NATIONAL TRANSPORTATION SAFETY BOARD
Virtual Meeting of November 2, 2021
(Information subject to editing)

Runway Overrun During Landing
Unalaska, Alaska
October 17, 2019
DCA20MA002

This is a synopsis from the NTSB's report and does not include the Board's rationale for the findings, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached findings and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

What Happened

On October 17, 2019, a Saab 2000 airplane, operated by Peninsula Aviation Services Inc. d.b.a. PenAir flight 3296, overran the end of runway 13 at Unalaska Airport (DUT), Unalaska, Alaska. The flight crew executed a go-around during the first approach to runway 13; the airplane then entered the traffic pattern for a second landing attempt on the same runway. Shortly before landing, the flight crew learned that the wind at midfield was from 300° at 24 knots, indicating that a significant tailwind would be present during the landing. Because an airplane requires more runway length to decelerate and stop when a tailwind is present during landing, a landing in the opposite direction (on runway 31) would have favored the wind at the time. However, the flight crew continued with the plan to land on runway 13.

Our postaccident calculations showed that, when the airplane touched down on the runway, the tailwind was 15 knots. The captain reported after the accident that the initial braking action after touchdown was normal but that, as the airplane traveled down the runway, the airplane had "zero braking" despite the application of maximum brakes. The airplane subsequently overran the end of the runway and the adjacent 300-ft runway safety area (RSA), which was designed to reduce airplane damage during an overrun, and came to rest beyond the airport property. The airplane was substantially damaged during the runway overrun; as a result, of the 3 crewmembers and 39 passengers aboard, 1 passenger sustained fatal injuries, and 1 passenger sustained serious injuries. Eight passengers sustained minor injuries, most of which occurred during the evacuation, and the remaining 32 occupants were not injured.

What We Found

Postaccident examination of the airplane's antiskid brake system found that the wire harnesses for the left main landing gear (MLG) wheel speed transducers were incorrectly routed; the harness that should have been routed to the left inboard wheel was instead routed to the left outboard wheel (and vice versa). As a result of the incorrect (crossed) wiring, the antiskid system performance was substantially compromised. Specifically, during most of the landing rollout, the left outboard tire was in a skid. However, because of the crossed wiring, the antiskid system perceived that the left inboard wheel was skidding and released the brake pressure to that wheel and the right inboard wheel (due to the paired-wheel design of the antiskid system). The system also perceived that the left outboard wheel was operating properly, even though the tire was skidding. As a result, the left outboard tire continued to skid and then burst, causing an additional loss of MLG wheel braking.

The incorrect wheel speed transducer wiring most likely occurred during the overhaul of the left MLG at the landing gear manufacturer's facility in January 2017, more than 2.5 years before the accident. This cross-wiring condition was not discovered until after the accident in part because the airplane was not in revenue service between the time of left MLG overhaul and PenAir's first revenue flight in June 2019. Also, the antiskid system does not generate a fault based on incorrect wiring. For a cross-wiring condition to potentially be detected, a significant skid event would have to occur for more than 2 seconds (based on the antiskid system's logic) and not be relieved. Saab's design of the wheel speed transducer wire harnesses did not consider that the harnesses could be incorrectly installed during maintenance and overhaul. In addition, three incidents that we investigated showed the potential for cross-wiring of antiskid system components in other airplane types.

The airplane should have had the landing performance capability to stop within the landing distance available on runway 13 or the RSA distance given the airplane's energy state, MLG touchdown location, environmental conditions, and runway surface conditions. However, the Saab 2000 could not tolerate the loss of MLG wheel braking in excess of 50%. Thus, the combined loss of left and right inboard and left outboard MLG wheel braking prevented the flight crew from stopping the airplane on the runway.

During postaccident interviews, the flight crewmembers stated that they were aware of the airplane manufacturer's 15-knot tailwind limit but thought that the reported wind direction and speed (300° at 24 knots) did not warrant a change of the runway for landing. The flight crew's continuation with the planned landing on runway 13 despite the knowledge of a tailwind that exceeded the manufacturer's limit was inappropriate and was consistent with plan continuation bias, which is an unconscious cognitive bias to continue with an original plan despite changing conditions.

Further, we found that PenAir designated DUT as an airport that required a company-specific qualification for pilots-in-command (PIC) because of the surrounding terrain and complex approach and departure procedures. At the time that PenAir qualified the accident captain as a PIC to operate at DUT (about 2 months before the accident), he did not meet the total flight time in the Saab 2000 that the company's PIC airport qualification policy required. Because PenAir allowed the captain to operate at DUT without gaining the experience that the company's policy intended, the captain might not have fully understood the challenges associated with landing the Saab 2000 at the airport.

In addition, we found that the Federal Aviation Administration (FAA) approved PenAir's use of the Saab 2000 on DUT runway 13/31 without considering whether the RSA at the airport was suitable, according to FAA guidance, for an airplane with the approach speed and size of the Saab 2000. No evidence indicated that either PenAir or the FAA was aware of the RSA standards for the Saab 2000 or the inconsistency between the standards and the existing RSA dimensions at DUT. Further, neither PenAir nor the FAA considered potential mitigations to ensure that the Saab 2000 could safely operate at the airport.

Probable Cause

We determined that the probable cause of this accident was the landing gear manufacturer's incorrect wiring of the wheel speed transducer harnesses on the left MLG during overhaul. The incorrect wiring caused the antiskid system not to function as intended, resulting in the failure of the left outboard tire and a significant loss of the airplane's braking ability, which led to the runway overrun. Contributing to the accident were (1) Saab's design of the wheel speed transducer wire harnesses, which did not consider and protect against human error during maintenance; (2) the FAA's lack of consideration of the RSA dimensions at DUT during the authorization process that allowed the Saab 2000 to operate at the airport; and (3) the flight crewmembers' inappropriate decision, due to their plan continuation bias, to land on a runway with a reported tailwind that exceeded the airplane manufacturer's limit. The safety margin was further reduced because of PenAir's failure to correctly apply its company-designated PIC airport qualification policy, which allowed the accident captain to operate at one of the most challenging airports in PenAir's route system with limited experience at the airport and in the Saab 2000.

What We Recommended

As a result of this investigation, we recommended that the FAA and the European Union Aviation Safety Agency review system safety assessments for landing gear systems on currently certificated transport-category airplanes to determine whether the assessments evaluated and mitigated human error that could lead to cross-wiring of antiskid brake system components, including the wheel speed transducers, and then require transport-category airplane manufacturers without such assessments to implement mitigations. We also recommended that the FAA and the European Union Aviation Safety Agency require system safety assessments addressing the landing gear antiskid system for the certification of future transport-category airplane designs; the certification should ensure that the system safety assessments evaluate and mitigate the potential for human error that can lead to a cross-wiring error. Further, we recommended that Saab redesign the wheel speed transducer wire harnesses for the Saab 2000 to prevent the harnesses from being installed incorrectly during maintenance and overhaul and that the FAA and the European Union Aviation Safety Agency require organizations that design, manufacture, and maintain aircraft to establish a safety management system.

We also recommended that the FAA notify certificate management team personnel about the circumstances of this accident and emphasize the importance of detecting and mitigating the safety risks that can result when certificate holders experience significant organizational change, such as bankruptcy, acquisition, and merger, all of which PenAir was experiencing for more than 2 years before the accident. We further recommended that the FAA revise agency guidance to include a formalized transition procedure to be used during a changeover of certificate management team personnel responsible for overseeing a certificate holder that is undergoing significant organizational change to ensure that incoming personnel are fully aware of potential safety risks.

In addition, we recommended that the FAA include the runway design code for runways of intended use among the criteria assessed when authorizing a scheduled air carrier to operate its airplanes on a regular basis at an airport certificated under Title *14 Code of Federal Regulations* Part 139.

Findings

1. None of the following were factors in this accident: (1) flight crew qualifications and airplane certification, which were in accordance with US regulations; (2) flight crew medical conditions; and (3) the airworthiness of the airplane's structures and engines.

2. The flight crew's decision to land on a runway with a reported tailwind that exceeded the airplane manufacturer's limit was intentional, inappropriate, and indicative of plan continuation bias.

3. The captain demonstrated inadequate aeronautical decision-making skills regarding which runway to use for landing and a lack of flight deck leadership by continuing the landing to a runway with a significant tailwind.

4. The evacuation delay for the crewmembers and some passengers was reasonable given the need to provide emergency medical attention to the critically injured passenger, and the emergency response was timely and effective.

5. The incorrect routing of the wheel speed transducer wire harnesses most likely occurred during the landing gear manufacturer's overhaul of the left main landing gear and was undetected by PenAir because such incorrect routing cannot be discovered unless a significant unrelieved skid event happens.

6. As a result of the crossed wiring of the left main landing gear (MLG) wheel speed transducers, the antiskid system responded to the left outboard tire skid by completely releasing the brake pressure to the left and right MLG inboard wheels.

7. Because the antiskid system could not alleviate the left main landing gear (MLG) outboard tire skid, the tire subsequently burst and resulted in an additional loss of MLG wheel braking.

8. The Saab 2000 could tolerate all the conditions at the time of the accident except for a loss of main landing gear (MLG) wheel braking in excess of 50%; thus, the combined loss of left and right inboard and left outboard MLG wheel braking prevented the flight crew from stopping the airplane on the runway.

9. A more robust design for the Saab 2000 wheel speed transducer wire harnesses that protects against human error could mitigate the potential for the incorrect installation of the harnesses.

10. The potential for cross-wiring of wheel speed transducer harnesses during installation or maintenance exists for other airplane types.

11. Safety management systems for aircraft designers, manufacturers, and repair stations would help identify and manage safety risks that current safety processes might not effectively mitigate.

12. PenAir's decision to allow the captain to operate at Unalaska Airport as a pilot-in-command (PIC) without meeting the PIC airport qualification criteria was inconsistent with company policy to ensure the necessary skill and experience level to operate at the airport.

13. The captain might not have fully understood the challenges associated with landing the Saab 2000 at Unalaska Airport because he had not achieved the experience that the company-designated pilot-in-command airport qualification policy intended.

14. Deficiencies associated with PenAir's safety management system decreased its effectiveness and resulted in reduced pilot feedback to management about safety concerns.

15. The Federal Aviation Administration's oversight of PenAir during the 2 years before the accident was insufficient to identify safety risks resulting from the company's bankruptcy, reduced route structure, loss of experienced pilots, acquisition, and merger.

16. The accident airplane would have been able to stop within a runway safety area that was suitable for the approach speed and size of the Saab 2000.

17. During the process of authorizing an air carrier to operate its aircraft at specific airports, the consideration of runway safety area dimensions for runways of intended use could help increase the aircraft's margin of safety if a runway excursion were to occur.

Recommendations

To the Federal Aviation Administration:

1. Identify all currently certificated transport-category airplanes for which system safety assessments for landing gear systems did not consider human error that could lead to cross-wiring of antiskid brake system components, including the wheel speed transducers, and require manufacturers of transport-category airplanes without such assessments to perform the assessments and then implement mitigations to prevent cross-wiring of antiskid brake system components.

2. Require the submission and consideration of system safety assessments addressing the landing gear antiskid system for the certification of future transport-category airplane designs. The certification should ensure that the

system safety assessments are consistent with the intent of Advisory Circular 25.1309, System Design and Analysis, and that the assessments evaluate and mitigate the potential for human error that can lead to a cross-wiring error.

3. Require organizations that design, manufacture, and maintain aircraft to establish a safety management system.

4. Notify principal operations inspectors and frontline managers about the circumstances of this accident and emphasize the importance of existing Federal Aviation Administration guidance for detecting and mitigating the safety risks that can result when certificate holders experience significant organizational change, such as high personnel turnover, a reduction to route structures or flight schedules, bankruptcy, acquisition, and merger.

5. Revise Order 8900.1, Flight Standards Information Management System, to include a formalized transition procedure to be used during a changeover of certificate management team personnel responsible for overseeing a certificate holder that is undergoing significant organizational change (for a reason described in volume 6, chapter 2, section 18 of the order) to ensure that incoming personnel are fully aware of potential safety risks.

6. Include the runway design code for runways of intended use among the criteria assessed when authorizing a scheduled air carrier to operate its airplanes on a regular basis at an airport certificated under Title 14 *Code of Federal Regulations* Part 139.

To the European Union Aviation Safety Agency:

7. Identify all currently certificated transport-category airplanes for which system safety assessments for landing gear systems did not consider human error that could lead to cross-wiring of antiskid brake system components, including the wheel speed transducers, and require manufacturers of transport-category airplanes without such assessments to perform the assessments and then implement mitigations to prevent cross-wiring of antiskid brake system components.

8. Require the submission and consideration of system safety assessments addressing the landing gear antiskid system for the certification of future transport-category airplane designs. The certification should ensure that the system safety assessments are consistent with the intent of Acceptable Means of Compliance 25.1309, Systems Design and Analysis, and that the

assessments evaluate and mitigate the potential for human error that can lead to a cross-wiring error.

9. Require organizations that design, manufacture, and maintain aircraft to establish a safety management system.

To Saab:

10. Redesign the wheel speed transducer wire harnesses for the Saab 2000 airplane to prevent the harnesses from being installed incorrectly during maintenance and overhaul.