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16. Abstract On April 1, 1976, Hughes Airwest Flight 5 and Northwest Airlines Flight 603 almost collided in instrument meteorological conditions over the Spokane International Airport, Spokane, Washington. Awest 5 executed a missed approach from the ILS approach to runway 21 at Spokane Airport as Northwest 603 departed runway 21 and began its climb. Both aircraft continued in a south-southwesterly direction until the flightcrew of Airwest 5 saw Northwest 603 and took evasive action. Awest 5 encountered the wake turbulence from Northwest 603 which rolled Awest 5 into a 60° to 70° angle of bank. Its captain returned the aircraft to level flight and landed at Spokane Airport without further difficulty. Northwest 603 continued to its destination. None of the 176 persons aboard the two aircraft were injured, and the aircraft were not damaged.					
<p>The National Transportation Safety Board determines that the probable cause of this incident was the inadequacy of the local air traffic control procedures to insure positive and adequate separation between arriving and departing aircraft. Contributing to the incident was the failure of the local controller to recognize and resolve the impending conflict in accordance with the basic mandate to insure positive separation between aircraft. Also contributing to the incident was the failure of the crew of Awest 5 to follow company ILS approach procedures and the recommended FAA position reporting procedures.</p> <p>As a result of this incident, the Safety Board issued two recommendations to the Federal Aviation Administration.</p>					
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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

AIRCRAFT INCIDENT REPORT

Adopted: August 18 1976

NEAR MIDAIR COLLISION
HUGHES AIRWEST, DOUGLAS DC-9, N9333
AND
NORTHWEST AIRLINES, INC., DOUGLAS DC-10, N148US
SPOKANE INTERNATIONAL AIRPORT
SPOKANE, WASHINGTON
APRIL 1, 1976

SYNOPSIS

On April 1, 1976, Hughes Airwest Flight 5 and Northwest Airlines Flight 603 almost collided in instrument meteorological conditions over the Spokane International Airport, Spokane, Washington. Airwest 5 executed a missed approach from the ILS approach to runway 21 at Spokane Airport as Northwest 603 departed runway 21 and began its climb. Both aircraft continued in a south-southwesterly direction until the flightcrew of Airwest 5 saw Northwest 603 and took evasive action. Airwest 5 encountered the wake turbulence from Northwest 603 which rolled Airwest 5 into a 60° to 70° angle of bank. Its captain returned the aircraft to level flight and landed at Spokane Airport without further difficulty. Northwest 603 continued to its destination. None of the 176 persons aboard the two aircraft were injured, and the aircraft were not damaged.

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1. INVESTIGATION

History of the Flights

On April 1, 1976, Hughes Airwest Flight 5 (Airwest 5), a Douglas DC-9-30, N9333, was a regularly scheduled passenger flight between Calgary, Alberta, Canada, and Los Angeles, California, with intermediate stops at Spokane, Washington, and Las Vegas, Nevada. Airwest 5 departed Calgary about 0635 ^{1/} with 49 passengers and 5 crewmembers aboard on an instrument flight rules (IFR) flight plan to Spokane.

About 0718:45, the Seattle air route traffic control center (Seattle Center) assumed radar control of Airwest 5 and issued descent clearances from FL 310 ^{2/} to FL 240 and then to 10,000 feet ^{3/}. About 0730:08, when Airwest 5 was about 7 miles north of Elk ^{4/}, Seattle Center transferred control of Airwest 5 to Spokane approach control. At 0730:24, Airwest 5 reported to the approach controller that it was descending to 10,000 feet and had received information Kilo ^{5/}. The approach controller cleared Airwest 5 to maintain 8,000 feet and to turn left to 170° to intercept the ILS localizer course for runway 21 at Spokane Airport.

About 0733:26, Northwest Airlines, Inc., Flight 603 (Northwest 603), a Douglas DC-10-30, N148US, departed the passenger terminal at Spokane International Airport with 111 passengers and 11 crewmembers aboard. The flight was a regularly scheduled passenger flight between Spokane, and Seattle, Washington. Northwest 603 had received an IFR clearance from Spokane to Seattle with instructions to depart runway 21, maintain runway heading, climb to FL 310, and contact Spokane departure control.

At 0734:24, the Spokane approach controller cleared Airwest 5 to descend to 4,000 feet. Airwest 5 acknowledged the clearance, and, at 0734:56, the approach controller informed Airwest 5 that it was "5 miles from the outer marker, turn right 180°, intercept the ILS localizer at or above 4,000, cleared for ILS runway 21 approach." Airwest acknowledged the clearance. At 0735:49, the approach controller told Airwest 5, "contact Spokane tower, 118.3, good morning." Airwest 5 acknowledged, "Okay, 118.3."

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- 1/ All times are Pacific standard based on the 24-hour clock.
 - 2/ FL 310 represents a barometric altimeter indication of 31,000 feet with 29.92 set in altimeter.
 - 3/ All altitudes are mean sea level unless otherwise indicated.
 - 4/ A Spokane area arrival fix located on the 006° radial of the Spokane VOR at 29 miles.
 - 5/ An automatic terminal information service broadcast which gave the following information: "This is Spokane International information Kilo; the 1455 Greenwich observation, sky--partially obscured; measured ceiling--400 overcast, visibility--3 miles, light snow and fog; temperature--30°F; dewpoint--26°F, wind--160° at eight; altimeter--29.98; ILS approach in use, landing runway 21, . . ."

Northwest 603 taxied to the approach end of runway 21 and at 0736:40 informed the Spokane tower local controller, "Northwest 603 heavy's ready." At 0736:43, the local controller cleared Northwest 603 for takeoff and, at 0736:55, Northwest 603 replied, "cleared to go."

At 0737:13, Airwest 5 contacted the tower and reported, "inside the outer marker." The tower local controller responded "...understand you're inside the outer marker?" Airwest 5 replied, "Yes sir." At 0737:22, the local controller said, "Roger, continue for runway 21, traffic is a heavy DC-10 taking the runway for departure at this time." Airwest 5 replied "Okay."

At 0737:40, Airwest 5 transmitted "...a little high, we're gonna hafta take a waveoff and go." The local controller responded, "roger" and at 0738:00, he transmitted "Hughes Air 5 maintain runway heading and maintain 4,000." At 0738:23, the local controller cleared Northwest 603 to contact departure control. At 0738:34, Northwest 603 reported to departure control, "...out of 4,200."

At 0738:35, the local controller transmitted, "Hughes Air 5, roger, we have you in sight." Airwest 5 responded, "You ah that's kind of a neat thing you did there, we missed that one by about 20 feet." The local controller cleared Airwest 5 to contact departure control.

At 0738:38, the departure controller transmitted, "Northwest 603 heavy maintain 4,500--Hughes Air 5 how do you hear?" At 0739:05, Airwest 5 reported to departure control, "...we're level at 5,000." The departure controller replied, "...maintain 5,000, turn right heading 360°." At 0739:19, Northwest 603 transmitted, "We got the Hughes Air..." At 0739:33, Airwest 5 transmitted, "We're level at five now, we pulled up to miss that heavy." The departure controller responded, "...fly heading 360° vector ILS runway 21 final approach course. At 0739:48, the departure controller transmitted, "Northwest 603...turn right heading 230°." The flight replied, "Okay 230° now, where's the Hughes Air right now." The departure controller replied, "He's at your 4 o'clock position, 4 miles northbound." Northwest 603 responded, "Okay, what's his altitude, we're level at forty-five." The departure controller said, "Northwest 603...maintain flight level 310, fly heading 230°." Northwest 603 complied and landed at Seattle without further difficulty.

The departure controller continued to vector Airwest 5 for an ILS approach to runway 21. The flight landed at Spokane Airport without further incident about 0748.

According to the flightcrew of Airwest 5, the aircraft was high and fast throughout the descent from 10,000 feet and throughout the ILS approach since the flight was in instrument meteorological and icing conditions and it was necessary to keep engine power well above flight

idle to maintain adequate operation of the aircraft's anti-icing systems. The aircraft was descending about 2,000 fpm without the use of speed brakes. When the aircraft intercepted the localizer course, its indicated airspeed was about 220 kn and the captain had extended the leading edge slats and speed brakes. The captain said that he still had difficulty slowing the aircraft to configure it for the approach. Since the aircraft crossed the outer marker (OM) about 1,300 feet above the published crossing altitude, the captain continued on a localizer-only approach. The flightcrew had to hurry to complete the final landing checks and did not report the position of their aircraft to the tower until after the aircraft had passed the OM.

Shortly after passing the middle marker (MM), the captain of Airwest 5 decided to abandon the approach because the aircraft was too high and too fast. He stated that his aircraft was about 500 feet below the assigned missed approach altitude of 4,000 feet so he made a "casual" missed approach. Shortly after the aircraft had been reconfigured for the missed approach, the captain and first officer saw the empennage of the DC-10 almost directly ahead of them at close range. The captain of Airwest 5 banked his aircraft to the right and pushed the control column forward. During this maneuver, Airwest 5 encountered the wake turbulence from the DC-10 and continued to roll into a 60" to 70" right bank before the captain regained control. He then started a left climbing turn to 5,000 feet, contacted departure control, and received radar vectors for another ILS approach.

The flightcrew of Airwest 5 stated that they believed their aircraft to be under radar control throughout the approach and missed approach because they thought that Spokane Tower was equipped with radar. Consequently, they were not overly concerned about potentially conflicting traffic.

The captain of Northwest 603 stated that when his aircraft left the runway he heard Airwest 5 report to Spokane tower that it was too high and would have to go around. The captain of Northwest 603 believed that Airwest 5 was then 2 to 3 miles behind his aircraft. After switching to the Spokane departure control frequency, he looked out the right side of the aircraft and saw Airwest slightly above and about 500 to 1,000 feet to the right of his aircraft.

ATC Handling of the Flights

Spokane International Airport is located within a Stage III terminal radar service area (TRSA). Radar approach and departure control services are provided by the Fairchild radar approach control (RAPCON) facility which is located at Fairchild Air Force Base about 3 miles west of Spokane Airport. The Fairchild RAPCON is equipped with an ASR-5 radar, the antenna for which is also located at Fairchild Air Force

Base. The Spokane Airport control tower is not equipped with radar. Direct telephone communications lines are provided for coordination between the tower controllers and the Fairchild RAPCON controllers.

According to a letter of agreement between the Fairchild RAPCON facility and the Spokane Airport control tower facility, which was dated July 1, 1974, the turbojet arrival gate for runway 21 at Spokane Airport was the OM. The letter provided that "Fairchild RAPCON shall forward /to Spokane tower/ aircraft identification, type (if Stage 111), and position from the arrival gate...at least 5 miles prior to reaching the arrival gate.. .. Acceptance of position information with respect to the airport shall constitute coordination for nonuse of the arrival gate.. .."

With regard to departure procedures, the letter provided that:

"(1) Spokane Tower shall, unless otherwise instructed by Fairchild RAPCON, clear IFR aircraft 'as filed' or as indicated on computer-generated flight progress strips, and instruct aircraft to maintain runway heading.

"(2) Fairchild RAPCON shall instruct Spokane Tower to hold or release departing aircraft.

"(3) Spokane Tower may release an IFR departure until an arrival has or is reported over the final approach fix, unless visual separation is applied."

The OM (and final approach fix) for the ILS approach to runway 21 at Spokane Airport is located 3.9 miles from the threshold on a magnetic bearing of 025" (inbound localizer course is 205") from the localizer transmitter. (See Appendix C.)

According to the FAA Terminal Air Traffic Control Handbook 7110.8D, Paragraph 940 ^{6/}, ATC must "separate a departing aircraft from an arriving aircraft making an instrument approach to the same airport by using...the following minima until vertical or lateral separation is achieved: a. When takeoff direction differs by at least 45 degrees from the reciprocal of the final approach course -- departing aircraft takes off before the arriving aircraft leaves a fix inbound not less than 4 miles from the airport."

At the time of the incident, the Fairchild RAPCON was manned by two controllers. One controller was working both the arrival and departure control positions and the other controller was working both the departure data and arrival data positions. These positions are

^{6/} This handbook was superseded by FAA Air Traffic Control Handbook 7110.65 effective April 16, 1976.

located side-by-side in the radar room. The Spokane Airport control tower was also manned by two controllers. One controller was working the local control position and the other controller was working both the flight data position and the ground control position. The FAA considered the manning adequate for the traffic conditions that usually exist at that time of day.

The following conversations took place between the WCON departure/arrival data controller (SKA) and the tower flight data/ground controller (FD/GC) during the pertinent time period involved:

0734:03 (SKA) "One zero miles from the outer marker, Hughes Air 5, **ILS.**"

0731:10 (FD/GC) "**Is** that 5 from the outer?"

0734:12 (SKA) "**He's 10** miles from the outer marker."

0735:32 (SKA) "Departure."

0735:33 (FD/GC) "Hughes Air 721."

0735:34 (SKA) "Released."

0735:35 (FD/GC) "Followed by Northwest 603 heavy."

0735:38 (SKA) "Released."

0737:46 (FD/GC) "Hughes Air 5 says he's too high, we don't have him in sight, he has to go around."

0737:49 (SKA) "Runway heading to 4."

0735:51 (FD/GC) "Okay and departure, Northwest 603 heavy."

0737:53 (SKA) "**E.M.** " 1/

0738:12 (FD/GC) "Would **you** tell us where Hughes Air 5 **is?**"

0738:14 (SKA) "Say again."

0738:15 (FD/GC) "Would you tell **us** where Hughes Air 5 **is**, 603 just departed."

0738:21 (SKA) "S.D." 1/

0738:31 (SKA) "You can give Hughes Air 5 a left or right turn if you like."

1/ Operating initials of the controller who acknowledges receipt of the message.

The local controller stated that he had received the information from approach control that Airwest 5 was 10 miles from the OM. He had received no call from Airwest 5 when Northwest 603 informed him that it was ready for takeoff, so, in accordance with the procedures set forth in the letter of agreement between Fairchild RAPCON and Spokane Tower, he cleared Northwest 603 for takeoff. The controller stated that when Airwest 5 called "inside the outer marker" he believed the flight was just inside the OM. At that time Northwest 603 was beginning its takeoff roll so he was not alarmed. He indicated that if the OM call is not received, the arrival/departure separation is predicated on the arriving aircraft's not being over the runway threshold before the departing aircraft completes its takeoff.

According to the local controller, when Airwest 5 called for the missed approach, Northwest 603 was about 2,000 feet down the runway on its takeoff roll. He did not consider having Northwest 603 abort the takeoff because he was not concerned about a possible conflict. It was only after he had received Airwest 5's missed approach directions from departure control that he became alarmed. By the time he had received the clearance from departure control to turn Airwest 5 either right or left, he saw Airwest 5 descend below the overcast. He further stated that he was not aware that "blind spots" existed in Fairchild RAPCON's radar coverage of Spokane Airport.

According to the Spokane Tower supervisor, who was working the ground control and flight data positions, she recognized that a separation problem existed when Airwest 5 called its missed approach while Northwest 603 was on its takeoff roll. She attempted to get Airwest 5's position from departure control but did not obtain the information in time to provide separation directions. She also was not aware that there was a radar "blind spot" over the airport.

The Fairchild RAPCON arrival/departure controller stated that after he cleared Airwest 5 to the Spokane tower frequency, he continued to monitor Airwest 5's approach until he lost the aircraft in the clutter of the airport. When he was informed that Airwest 5 was making a missed approach and was asked for missed approach instructions, he saw a target near the departure end of the runway. He thought the target was Airwest 5 and he told the tower controller that he could turn Airwest 5 either right or left. He said that at that time he was not aware that a potential conflict existed.

The Fairchild RAPCON supervisor, who was working the arrival and departure data positions, was seated next to the arrival/departure controller and could see his radarscope. When Airwest 5 initiated its missed approach, he was entering departure data in the computer terminal and did not see the conflict develop. When he next looked at the radarscope, he could see only one target until after Airwest 5 began a turn. He said that a separation of 125 to 150 feet between two aircraft was required before their separate returns could be distinguished.

Also, the RAPCON supervisor was aware of the radar blind spots from the returns over Spokane Airport; they extended from about the MM for runway 21 to the departure end of the runway. He believed, however, that the return from an aircraft at an altitude of 3,000 feet normally should not be lost. He stated that it was not unusual for two controllers to handle the workload at that time of morning because the traffic load was usually light.

Flight Track Information

Both aircraft were equipped with flight data recorders (FDR) and cockpit voice recorders (CVR). The FDR's were obtained and the data were extracted. The CVR's were not available because they were equipped with continuous-use recording tapes of 30 minutes duration, and they continued in use following the incident.

Data from the Seattle Center National Airspace System (NAS) Stage A digitized radar system were retrieved and processed. These data were used to verify the FDR information from both aircraft and to establish a common time base correlation. (See Appendix D.) NAS Stage A radar coordinate data showed that Airwest 5 passed the OM for runway 21 about 0736:30. At that time, Airwest 5's FDR showed an airspeed of 224 kn at an altitude of about 4,700 feet.

The FDR information from Airwest 5 indicated that between 0738:13 and 0738:15, the aircraft rolled rapidly to the right. During that 2-second period, the aircraft's altitude was about 3,225 feet, its indicated airspeed was about 180 kn, and its heading was 205°. During this same time period, Northwest 603's altitude increased from 3,450 feet to 3,550 feet; its airspeed was about 165 kn and its heading was 203".

During the 10-second period which preceded Airwest 5's roll, Airwest 5's altitude varied slightly between 3,250 feet and 3,225 feet. Its airspeed increased from about 156 kn to 180 kn, and its heading changed from about 200" to 205". During this period, Northwest 603's altitude increased from 2,900 feet to 3,450 feet, and its airspeed increased from about 160 kn to 165 kn. Its heading was constant at about 203".

During the 10-second period after the roll, Airwest 5's altitude decreased to about 3,125 feet (the lowest altitude recorded throughout the approach and missed approach) and the airspeed increased to about 210 kn. The aircraft's heading changed from 205° to 213°. During this period, Northwest 603's altitude changed from 3,550 feet to 4,200 feet, and its airspeed decreased from 165 kn to 160 kn. Its heading was constant at 205".

A calculator was programmed with ground-related position rates-of-change which were derived from the FDR information from both aircraft, the NAS Stage A radar data, and an assumption about wind velocity distribution for the period of time between 0737:56 and 0738:25. The shortest, nominal three-dimensional distance between the two aircraft was computed to have been 291 feet at 0738:21. This distance is within the range of the resolution of the radar equipment which is specified accurate to 1/8 nmi., and 1/10° in azimuth. The actual distance between the two aircraft could have been greater or less than the nominal 291 feet, because of the tolerances involved in the recording systems which must be applied to nominal values. The exact tolerance to be applied to the computed separation distance is unknown because the tolerances related to the assumptions made for the wind model and time correlation cannot be determined, and because the position on the aircraft from which the separation distance is measured is not known.

Injuries and Damage

There were no injuries or damage.

Other Information

According to the Airman's information Manual (AIM) 8/, Part I, February 1976, regarding position reports during IFR flight, the pilot should report to ATC without request when he leaves the final approach fix inbound (FAF) on the final approach. In a chapter entitled "Good Operating Practices", the following was included: "Pilots conducting an instrument approach are reminded of the importance of reporting to ATC or an FSS when over the final approach fix on final approach. ATC may predicate separation between departures and arrivals and between successive arrivals on the basis of this report; therefore, failure to make the report may compromise separation criteria."

In the February 1976 AIM chapter entitled "Arrival--IFR", and under a subtitle "a. Radar Approach Control", the pilot is advised that ".../A/fter passing the final approach fix on final approach, aircraft are expected to proceed direct to the airport and complete the approach or effect the missed approach procedure published for that airport. Radar service is automatically terminated when the landing is completed or the tower controller has the aircraft in sight, whichever occurs first. In those instances where ARTCC's vector to the final approach course, radar service is automatically terminated upon interception of the final approach course or when instructed to change from center frequency, whichever occurs first."

8/ The information in this manual is advisory only. Except for cited Federal Aviation Regulations, compliance with the procedures and practices contained therein is not mandatory.

No information regarding the termination of radar service was included for the situation where a radar approach control provides vectors for the aircraft to intercept the final approach course and then transfers control of the aircraft to a control tower that is not equipped with radar.

The Airwest/Jepco Airways Manual provided information to Hughes-Airwest flightcrews on instrument approach and departure procedures. In Section 11, the manual specified: "The following reports should be made to ATC or FSS facilities without request: . . . When leaving final approach fix inbound on final approach. . . ."

The Hughes Airwest DC-9 Operating Manual, Standard Operating Procedures Chapter, specified that on a normal ILS approach:

"1. The ILS begins when the aircraft is over the IAF if the pilot is doing his own navigating to position the aircraft on the final approach or when within approximately 2 to 3 minutes of being inbound over the outer marker if being vectored to the final approach course.

"2. Prior to arriving at this point the descent and approach checks and the approach briefing will have been completed. The radios will have been tuned and identified, final approach course set in CDI, the aircraft will be in the maneuvering configuration and A/S will be within 30 K or less of minimum maneuvering speed."

On April 2, 1976, Fairchild RAPCON issued the following instructions to the RAPCON controllers: "Effective immediately, each arriving aircraft not conducting a radar approach shall be instructed to contact the tower 'now' and report the final approach fix."

On April 7, 1976, the FAA issued General Notice (GENOT) RWA 6/49, "Proper Coordination," and it contained the following:

"We are concerned over the apparent lack of proper coordination and exchange of timely information between facilities/controllers with regard to arrival and departure aircraft. It is imperative that the position of the arriving aircraft be known to the local controller to ensure proper separation between that aircraft and a departing aircraft. Accordingly, local controllers shall determine the position of the arriving aircraft prior to releasing a departure by visual observation, use of a BRITE radar display in the tower, asking the pilot or by coordination with approach control. Coordination and timely communication are fundamental elements in the

initial and qualification training of controllers. Proficiency and remedial training must continue to emphasize the critical nature of coordination. Facility Chiefs shall ensure that Handbook 7110.65-345/391/392/742 are included in this training. The contents of this GENOT shall be the subject of a special briefing to all terminal specialists. All terminal Facility Chiefs shall ensure that these briefings are completed no later than Friday, 5/7/76, and that a report to that effect is made to their respective Division Chief. Air Traffic Division Chiefs shall report the completion of these briefings to AAT/1 no later than Monday, 5/10/76."

On April 8, 1976, Fairchild RAPCON and Spokane Tower issued a joint order to insure the proper coordination and exchange of timely information between the two facilities regarding arriving aircraft. The order provided that:

"a. Fairchild RAPCON personnel shall ensure that arrival information is forwarded to Spokane Tower at least 5 miles prior to an aircraft reaching the final approach fix. Aircraft shall be changed to Tower frequency as soon as possible after arrival information is forwarded.

"b. After receiving arrival information, Spokane Tower personnel shall not release a departure until the position of the arriving aircraft has been determined by visual observation, pilot report, or coordination with Approach Control. Spokane Tower shall ensure that aircraft depart prior to an arriving aircraft reaching the final approach fix."

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

Based on the Airwest 5 flightcrew's observations and the composite NAS Stage A radar data and FDR information, the Safety Board concludes that Airwest 5 and Northwest 603 almost collided while the two flights were operating in instrument meteorological conditions. There was no malfunction or failure of any communication or navigation equipment. Both flightcrews and the air traffic controllers were properly certificated and qualified for the operations they were performing. There was no evidence that physiological or medical factors interfered with the performances of their respective duties. Therefore, the causal factors of the near-collision are related either to flight operational deficiencies or to ATC procedural deficiencies, or to both.

The separation procedures set forth in the letter of agreement between Fairchild RAPCON and Spokane Tower did not provide for positive separation between arriving and departing aircraft. The procedures placed too much reliance on a report from the arriving pilot that he was over the FAF and inbound to the airport. However, according to the Federal Aviation Regulations, the report is not mandatory unless specified by ATC, and, in this instance, ATC (Fairchild RAPCON arrival controller) did not tell Airwest 5 to report when over the FAF. Moreover, the separation procedures did not provide for the possibility of a communications failure.

The separation procedures also specified the use of a separation fix that was less than 4 miles from the airport, which did not meet the requirements of paragraph 940, FAA Terminal Air Traffic Control Manual, 7110.8D. Also, the procedures provided that "Spokane Tower may release an IFR departure until an arrival has or is reported over the final approach fix...." The tower controllers apparently interpreted "release" to mean "clearing an aircraft for takeoff," whereas paragraph 940 required that the departing aircraft takeoff before the arriving aircraft leaves the fix. These two factors clearly reduced the amount of separation between aircraft arriving and departing runway 21 at Spokane Airport.

The ATC procedures used for separation of aircraft in this instance might have been adequate had Spokane Tower been equipped with radar. However, without radar, the local controller's only means of providing separation were visual observation of the two aircraft and distance based on the arriving pilot's report over the FAF. The local controller apparently assumed that Airwest 5 would be in a position to land because he told the flight to continue after it had reported "inside the outer marker."

A controller's primary responsibility is to separate traffic regardless of any deficiencies in local ATC procedures. When Airwest 5 reported inside the outer marker, the local controller should not have assumed that almost 3.9 miles spacing existed between the two airplanes. Instead, he should have realized that the minimum spacing requirements had already been compromised. This realization should have prompted him to direct Airwest 5 to discontinue the approach and to stop Northwest 603 on the runway, since the DC-10 had not yet begun its takeoff roll. Because he could not see either aircraft, he had to rely on Fairchild RAPCON to provide separation directions. However, because of the radar coverage limitations, the RAPCON controller could not identify the two aircraft in time to prevent the conflict.

Although the captain of Airwest 5 was apparently justified in assuming that his aircraft was under radar control throughout the approach and missed approach because no information to the contrary was provided by ATC, his failure to inform Spokane Tower of his position when his aircraft was over the OM compromised separation between his aircraft and Northwest 603. In conformity with good operating practices, Airwest's

procedures suggested that he make the report even though Federal Aviation Regulations did not require that he do so. Moreover, it is apparent that the manner in which he flew the approach did not conform to Airwest's requirements and led directly to his failure to properly report his position and to his need to fly a missed approach rather than land.

The captain of Airwest 5 was at a disadvantage throughout the descent into Spokane because he had to maintain comparatively high thrust levels to operate anti-icing equipment. However, he could have selected several different courses of action to insure that he complied with company procedures. For instance, he could have extended the speed brakes sooner, or he could have requested either a 360-degree turn or delaying vectors to provide the additional time needed to properly descend to 4,000 feet, to properly configure the aircraft, and to complete the required checks before he intercepted the ILS glideslope. Had he done so, he would have had no difficulty in properly reporting his position or in landing from the approach -- either of which would have enabled ATC to provide adequate separation between his aircraft and Northwest 603.

The above-mentioned deficiencies notwithstanding, the Safety Board believes that separation between arriving and departing aircraft cannot be based solely on a nonmandatory report from the arriving pilot that his aircraft is over the FAF and inbound to the airport, or on assumptions that a pilot flying an instrument approach in instrument meteorological conditions will succeed in landing from the approach. More positive measures must be used because of the possibility of communications failures or congestion and because of the many factors that can cause the pilot of an arriving aircraft to fly a missed approach.

The Safety Board believes that the requirements of paragraph 3b of the Fairchild RAPCON/Spokane Tower order of April 8, 1976, will preclude the repetition of an incident such as this because a departing aircraft cannot be released for takeoff until the position of the arriving aircraft is known. Moreover, the departing aircraft must have departed before the arriving aircraft reaches the FAF which should provide the required 4-mile separation. However, the Safety Board believes that arriving flights also should be informed that radar service is terminated when Fairchild W C O N transfers control of the flight to Spokane Tower.

Additionally, the Safety Board is concerned that similar facilities might exist within the ATC system; that is, a radar approach control which provides service to control towers that are not equipped with radar. Although the GENOT issued by the FAA on April 7, 1976, recognizes this problem, we believe that action should be taken to insure that the proper procedures are employed at all of these facilities.

Conclusions

(a) Findings

1. There was no malfunction or failure of any communication or navigation equipment.
2. The flightcrews and air traffic controllers were properly certificated and qualified for the duties they were performing.
3. The Federal Aviation Regulations do not require that the pilot of an arriving aircraft report his position when over the FAF to that airport unless specified to do so by ATC,
4. The separation procedures used by Fairchild RAPCON and Spokane Tower did not require the pilot of an arriving aircraft to report his position when over the FAF inbound to the Spokane Airport while on an instrument approach.
5. The separation procedures used by Fairchild RAPCON and Spokane Tower did not provide positive separation between arriving and departing aircraft because too much reliance was placed on a nonmandatory report from the arriving pilot that his aircraft was over the FAF inbound to the airport. Also, the procedures did not provide for at least a 4-mile separation between the arriving aircraft and the departing aircraft.
6. The Spokane Tower local controller did not know positively the position of Airwest 5 when he cleared Northwest 603 for takeoff.
7. Following Airwest 5's report "inside the outer marker," the local controller attempted to apply **IFR** separation criteria on the assumption that Airwest 5 would be able to land from the approach.
8. The local controller did not take positive steps at the first indication that the separation between the two airplanes was questionable and while he still had the opportunity to delay the takeoff of Northwest **603**.
9. Airwest procedures recommended that Airwest flightcrews report their aircraft's position to ATC when it was over the FAF and inbound to the airport on an instrument approach; the flightcrew of Airwest 5 did not follow this recommendation.
10. The flightcrew of Airwest 5 did not comply with company procedures for flying a normal **ILS** approach or for executing a missed approach. Their failure to follow these procedures led directly to their failure to properly report their position to ATC when they were over the FAF, and led to their need to execute a missed approach.

11. The Airwest 5 flightcrew's failure to report their position over the FAF compromised separation between their aircraft and Northwest 603.
12. The procedures adopted by Fairchild W C O N and Spokane Tower after the incident will, if adhered to, provide positive separation between aircraft arriving and departing Spokane Airport.

(b) Probable Cause

The National Transportation Safety Board determines that the probable cause of this incident was the inadequacy of the local air traffic control procedures to insure positive and adequate separation between arriving and departing aircraft. Contributing to the incident was the failure of the local controller to recognize and resolve the impending conflict in accordance with the basic mandate to insure positive separation between aircraft. Also contributing to the incident was the failure of the crew of Airwest 5 to follow company ILS approach procedures and the recommended FAA position reporting procedures.

3. RECOMMENDATIONS

As a result of this incident, the National Transportation Safety Board made the following recommendations to the Federal Aviation Administration:

Revise the Airman's Information Manual so that the aviation community will not be misled regarding radar approach control services at locations where the tower cab is not radar equipped and the approach control facility has limited, low-altitude radar coverage capability. (Class 11--Priority followup.) (A-76-91.)

Review all local departure and arrival procedures and assure that they provide positive separation between aircraft whenever radar and nonradar operations interface. (Class 11--Priority followup.) (A-76-92.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.
Chairman

/s/ KAY BAILEY
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

/s/ WILLIAM R. HALEY
Member

August 18, 1976

APPENDIX A

1. Investigation

The National Transportation Safety Board was notified of the incident at 1000 P.s.t., on April 1, 1976. Safety Board investigators proceeded immediately to Spokane, Washington. Parties to the investigation were: Federal Aviation Administration, Northwest Airlines, Inc., Hughes Airwest, Air Line Pilots Association, and Professional Air Traffic Controllers Organization.'

2. Hearing

There was no public hearing.

APPENDIX B

Flightcrew and Controller Information

Captain Marshall R. Smith (Hughes Airwest)

Captain Smith, 57, holds Airline Transport Pilot Certificate No. 437271 with a type rating in the DC-9. He received his last proficiency check on November 10, 1975 and his last line check on November 29, 1975. His airport qualification date for Spokane was June 1975. Captain Smith held a first class medical certificate which was issued December 3, 1975, with the limitation that he wear glasses to correct for near and distant vision while exercising the privileges of his airman certificate.

First Officer George Avellar (Hughes Airwest)

First Officer Avellar, 39, holds Airline Transport Pilot Certificate No. 1602916. He received his last proficiency check on April 7, 1975. He held a first class medical certificate which was issued on June 10, 1975 without any limitations.

Mr. Donald E. Moore, Supervisory Air Traffic Control Specialist

Mr. Moore was employed by the FAA October 27, 1947. He was assigned to Fairchild RAF'CON March 3, 1963, and has been fully qualified at that facility since November 8, 1965.

Mr. David P. Dalsanders, Air Traffic Control Specialist

Mr. Dalsanders had been employed by the FAA for about 5 years. He was initially assigned to duties at the Felts Airport control tower, Spokane, Washington. On December 12, 1971, he was assigned to the Spokane Airport control tower and on November 11, 1973, he was assigned to Fairchild RAF'CON. He is a fully qualified journeyman controller, and he holds Control Tower Certificate No. 531-46-2821.

Ms. Wilma J. Seitz, Air Traffic Control Specialist

Ms. Seitz was employed by the FAA on June 17, 1968. She has been assigned to the Spokane Tower since November 28, 1971. She was facility rated on September 1, 1972, and she holds Control Tower Certificate No. 532-48-7143.

Mr. Gary E. Straub, Air Traffic Control Specialist

Mr. Straub was employed by the FAA on October 27, 1947. He was assigned duties at the Spokane Tower on November 10, 1974. He is a fully qualified journeyman controller for the tower facility. He received a facility rating on June 30, 1975.

APPENDIX C

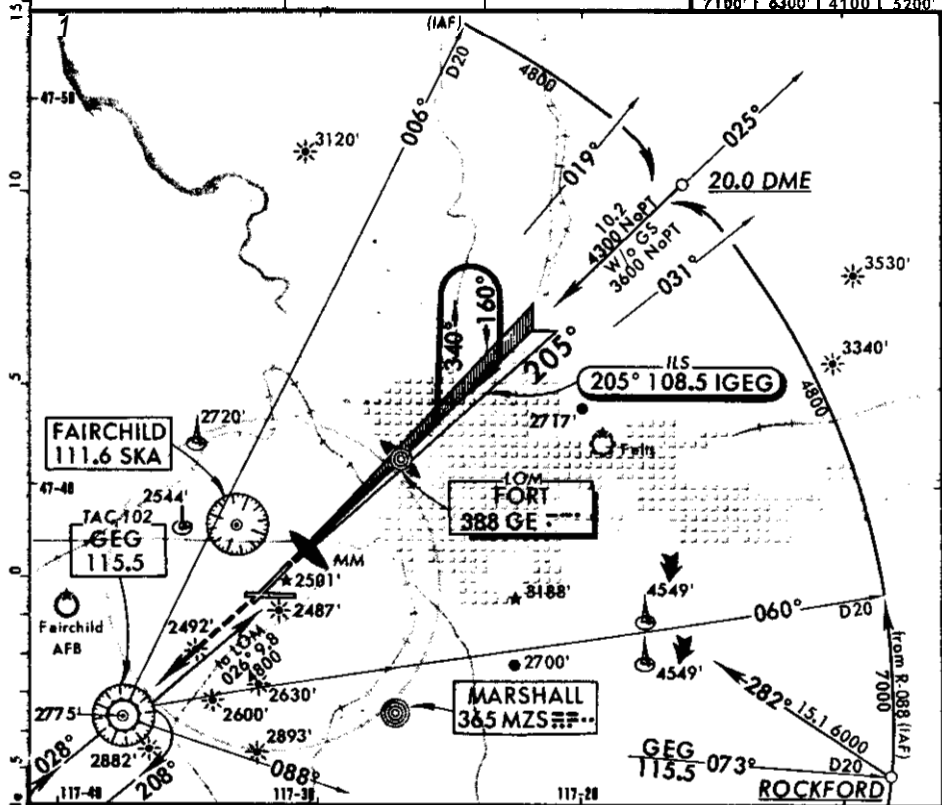
Jeppesen Approach Chart

OCT 10-75

SPOKANE, WASH.

SPOKANE INT'L

SPOKANE Tower 118.3		Apt. Elev 2372'		SPOKANE INT'L	
A111 127.8		Var 21°E		Eff Oct 16 ILS Rwy 21	
Approach (R) 124.7		Departure (R) 124.3		Ground 121.9	
		GS 329.9		LOC 108.5 IGEG	
				MSA 360°-090° 180° 270°-360° 7100' 4300' 4100' 5200'	



NOTE: No back course.

GS height above threshold 55'.

MM GS 2538' (197')

LOM GS 3520' (1179')

4300' (1959')

NORTH 10 NM 4800' (2459')

3600' (1259')

IDZ RWY 21 2341'

APT. 2372'

PULL UP: Climb to 4000 feet direct GEG VOR and hold SOUTHWEST, or as directed.

	STRAIGHT-IN LANDING RWY 21							CIRCLE-TO-LAND	
	DM 2541' (200')	DM 2591' (250')	MDA 2660' (319')					MDA	
	FULL ILS	Mkr out	ALS out	Mkr & ALS out	GS out	GS & MM out	GS & ALS out		
A								A	2820' (448') -1
B	RVR 24 or 1/2	RVR 24	RVR 40	RVR 50	RVR 24	RVR 24	RVR 50 or 1	B	2840' (468') -1
C		or 1/2	or 3/4	or 1	or 1/2	or 1/2		C	2840' (468') -1 1/2
D	RVR 24 or 1/2	RVR 40	RVR 40 or 3/4	RVR 50	RVR 40	RVR 40	RVR 50 or 1	D	2960' (588') -2
E								E	Non-Skid
F	DM 2691' (350')	DM 2691' (350')				MDA 2700' (359')		F	3040' (668') -2
G	RVR 40 or 3/4	RVR 50 or 1				RVR 50 or 1		G	
H	Gnd speed-Kts	60	80	100	120	140	160	H	Air Carrier Jets: SF1 or HIRL out-not less than RVR 40 or 3/4.
I	G.S.	275°	292	389	487	584	681	I	
J	LOM to MAP	3.9	3.54	2.56	2.20	1.57	1.41	J	

CHANGES: LOC & GS relocated, freq. changed, back crs deleted. © 1968 JEPPESEN & CO., DENVER, COLO., U.S.A. ALL RIGHTS RESERVED

0737:13

RW 005 Hughes Air Five's inside the outer

0737:16

LC Hughes Air Five understand you're inside the outer marker?

0737:20

RW 005 Yes sir

0737:22

LC Roger continue for Runway Two One, traffics' a heavy DC Ten taking the runway for departure at this time.

0737:40

RW 005 Ah Hughes Air Five's a little high We're gonna hafta take a wave and ah go

0737:46

LC Hughes Air Five Roger

0736:43

LC Northwest Six Oh Three Heavy, Spokane Tower, cleared for takeoff

0736:55

NW 603 Cleared to go, Six Oh Three

0737:40

RW 005 Ah Hughes Air Five's a little high We're gonna hafta take a wave and ah go

0737:46

LC Hughes Air Five Roger

0738:00

LC Hughes Air Five Maintain Runway heading and maintain four thousand

0738:05

RW 005 OK, runway heading and maintain four thousand

0738:25

NW 603 Six Oh Three, good day

0738:34

NW 603 Spokane departure Northwest Six Three Heavy out of forty two hundred

0738:39

RW 005 Yea ah thats kind of a neat thing you did there we missed that one by about twenty feet

FIG. 1. HUGHES AND RYAN'S ALTITUDE PERFILES AND RADAR TRANSMISSIONS CORRELATED FROM FLIGHT RECORDS AND THIS CASE A RADAR INFORMATION

0737:13

RW 005 Hughes Air Five's inside the outer

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RW 005 OK, runway heading and maintain four thousand

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NW 603 Spokane departure Northwest Six Three Heavy out of forty two hundred

0738:39

RW 005 Yea ah thats kind of a neat thing you did there we missed that one by about twenty feet

FLY HEIGHTS AND REPORTS ALTITUDE DEVIATIONS AND RADIO TRANSMISSIONS CORRELATED FROM FLIGHT RECORDS AND THIS STATE A RADIO INFORMATION