiting traffic, reducing controllers' situational awareness about some of the aircraft operating within their airspace.

Findings as to Causes and Contributing Factors

1. Neither the tower north controller nor the tower south controller fully coordinated the departure of JAL17 from Runway 26R and the arrival of PCO361 on Runway 12.
2. The tower advisory controller did not correlate inbound visual flight rules aircraft landing at the Vancouver Airport with aircraft identification and intention information: there was no requirement to do so.
3. The tower north controller did not conduct an effective visual scan of the departure path for Runway 26R before clearing JAL17 for take-off.
4. On being informed of a pending departure from Runway 26R, the tower south controller did not advise the tower north controller of all the pertinent traffic arriving for Runway 12.

Findings as to Risk

1. Because Runway 26R was seldom used for departures, some controllers did not have experience in this type of operation. Vancouver Tower did not have specific published procedures to guide controllers in conducting departures from Runway 26R, increasing the risk that coordination between controllers would be incomplete and result in an incident or accident.

Safety Action

On 21 November 2002, Operations Bulletin 02-64, "Departures Runway 26R During Crane Operations," was disseminated by Vancouver Tower management. This bulletin stipulated that "when Runway 26R is used for departures during the Bypass Pier Construction Project ... the use of Runway 12 for arrivals shall be discontinued." Consequently, changes to internal coordination procedures to include the tower advisory position were stipulated. Additionally, because visual flight rules (VFR) arrival traffic intended for Runway 12 would have to be routed to Runway 26R, the tower advisory controller was required to switch these aircraft to the tower north frequency (119.55 MHz) at Point Grey.

Effective 01 March 2003, a change to Vancouver Tower Class C airspace procedures required all arriving and departing VFR aircraft to obtain discreet transponder codes. This change allows aircraft tracked by radar to be correlated with flight plan information, including flight number or aircraft registration, and, thereby, be more conspicuous on the radar display. Additionally, the extended computer display system (EXCDS) electronic flight progress strips for VFR aircraft will be coloured to differentiate VFR flights from other aircraft. All control positions in the Vancouver Tower are equipped with the EXCDS display.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 06 November 2003.

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