INCIDENT

Aircraft Type and Registration:	Saab-Scania SF340B, G-LGNI
No & Type of Engines:	2 General Electric CO CT7-9B turboprop engines
Year of Manufacture:	1989
Date & Time (UTC):	16 December 2010 at 1555 hrs
Location:	Kirkwall Airport, Orkney Islands
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 17
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	43 years
Commander's Flying Experience:	4,100 hours (of which 3,200 were on type) Last 90 days - 125 hours Last 28 days - 17 hours
Information Source:	AAIB Field Investigation

Synopsis

When landing in a strong crosswind on a slush covered runway the nosewheel steering system did not operate and, initially, the power levers could not be moved into the beta range. When the aircraft decelerated to taxi speed the nosewheel steering system operated normally. It is probable that delayed closure of the mainwheel weight-on-wheels switches caused both problems.

History of the flight

The aircraft departed Inverness Airport at 1510 hrs on a scheduled passenger flight to Lerwick Airport, where it landed at 1555 hrs. Weather conditions reported at the time were surface wind from 330° at 27 kt, visibility 7,000 m, light showers of hail, few cloud at 700 ft, broken cumulonimbus cloud at 1,000 ft, temperature -2°C, dewpoint -5°C and sea level pressure 1002 mb.

Runway 27 was reportedly covered with slush to depths between 3 mm and 5 mm. On landing, the aircraft commander, who was pilot flying, gave the co-pilot control of the control yoke, in accordance with normal procedures. He attempted to select the beta range (ground pitch control) of propeller operation by moving the power levers aft. Initially he was unable to do so and they remained in the flight idle position. At the same time he attempted to use the nosewheel steering but was unable to operate it, so used a combination of rudder and differential braking to steer the aircraft. Shortly after commencing

braking he was able to select the power levers into the beta range. When the aircraft had slowed to taxiing speed the commander again tried to use the nosewheel steering system and found that it responded normally. The aircraft taxied to a parking stand without further incident. A subsequent engineering investigation did not find any related technical defects.

Flight idle stop system

The purpose of the flight idle (FI) stop system is to prevent the pilot from selecting the beta range in flight. It consists of an automatically operated mechanical stop arm located within the control quadrant which physically blocks power lever movement below flight idle when the aircraft is in flight. The stop is opened by a solenoid, allowing unrestricted movement of the power levers, when the following conditions are met:

Left or right landing gear extended	AND	Left or right inboard or outboard wheel speed greater than 25 kt OR left or right weight on wheels detected

The manufacturer stated that the Saab 340 has "relatively stiff" main undercarriage oleos and that propeller wash at flight idle may result in sufficient wing lift that the weight of the aircraft is slow to settle fully onto its wheels after landing. Consequently, in normal operation it may be wheel speed rather than weight on wheels that causes the FI stop to open. Then, when the power levers are moved to the beta range the resulting reduction in propeller wash will allow the aircraft to settle fully onto the main oleos allowing the weight-on-wheels switches to close.

Nosewheel steering system

The nosewheel steering system has a single hydraulic actuator. An electrically operated shutoff valve prevents hydraulic pressure from reaching the steering control valve in flight. There is a deflection switch in the system that detects the castor angle of the nosewheel. This switch operates at a castor angle of 20° ± 5°. The shutoff valve is opened by applying electrical power through the following switches in series.

Nosewheel deflected by less than 20°±5°	Nosewheel deflected by more than 20°±5°
1. Nose landing gear downlock 2. Steering wheel microswitch 3. Nosewheel deflection switch 4. Ground handling lockout switch	1. Left or Right weight-on-wheels 2. Nosewheel deflection switch 3. Ground handling lockout switch

Analysis

Slush covering the runway at Lerwick may have delayed acceleration of the main landing gear (MLG) wheels to above 25 kt. This, together with any delay in closure of the weight-on-wheels switches, would have delayed opening of the FI stop and initially prevented the pilot from moving the power levers to the beta range.

During landing on a slush covered runway in a crosswind of the magnitude reported, it is likely that the nosewheel would castor before the nosewheel steering was engaged. If the castor angle exceeded 20° ± 5°, power for the nosewheel steering system would be routed through the MLG weight-on-wheels switches rather than the nose landing gear downlock. Nosewheel steering would not then be available until closure of a MLG weight-on-wheels switch or until the castor angle reduced below 20° ± 5°.

Safety action taken

The manufacturer has taken action to publish suitable warnings in the Aircraft Operations Manual to warn crews of the possibility that:

> *'1. When landing on a slippery surface there could be a transitory delay in opening of the flight idle stop.*
>
> *2. When landing on a slippery surface with a crosswind there could be a transitory delay in the nosewheel steering system becoming operational.'*

Conclusion

The investigation determined that castoring of the nosewheel when landing on a slippery surface in a crosswind could render the nosewheel steering system inoperative until closure of a weight-on-wheels switch. Delay in closure of weight-on-wheel switches, together with slow acceleration of the main wheels, would also delay opening of the FI stop. Together these conditions could result in the symptoms reported by the commander. Considering the safety action taken by the manufacturer, no Safety Recommendations were made.