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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: August 23, 1984

Forwarded to:

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-84-98 through -102

At 1406 Yukon standard time, on December 23, 1983, Korean Air Lines (KAL) Flight 084, a scheduled cargo flight from Anchorage, Alaska, to Los Angeles, California, collided head-on with SouthCentral Air (SCA) Flight 59, a scheduled commuter flight from Anchorage to Kenai, Alaska, on runway 6L-24R at Anchorage International Airport. Both flights had filed instrument flight rules flight plans, and instrument meteorological conditions prevailed at the time of the accident. The SouthCentral Air Piper PA-31-350 was destroyed by the collision impact, and the Korean Air Lines McDonnell Douglas DC-10-30 was destroyed by impact and post-impact fire. Of the eight passengers aboard Flight 59, three were slightly injured; the pilot was not injured. The three crewmembers on Flight 084 sustained serious injuries.

The pilot of SCA 59 had requested clearance to runway 6L at 1339:36. The pilot reported to the ground controller passing the approach end of runway 32 at 1343:17, and he reported arriving at taxiway W-3 at 1344:08. At 1344:18, the pilot reported on the local frequency that he was holding short of runway 6L and that he would be ready for departure as soon as the runway visual range improved.

The ground controller cleared KAL 084 to taxi to runway 32 at 1357:37. The ground controller could not observe KAL 084 taxiing to the runway because fog was restricting surface visibility at the airport to 1/8 mile. He requested and received a report from the captain when KAL 084 reported entering the east-west taxiway at 1401:45. The ground controller then requested the captain to hold short of runway 32 and change to the tower local control frequency.

At 1402:36, the captain of KAL 084 reported on the local control frequency that he was taxiing on the east-west taxiway and was ready for takeoff. At 1402:54, the local controller cleared KAL-084 to taxi into position and hold on runway 32. At 1403:39, the local controller requested the pilot of SCA 59 to confirm his position. The pilot confirmed that he was holding at the W-3 intersection. At 1404, KAL 084 was cleared for takeoff on runway 32. The captain acknowledged the clearance. At 1405:28, SCA 59 was cleared onto runway 6L to hold for takeoff by the tower controller. At 1406:18, the captain of KAL 084 transmitted that he was starting the takeoff roll.

1/ For more detailed information, read Aircraft Accident Report--"Korean Air Lines McDonnell Douglas DC-10-30, HL7339, SouthCentral Air Piper PA-31-350, N35206, Anchorage, Alaska, December 23, 1983" (NTSB/AAR-84/10).

The Safety Board cannot determine precisely the procedures the KAL crew used while taxiing since the cockpit voice recorder was not recovered. The captain stated that while taxiing, he attempted to keep the airplane centered on the yellow taxi line but because of snow and ice ground cover and the reduced visibility, he could not positively identify his location on the airport once the airplane left the cargo ramp. The captain stated that he turned the aircraft right from the north apron to what he and the first officer believed was the east-west taxiway. The Safety Board believes that the crew actually turned, not about 100° to the right which would have turned them onto the east-west taxiway, but about 60° right or to taxiway W-1. From there, the captain turned the airplane about 50° right, instead of about 90°, to what the flightcrew believed was runway 32, but to what was, in fact, runway 24R.

The primary sources of information that are ordinarily available to crewmembers for guidance on airport surfaces were either partially or completely unavailable to the crew of KAL 084. At nighttime or under limited visibility conditions, crewmembers rely on runway surface markings such as taxiway lines and runway numbers, taxiway and runway lights, and runway and taxiway signs to provide them with information concerning their location on the airport. If the visibility is adequate, or if the airport is equipped with Airport Surface Detection Equipment (ASDE), ground controllers can assist the aircraft crewmembers by providing information on their location. The flightcrew of KAL 084 operated essentially without external information to assist them while taxiing since the visibility was restricted and the airport did not have an ASDE.

From the response of the captain of KAL 084 to questioning, the Safety Board could not determine why an experienced crew, such as this crew, did not verify whether they were on the correct runway by checking their heading instruments. The Safety Board could not find any factor which may have adversely affected the crew's vision, coordination, or decisionmaking capabilities to determine that their heading was 80° from the correct runway bearing. The failure of the crew to verify the runway heading may indicate that the initial or recurrent training the crew received or the operating procedures established for KAL crewmembers are deficient. It may be that verification of runway heading is such a rudimentary procedure that the air carrier believed that specialized training was not necessary. While such a belief may have been reasonable and reflective of accepted practice, that this crew failed to carry out this basic step indicates that a deficiency which needs to be addressed may exist in air carrier crew training and certification procedures.

The Safety Board cannot explain why the captain of KAL 084 decided to take off in the face of his uncertainty as to whether his airplane was holding at runway 32. The captain stated:

... I felt unsure that the aircraft was on the correct runway. . . . I discussed this with my copilot [the first officer] who felt sure that we were on the correct runway. After 3-4 minutes of discussion, I considered taking runway 6R because of my uncertainty. However, the runway size and lighting appeared to be correct so I decided to take off.

This statement indicates that the captain failed to recognize that his familiarity with the airport would not compensate for the limitations in other sources of information he would use ordinarily to confirm the aircraft's location. The captain failed to exercise proper decisionmaking responsibility by relying too heavily on the first officer's belief that the airplane was on the correct runway. Proper command procedures should have dictated to the captain not to commence takeoff without confirming that he was holding at runway 32.

The captain's statement indicates that he felt that the first officer, who had a higher level of recent experience at the airport than the captain, was more certain about the aircraft's location than the captain was. The first officer stated that, "In spite of poor visibility, our aircraft advanced and was able to get onto the east-west taxiway." The evidence indicates that KAL 084 was never on the east-west taxiway. Unlike the captain, the first officer in his statement did not manifest any uncertainty about the aircraft's location. The Safety Board believes that the first officer's strong belief about their location may have influenced the captain's decision to commence takeoff. The first officer's confidence regarding being on the correct runway in the face of the captain's uncertainties constituted a slight role reversal in that the captain's overall command authority when deciding to take off was influenced by the first officer's comments. In the past, the Safety Board has encouraged assertiveness training for first officers, to exercise their responsibilities as part of the cockpit team; however, a companion responsibility for captains to exercise positive cockpit crew management must exist. In this instance, the crew concept broke down. This breakdown may have been due to the crew's intense concentration on the airport surface markings and runway and taxiway signs in order to confirm their location. The Board believes that such a situation may lead to a breakdown in carrying out individual cockpit responsibilities unless the crewmembers have been trained to recognize and react to the situation.

Because the crew of KAL 084 commenced takeoff in spite of the uncertainty regarding their location on the airport, the Safety Board is concerned that the crew was not properly trained in ground operations in marginal meteorological conditions existing at the time. A common procedure for takeoffs in restricted visibility is for pilots to cross-check their gyro/compass heading with the runway heading prior to commencing takeoff. Crews should be trained to perform such a procedure regardless of how selfevident their position may appear to them. As a result of this accident and similar errors in air carrier ground operating procedures demonstrated by ground collision accidents at airports during restricted visibility conditions, as well as by the data from the Aviation Safety Reporting System of the National Aeronautics and Space Administration, the Safety Board is concerned that flightcrews are not being adequately trained in managing cockpit resources and coordinating their responsibilities when operating in marginal ground maneuvering conditions that require intense concentration. The need for specific training in ground operation procedures for crews is especially important since there are no requirements for standardized, illuminated, and easy-to-read runway and taxiway signs at airports certificated for air carrier operations. When there is obscuration of taxiways and runways added to restricted visibility, the need for a crew that is well trained in ground operations becomes critical. It is not possible for air traffic controllers during these conditions to verify an aircraft's location on the airport, in the absence of a radar such as ASDE that tracks airport surface traffic, other than relying on the crew to accurately report their location.

The demands on the crew of KAL 084 while they were taxiing were not excessive for a highly experienced crew, despite the lack of much of the information that crews usually rely on to taxi caused by the limited visibility and absence of ASDE. The Safety Board examined several of the runway and taxiway signs at the airport to determine if all of the available sources of ground location information external to the airplane were adequately presented to the KAL 084 crew. The KAL airplane passed four signs identifying runways and taxiways along the route that the Board believes it took while taxiing. One of the four signs, the sign designating taxiway N-1, was not equipped for electrical illumination. At night in restricted visibility conditions when additional guidance is most needed, such as existed at the time of this crash, this sign would provide no information or guidance to flightcrews. Another of the four signs was only partially illuminated, because only three of its seven lights were operating at the time of the accident. The other two signs, which identified runway 14 and runway 6L/24R, were illuminated.

Airports certificated under 14 CFR Part 139 are not required to have taxiway/runway guidance signs installed. However, if the signs are installed, Section 139.47(b) requires that the operator "must show that any guidance signs installed at the airport are in operable condition." For each airport certificated under 14 CFR Part 139, the Federal Aviation Administration (FAA) approves an Airport Operations Manual (AOM), which, in part, lists key elements of the airport, such as runway lights, that are required to be inspected daily to ensure that they are in operable condition. For many airports, including Anchorage International, the approved AOM does not include guidance signs in the list of key elements. Therefore, although 14 CFR 139.47(b) requires that the signs be in operable condition, the FAA has not supplied guidance to the airport operators on how or when this requirement will be met.

The Safety Board believes that as KAL 084 taxied along taxiway W-1, the crew thought that they were on the east-west taxiway, and that when they crossed the east-west taxiway, they thought it was the north-south taxiway and continued to what they believed was runway 32 but was instead runway 24R. There were no signs along this ground path to indicate, first, that the taxiway they had entered was W-1 and, second, that the first intersection they then crossed was the east-west taxiway. The crew of KAL 084 had no external source of information to designate either the taxiway they were on or the taxiway they were crossing as the airplane taxied to the intersection of taxiway W-1 and runway 6L/24R. Since the accident, signs have been installed at both intersections to designate the intersecting taxiways. The FAA should require under 14 CFR Part 139 that airport operators place appropriate runway or taxiway signs at each intersection along airport taxiways to designate either the intersecting taxiway or runway.

The crew of KAL 084 did not indicate in their statements that they saw the fully illuminated sign designating runway 6L/24R. Several factors may have contributed to the failure of the crew of KAL 084 to notice this sign, even though it was fully illuminated. The sign was dirty, which reduced the contrast between its background and lettering. Since the airport surfaces were obscured partially by snow, frost, and ice, the crew was looking intently for ground markings. Moreover, the visibility was restricted, which further limited the crew's ability to see the sign, particularly since the location of the DC-10 cockpit about 30 feet above the ground increases the slant range from cockpit to guidance signs placed aside taxiways and runways.

Contributing to the crew's failure to notice the runway sign was that, despite the different purposes that the runway and taxiway signs serve, the signs had common shape, color, and dimensional characteristics. The runway and taxiway signs had identical amber backgrounds with black lettering. The characters on the signs were identically sized. The signs, which were the same height, differed only in their width according to the number of characters on the sign. The Safety Board is concerned that in similar situations other flightcrews or vehicle operators could inadvertently enter an active runway. Runway and taxiway intersection signs should reflect, in their sizes, shapes, colors, and dimensions, the particular route they mark; a sign identifying a taxiway intersection should have a different appearance from a sign identifying a runway, and these signs should then be installed at airports certificated under 14 CFR Part 139.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require that airports certificated for air carrier operations install signs at all runway and taxiway entrances, exits, and intersections that indicate the identity of the runway or taxiway. (Class II, Priority Action) (A-84-98)

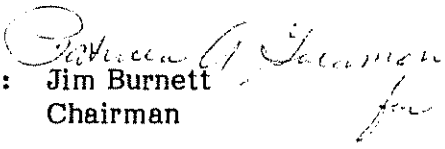
Require that the graphics on taxiway/runway identification signs be standardized and of sufficient size to enable them to be legible to aircraft crewmembers in all meteorological conditions in which air carrier operations are authorized. (Class II, Priority Action) (A-84-99)

Require that airport operators inspect and maintain the lights illuminating airport taxiway/runway identification signs as part of the daily airport inspection requirements. (Class II, Priority Action) (A-84-100)

Require at all airports certificated for air carrier operations that uniform signs be installed which are classified by function (e.g., runway entrance, runway exit, taxiway intersection) with each function having a unique shape, color, and/or size so that runway entrance signs are distinguishable from all other advisory signs on airport property. (Class II, Priority Action) (A-84-101)

Require that air carriers incorporate in training of their crewmembers procedures and responsibilities during ground operations in restricted visibility conditions, to enable them to operate safely in such conditions. (Class II, Priority Action) (A-84-102)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY and GROSE, Members, concurred in these recommendations.

By: 
Chairman