Saab-Scania SF340A, G-GNTF

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Aircraft Type and Registration:	Saab-Scania SF340A, G-GNTF
No & Type of Engines:	2 General Electric CT7-5A2 turboprop engines
Year of Manufacture:	1988
Date & Time (UTC):	13 February 1999 at 1321 hrs
Location:	Runway 27 at East Midlands Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 3 - Passengers - 34
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Substantial to nose landing gear. Minor debris damage to No 2 propeller blade and lower forward fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	41 years
Commander's Flying Experience:	3,925 hours (of which 770 were on type)
	Last 90 days - 156 hours
	Last 28 days - 51 hours
Information Source:	AAIB Field Investigation

History of the flight

The crew arrived at East Midlands Airport at 0500 hrs, one hour before the scheduled report time of 0600 hrs. The commander, who was a newly appointed line training captain, wanted the extra hour to brief the first officer who was on his second day of line training. The crew were to operate four sectors that day. The first officer was to act as the pilot flying (PF) for the first sector to Edinburgh and pilot not flying (PNF) for the return flight to East Midlands. Similarly he was to act as PF for the third sector to Belfast and PNF for the return. The first 2 sectors were flown without incident.

On the third sector to Belfast the aircraft was given a late descent clearance resulting in a steeper than normal approach. The commander took control briefly during the approach but handed control back to the first officer for the landing. The first officer completed a normal approach but the aircraft floated resulting in a late touchdown. The commander had emphasised the need for

accurate speed control and the technique required to 'fly the aircraft onto the runway rather than flare'. He decided that the first officer should act as PF for the final sector so that he could improve his handling techniques especially on departure and final approach to landing. The weather conditions at East Midlands were fine. The ATIS information, valid at 1321 hrs, gave a surface wind of 190°/07 kt with a visibility of 9 km, scattered cloud at 1,800 feet, temperature +6°C, dewpoint +1°C, QNH of 1034 mb with the runway surface as damp.

The commander reported that during the final sector the first officer appeared to be satisfactorily 'ahead of the aircraft'. Having been vectored by radar onto the extended centreline the first officer carried out an auto-coupled ILS approach to Runway 27. During the approach the crew were asked to slow down because of a departing B737. This instruction was complied with and the aircraft was stable and correctly aligned when the first officer disconnected the autopilot at approximately 200 to 300 feet. The first officer reported that at approximately 100 to 150 feet the aircraft began to drift off the centreline and to 'balloon upwards'. After the aircraft crossed the threshold it floated above the runway for some considerable distance losing speed before the commander took control. Almost immediately the aircraft landed heavily on the main landing gear and pitched forward causing the nose wheel to impact with the runway.

The commander reported that after the impact there was a very noticeable vibration and, believing that the nose landing gear tyres had burst, he applied gentle braking, turned the aircraft off the runway onto taxiway 'D' and brought it to a stop. After consultation with the fire crew the commander decided that a passenger evacuation was not required and therefore the engines were shutdown to allow the passengers to disembark normally.

The commander stated that 'the situation had developed rapidly from a normal approach and that he failed to react early enough'. Furthermore he was aware that he was quite tired as he was on his third day of 'early starts' having been involved in teaching first officers on the first days of their line training'.

Engineering aspects

The rims on both the nose wheels had disintegrated in the impact and the wheels had been worn down to the hubs. Debris from the wheel rims had damaged one blade of the No 2 propeller and there was minor damage to the external tunnel carrying the hydraulic services on the lower forward fuselage. A heavy landing check, carried out by the maintenance organisation, did not find any further landing damage other than to the nose wheels, however, later detailed inspection of the main wheels showed cracking around the drive keys.

A fireman, situated in a disused fire observation post adjacent to the runway, saw the landing. He reported that the first touchdown of the aircraft's main wheels was just after Taxiway 'C' rapid exit turn-off, some 960 metres beyond the threshold. The position of some of the debris and marks left by the nose wheel rims and hubs on the runway were compared to this position. The first marks from the nose wheel rims were found some 50 to 100 metres beyond the reported position. The left nose wheel tyre was found intact, almost undamaged, just to the south of the runway. The right tyre, in two halves and more damaged, was found just to the north of the runway. The pattern of damage indicated that the two nose wheels had failed close to the first marks made by the nose wheel rims and that the initial failures had been of the rims. The rim failures had liberated the tyres from the landing gear and allowed the rims to wear down to the hubs during the subsequent 600 metres roll down the runway onto taxiway Delta.

Reconstruction of the tyres and rims confirmed that the failure of both nose wheels had been initiated by sudden overload of the wheel rims. There was no evidence of pre-existing damage to the wheels. Maintenance records showed that there had been no previous recorded incidents to the wheels since they had been installed on the aircraft on 16 January 1999.

Flight data records

The aircraft was fitted with a Fairchild A100A 30-minute duration Cockpit Voice Recorder (CVR) and a Sundstrand Universal Flight Data Recorder (UFDR) with a 25 hour recording duration. Both units were removed and successfully replayed at the AAIB. The CVR began during the approach into East Midlands and confirmed the crew's recollection of events.

The FDR showed that the aircraft initially descended from around 100ft at approximately 10 feet/s (600 feet/min) and at a speed of 125 KIAS. V_{ref} was 117 kt. At approximately 60 feet the elevator angle increased and the pitch attitude of the aircraft increased to 3°. The elevator angle then decreased and there were four subsequent pitch oscillations increasing in amplitude. The maximum pitch attitude reached was 6.7° at approximately 2 feet Radio height and at an airspeed of 110 KIAS. The rate of descent decreased and the aircraft floated along the runway. The elevator angle then decreased and the aircraft pitched down to 0°. The aircraft touched down 1 second later, with a peak normal acceleration of 2.47g. The pitch attitude was 1.8° and the airspeed was 107 KIAS. Pitch attitude then increased to 5.3° with no movement of elevator position. Two and a half seconds later there was another peak in normal acceleration of 1.52g at a pitch attitude of 2.11°. The aircraft decelerated rapidly, with a peak longitudinal deceleration of -0.49G, 4 seconds after the second touchdown.

Operations manual extracts

Section 9.4.0 of the operator's Operations Manual (OM) deals with the flare and touchdown phase of a normal landing. The relevant extract is reproduced below:

> 'Flare and Touchdown
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> Flare should be initiated when the main gear is a few feet above the runway and is accomplished by raising the nose 5° to 6° from approach attitude, (ie for all normal cases the flare touchdown attitude should be 4° to 5° nose-up). Power levers should be retarded to GROUND IDLE as soon as possible after - but not before - touchdown. Chopping the power levers prior to touchdown may result in a hard landing.
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> Do not cause the aircraft to float just above the runway by increasing the nose-up attitude during the flare as this increases the landing distance and may result in a tail strike. Fly onto the runway near the aiming point. A nose-up attitude in excess of 10° at or after touchdown will cause the tail to contact the ground.
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> If the aircraft should bounce, hold or re-establish a normal landing attitude and add power as necessary to control the rate of descent. Power need not be added for a shallow bounce or skip.

> If a high, hard bounce occurs, initiate a go-around. Apply GA power and use normal go-around procedures. A second touchdown may occur during the go-around. Do not retract the landing gear until a positive rate of climb is established.'

Flight and duty times

The OM includes a Flight and Duty Times Limitations Scheme. It states that the purpose of the scheme is to interpret the requirements of the relevant articles of the Air Navigation Order and Civil Aviation Publication (CAP) 371, 3rd Edition, as they apply to the regulation of flight times and the avoidance of fatigue in crew members.

The aim of the document is to express the intent behind the published relevant documents, thereby taking all reasonable precautions to ensure that crew members are adequately rested at the beginning of each flying duty period. To meet this aim, due note will be taken of the length of duty cycles, periods of time-off and cumulative duty hours.

The document includes a table detailing the maximum flight duty period (FDP) dependent on local time of the start of duty and the number of sectors to be flown. A flying duty period is described as any time during which a person operates in an aircraft as a member of its crew. It starts when the crew member is required by an operator to report for a flight and finishes at 'on-chock' or 'engines off' at the end of the final sector. For duties starting between 0600 hrs and 0759 hrs and involving four sectors, the maximum flight duty period allowed, without the use of the commander's discretion, is 10 hours and 45 minutes.

The document states that the standard reporting times prior to flight will be 60 minutes; occasionally this may be reduced to 45 minutes (Turboprop aircraft types only). Pre-flight duties are part of the FDP. Thirty minutes will be allowed for post-flight activities (this includes post-flight positioning, if any). The time spent between reporting for a flight and the completion of post-flight tasks determines the length of the subsequent rest period. A non-standard reporting time designed to take advantage of an increased FDP from a more favourable time band will not be used.

The crew was required to report for duty at 0600 hrs to operate the scheduled flight to Edinburgh departing at 0700 hrs. After a 30 minute turn-round they were to depart from Edinburgh at 0840 hrs to arrive back at East Midlands at 0950 hrs. After a further 40 minutes on the ground the aircraft was to depart for Belfast at 1030 hrs to arrive at 1140 hrs. Here the crew was scheduled for a 20 minute turn-round to depart at 1210 hrs to arrive a East Midlands at 1320 hrs. This schedule gave the crew a flight duty period of 7 hours.

The commander, who had just been appointed as a line training captain, commenced his line training duties two days before the accident. On Thursday 11 February 1999, after at least five days free from duty, he was rostered to fly with a new first officer, training him on his first four line training sectors. The rostered report time was 0540 hrs for a departure at 0640 hrs. Because it was the first officer's first day of line training, the commander decided to commence at 0440 hrs to give himself time to fully brief the first officer. After the flight the commander debriefed the first officer one hour beyond the end of the recorded duty period. The next day the commander was rostered to fly with the first officer involved in the accident on his first four line training sectors. Again the commander arrived for work at 0440 hrs, one hour before the required report time of 0540 hrs, so that he could conduct a comprehensive pre-flight briefing. On the day of the accident the

commander and first officer reported at 0500 hrs, which was once more one hour before the required report time.

Follow-up action

As a result of the accident the operator instituted a change in training procedures and revised the training requirements for the promotion of captains to 'Line Training Captain'.

The training procedure changes were as follows: A safety pilot was to occupy the jump seat during the initial phase of line training. The safety pilot, a qualified first officer or captain, would be a company requirement for the first 5 sectors of any new trainees line training. Once the trainee had completed five sectors the safety pilot would be 'stood down' at the training captain's discretion. The primary role of the safety pilot would be to prevent a breach of safety standards. At the discretion of the training captain, the safety pilot would carry out duties that would assist in the smooth and efficient co-ordination of 'the team'. He/she may be required to fly any sectors as applicable and assist in the paperwork, walk-rounds and turn-rounds etc.

Following discussion with the CAA the company decided that the selection and training requirements for a line training captain were to be increased. The following minimum experience is now required: 3,000 hours total flying experience; 1,000 hours on type; 500 hours in command on type; base check and line check to the required standard and a selection interview conducted by the chief training captain.

The training of line training captains was to include a Company Core Course; a one day ground school covering type training techniques, limits for training captain intervention, paperwork etc; a four hour simulator session; 10 training sectors under supervision of a TRE/IRE and a two sector line check, one as PF and one as PNF under the supervision of the chief training captain. Further training requirements would be required to upgrade to full training captain status.`