
Accident with aircraft SE-LIR at the Gällivare airport, BD County, Sweden, on 10 November 2000

Micro-summary: A high flare of this F-27 results in a hard landing.

Event Date: 2000-11-10 at 1622 UTC

Investigative Body: Swedish Accident Investigation Board (AIB), Sweden

Investigative Body's Web Site: <http://www.havkom.se/>

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Report RL 2001: 18e

***Accident with aircraft SE-LIR
at the Gällivare airport, BD County,
Sweden, on 10 November 2000***

Case L-113/00

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Translated by Bob Arnesen

From the original Swedish at the request of the Board of Accident Investigation.
In case of discrepancies between the English and the Swedish texts, the Swedish text is to be considered the authoritative version.

2000-06-29

L-113/00

Swedish Civil Aviation Administration

601 79 NORRKÖPING

Report RL 2000: 18e

The Board of Accident Investigation (Statens haverikommission, SHK) has investigated an aircraft accident that occurred on November 10, 2000 at the Gällivare airport, BD County, Sweden, involving an aircraft with registration SE-LIR.

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717) the Board herewith submits a final report on the investigation.

S-E Sigfridsson

Monica J Wismar

Henrik Elinder

Contents

SUMMARY	4
1 FACTUAL INFORMATION	6
1.1 History of the flight	6
1.2 Injuries to persons	7
1.3 Damage to aircraft	7
1.4 Other damage	7
1.5 Personnel information	7
1.5.1 <i>The Commander</i>	7
1.5.2 <i>The Co-Pilot</i>	7
1.5.3 <i>Other crew members</i>	8
1.5.4 <i>The pilot's duty periods</i>	8
1.6 Aircraft information	8
1.7 Meteorological information	9
1.8 Aids to navigation	9
1.9 Communications	9
1.10 Aerodrome information	9
1.11 Flight recorders	9
1.11.1 <i>Flight Data Recorder (FDR)</i>	9
1.11.2 <i>Cockpit Voice Recorder (CVR)</i>	10
1.12 Accident site and aircraft wreckage	10
1.12.1 <i>Accident site</i>	10
1.12.2 <i>Aircraft wreckage</i>	10
1.13 Medical information	10
1.14 Fire	11
1.15 Survival aspects	11
1.16 Tests and research	11
1.17 Organisational and management information	11
1.17.1 <i>General</i>	11
1.17.2 <i>Pre Flight Inspection (PFI)</i>	11
1.17.3 <i>Unscheduled maintenance checks</i>	11
1.18 Additional information	12
1.18.1 <i>Flight Safety report (FSR)</i>	12
2 ANALYSIS	12
2.1 The Flight	12
2.2 The Technical Standard	13
2.2.1 <i>Reporting of damage to the aircraft</i>	13
2.2.2 <i>Aircraft inspection before flight</i>	13
3 CONCLUSIONS	13
3.1 Findings	13
3.2 Causes	14
4 RECOMMENDATIONS	14

APPENDIX

- 1 Extracts from Register of Licences regarding the pilots
(to the Swedish Civil Aviation Administration only)

Report RL 2000:18e

L-113/00

Report finalised 2001-06-29

<i>Aircraft: registration, type</i>	SE-LIR , F27 MK 050
<i>Class/airworthiness</i>	Normal, airworthy
<i>Owner/Operator</i>	Aircraft Financing and Trading B.V/ Skyways Express AB, P.O. Box 1537, 581 15 Linköping, Sweden
<i>Date and time</i>	2000-11-10, at 17.22 hours in darkness <i>Note:</i> All times in the report in Swedish Standard Time = UTC + 1 hour
<i>Place of occurrence</i>	Gällivare airport, BD county, Sweden (pos 6707N 2048E, 312 m above sea level)
<i>Type of flight</i>	Scheduled flight
<i>Weather</i>	According to SMHI's (Swedish Meteoro- logical and Hydrological Institute) analysis: wind 140°/2 knots, visibility 1,800 m in mist, clouds 3–4/8 at 300 ft and 5–7/8 at 400 ft, temp/dew point +01/+01 °C, QNH 1010 hPa.
<i>Persons on board:</i> crew	2/1
passengers	49
<i>Injuries to persons</i>	None
<i>Damage to aircraft</i>	Substantially damaged
<i>Other damage</i>	None
<i>Commander:</i>	
age, certificate	56 years, ATPL (Airline Transport Pilot's Licence)
total flying time	Approx. 14,700 hours, of which 3,000 hours on type
flying hours previous 90 days	167, all on type
number of landings previous 90 days	88
<i>Co-pilot:</i>	
age, certificate	48 years, CPL (Commercial Pilot's Licence)
total flying time	4,070 hours, of which 810 hours on type
flying hours previous 90 days	142, all on type
number of landings previous 90 days	136
<i>Cabin Attendant:</i>	Employed since 1996

The Board of Accident Investigation (SHK) was notified on November 15, 2000, that an aircraft with registration SE-LIR had an accident at 17.22 hrs on November 10, 2000 at the Gällivare airport, BD County, Sweden.

The accident has been investigated by SHK represented by Sven-Erik Sigfridsson, Chairman, Monica J Wismar, Chief investigator flight operations, and Henrik Elinder, Chief technical investigator aviation.

The investigation was followed by Max Danielsson from the Swedish Civil Aviation Administration.

Summary

The aircraft was operated by Skyways Express AB on its scheduled flight, JZ 206, between the Stockholm/Arlanda and Gällivare airports on the 10th of November 2000. The co-pilot was the flying pilot for the flight and was sitting in the left seat as he was undergoing route training in connection with his upgrade to commander. The commander, who also was the route-training instructor, sat in the right seat for the flight.

The flight to Gällivare was normal. The normal flap setting for landing is 25 degrees. However the pilots had agreed to perform the landing using a 35 degree flap setting for training purposes. When the aircraft was 40 feet (approx 12 m) above the runway the co-pilot commenced the round out prior to landing. The commander felt that the aircraft rounded out to high and was losing speed far too fast whereby he grasped the control column, pushed it forward and then released it. The aircraft levelled off for a short time and then sank rapidly from about 10 ft (3 m) above the runway, making firm contact with the runway. The co-pilot held on to the control column during the landing although he had interpreted the commander's intervention as his taking control, despite his not reporting "My controls".

Neither the commander nor the co-pilot felt it necessary afterwards to report the landing as being hard. No note was made in the aircraft log and no special inspection of the aircraft was asked for or done. The commander wrote in the co-pilots training syllabus that he should be more aware of rounding out too early during the landing.

About a day later after the aircraft had flown six more flights, substantial structural damage was found to the aft section of the aircraft.

The investigation has shown that the landing was made in a somewhat uncontrolled fashion and that contact with the runway was made with an unusually nose high attitude. Communication between the pilots during the landing sequence has also not followed standard procedure.

The fact that the damage was in a vulnerable area and also was so visible indicates that there are shortcomings in the pre-flight inspection process.

The accident was caused by a breakdown in communication between the pilots in connection with the landing. Additional factors that led to the outcome of the accident were the fact that the landing was carried out in darkness, that the co-pilot was not familiar with flying from the left seat and that the landing was made with a 35 degree flap setting.

Recommendations

None.

1 FACTUAL INFORMATION

1.1 History of the flight

Skyways Express AB: s regular scheduled flight JZ206 departed the Stockholm/Arlanda airport on November 10, 2000 bound for Gällivare. The co-pilot was the flying pilot for the leg and he occupied the left seat as part of his route training in connection with his upgrade to commander. The commander, who was also the route-training instructor, occupied the right seat.

The flight to Gällivare was normal and an autopilot coupled ILS¹ approach to runway 30 was performed. The landing is normally made with a 25 degree flap setting but the pilots had agreed that a landing flap setting of 35 degrees would be used for training purposes. When the aircraft was established on final approach and visual contact was made with the runway, the co-pilot disconnected the autopilot and flew the remainder of the approach and landing manually. Both pilots have stated that they crossed the threshold with the correct speed, 97.5 knots, as determined earlier for the landing weight.

The co-pilot started the landing round out at an altitude of about 40 ft (approx. 12 m) above the runway. The commander felt that the aircraft had rounded out too high and that the speed was rapidly decreasing, causing him first to push the control column forward and then release it. The aircraft levelled off shortly at about 10 ft (3 m) and then sank rapidly with a firm setting on the runway. The sequence of events happened quite quickly. The commander felt that contact with the runway was made on all three landing gears at the same time and that the co-pilot raised the nose sharply after touchdown.

The co-pilot had his hands on the control column during the entire landing sequence but felt that the commander had taken control without reporting "My controls". He felt that touchdown had occurred on the main landing gear with a nose high attitude.

After taxiing in to the terminal building and disembarking the passengers they met the crew that was scheduled to fly the aircraft back to Stockholm. The cabin attendant remarked to the pilots that she felt that the landing was hard but as the flight had originally been delayed, she became busy preparing the cabin for departure together with the other C/A to make up time during the turn around. Both pilots then left the aircraft with no further discussion about the landing.

Neither the commander nor the co-pilot felt that the landing could be classed as hard and saw no need to report it as such. No note was made in the aircraft log and no further special inspection was considered to be necessary. The commander noted in the co-pilots training syllabus that he should be more aware of starting the round out too early.

About one day after the event, when the aircraft had flown a further six legs, substantial damage to the aft section of the aircraft was discovered.

The accident occurred at 1722 hours at position 6707N 2048E, 312 m above sea level.

¹ ILS – Instrument Landing System

1.2 Injuries to persons

	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>	<i>Total</i>
Fatal	—	—	—	—
Serious	—	—	—	—
Minor	—	—	—	—
None	3	49	—	52
Total	3	49	—	52

1.3 Damage to aircraft

Substantially damaged.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 *The commander*

The commander was 56 years old at the time and had a valid ATPL Licence.

Flying hours

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	4	167	14,700
This type	4	167	3,000

Number of landings this type previous 90 days: 88.

Flight training on type concluded in June 1997.

Latest proficiency check (PC) carried out in 2000-08-08 on a F27 MK050 simulator.

Medical Certificate Class 1 valid until 2001-03-30.

1.5.2 *Co-pilot*

The co-pilot was 48 years old at the time and had a valid CPL Licence.

Flying hours

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	2	142	4,070
This type	2	142	810

Number of landings this type previous 90 days: 136.

Flight training on type concluded in May 1999.

Latest PC carried out in 2000-05-23 on a F27 MK050 simulator.

Medical Certificate Class 1 valid until 2001-04-01.

The co-pilot had since beginning on type landed with a 35 degree flap setting only three times. This flap setting is used for landing on short runways and is not normally trained in the simulator.

Other than in the simulator the co-pilot had flown the aircraft type from the left seat only on one previous occasion during a school flight.

1.5.3 Other crew members

A cabin attendant was part of the crew. She had been employed with the company since 1996 and had completed her last emergency training on June 13, 2000.

1.5.4 The pilot's duty periods

During the week before the accident the pilots had the following duty periods:

	<i>Commander</i>	<i>Number flights</i>	<i>Co-pilot</i>	<i>Number flights</i>
2000-11-03	05.25–11.25	2	08.00–15.00	school flight
2000-11-04	Off		Off	
2000-11-05	Off		Off	
2000-11-06	05.40–11.25	1 active + 1 passive	00.30–07.30	school flight
2000-11-07	05.25–11.25	2	08.35–20.30	school flight
2000-11-08	Standby		Off	
2000-11-09	11.30–16.00	meeting	Off	
2000-11-10	11.10–16.40	2	10.15–16.25	1

1.6 Aircraft information

AIRCRAFT:

Manufacturer: Fokker
Type: F27 MK050
Serial number: 20151
Year of manufacture: 1989
Gross weight: Max authorised 19,730 kg, actual 19,020 kg
Centre of gravity: 36.1 % MAC, within allowable limits
Total flying time: 17,047 hrs
Number of cycles:
Flying time since latest inspection: T8 check 70 hours, C2 check 2,422 hours
Fuel loaded before event: Jet A1 1,540 litres

ENGINE:

Manufacturer: Pratt & Whitney
Model: 125 B
Number of engines: 2
Engine

Nr. 1	Nr.2
<i>Time since last overhaul:</i> 2,610	2,656
<i>Cycles since last overhaul:</i> 2,799	2,864

PROPELLER/ROTOR:

Manufacture: Dowty
Operating time since latest overhaul
Propeller 1: 2,422 hrs
Propeller 2: 2,419 hrs

The aircraft had a valid Certificate of Airworthiness.

1.7 Meteorological information

According to SMHI's analysis:: wind 140 degrees at 2 knots, visibility 1,800 meters in mist, clouds 3–4/8 based at 300 feet and 5–7/8 based at 400 feet, temperature +01°C, dew point +01°C, QNH 1010 hPa.

Sunset was at 1420 hours in Gällivare on November 10, 2000.

1.8 Aids to navigation

Runway 30 at the Gällivare airport (ESNG) is equipped with ILS. The aircraft was properly equipped for instrument flight. The approach was made in instrument meteorological conditions (IMC) and in darkness.

1.9 Communications

Normal communications were observed between the crew and the radio operator manning the Airport Flight Information Service (AFIS).

1.10 Aerodrome information

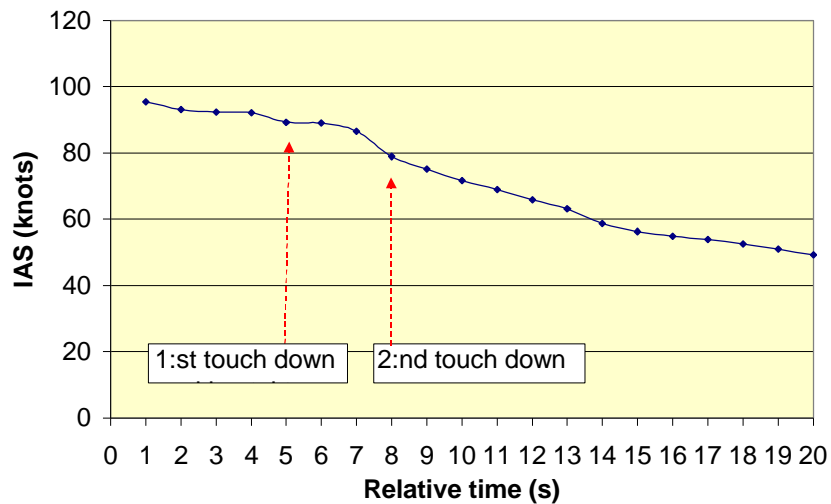
All the requirements outlined in the Air Information Publication (AIP) for Sweden concerning airport status were met. The area around the airport is made up of a mixture of swamp and forest with no fixed lighted references.

1.11 Flight recorders

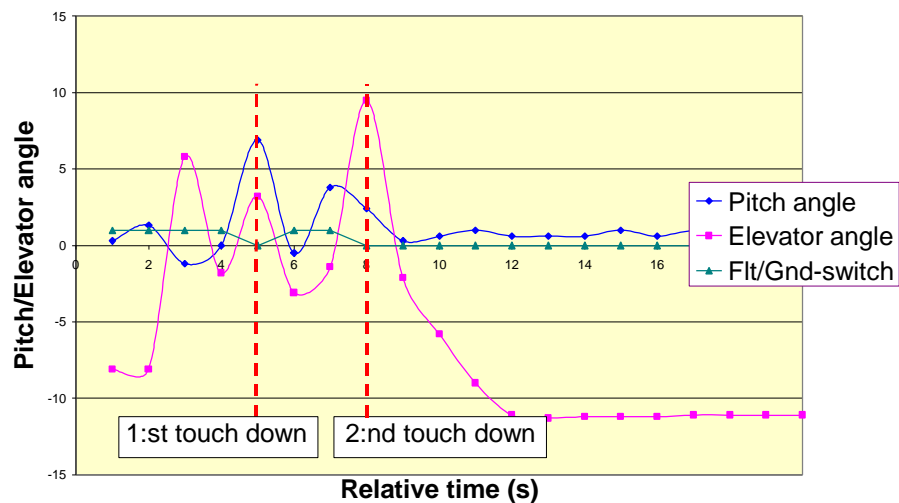
1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with Honeywell 980-4100DXUS flight data recorder and data from the landing phase have been analysed. For some unknown reason it was only possible to read the data recorded from four seconds prior to the first touchdown.

In the diagram below the relationship between indicated air speed (IAS) during the landing and the time in seconds from the first recorded data can be seen.



In the following diagram the aircraft pitch angle, the aircraft elevator angle and the ground contact as recorded through the flight/ground switch are compared in relation to time from the first recorded data.



The largest vertical acceleration occurred during the first touchdown and was measured by the aircraft accelerometers as follows:
1.692/2.855/1.792/1.103/0.838/0.769/0.719 g

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with an L-3 Communication 93A100-80 cockpit voice recorder. Recordings from the accident were not available, as new recordings on subsequent flights had erased them.

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

Touchdown was made about 300 m from the threshold of runway 30.

1.12.2 *Aircraft wreckage*

About one day after the event aircraft damage due to the tailbumper being pushed in was noticed and the underside of the aircraft in the aft section between station 17020 and station 20060 had also received substantial structural damage that was easily seen. Five different crews subsequent to the accident had flown the aircraft and performed six flights after the event. The aircraft was taken out of service and a ferry flight was performed to the manufacturer in Holland where repairs were made.

1.13 **Medical information**

Nothing indicates that the mental and physical condition of the crew had been impaired before the flight.

1.14 **Fire**

There was no fire.

1.15 **Survival aspects**

All passengers and crew had their seat belts fastened. The g-forces during the landing were such that no personal injuries were experienced.

1.16 **Tests and research**

Other than the structural damage that occurred during the accident no other faults were found with the aircraft.

1.17 **Organisational and management information**

1.17.1 *General*

Skyways Express is a regional carrier based in Linköping, Sweden. The company has an AOC² in accordance with JAR-OPS³. The company is owned by Skyways Holding AB, who have a total of about 1,000 employees and fly both scheduled and unscheduled commercial traffic with a fleet of 46 aircraft, including the Embraer EMB-145, the Fokker F27 MK050 and the SAAB SF340.

1.17.2 *Pre Flight Inspection (PFI)*

The airline has received approval from the Swedish Civil Aviation Authority (CAA) to operate its aircraft for a period of up to maximum three days between periodic maintenance by an authorized aircraft mechanic. A requirement for this approval is that one of the pilots must perform a so-called Pre Flight Inspection (PFI) prior to every flight to check that no external damage has occurred and that the aircraft is airworthy. Every PFI

² AOC – Air Operator Certificate

³ JAR-OPS – Joint Aviation Requirements - Operations

must be documented in the aircraft log. All six PFI's performed after the accident had been signed for in the aircraft log.

1.17.3 *Unscheduled Maintenance Checks*

If the aircraft has during flight been subject to anything non-normal the pilots shall in accordance with procedures outlined in the company Flight Operations Manuel (FOM) note such occurrences in the aircraft log as information to the technical staff. It is then the responsibility of a qualified mechanic to perform the necessary checks to determine the serviceability and airworthiness of the aircraft prior to the next flight. Examples of non-normal events are:

- flight in heavy turbulence
- lightning strike
- hard landing
- bird strike
- tire burst or taxiing on a deflated tire

1.18 **Additional information**

1.18.1 *Flight Safety Report (FSR)*

In an internal company FSR the actual aircraft was reported as being involved in an incident later the same day, having experienced a loss of cabin pressure. The flight was discontinued and the aircraft returned to the departure airport.

2 **ANALYSIS**

2.1 **The Flight**

Both pilots were well versed in the operation of the aircraft. The co-pilot was, however, inexperienced in flying from the left seat. The reported weather at the airport was less than favourable with a low cloud base and limited visibility in mist. The landing was also performed in darkness at an airport that had very few fixed lighted references in the surrounding area.

The normal flap setting for landing is 25 degrees. A 35 degree flap setting is used only in special circumstances and affects the flight characteristics of the aircraft. The greater flap angle gives amongst other things a higher sink rate and a different approach angle and view over the aircraft nose. Even if the co-pilot had at some time earlier performed such an approach it is questionable, considering the existing landing conditions and his inexperience landing from the left seat, whether it was suitable to allow the co-pilot to perform such an approach during his first flight as a commander candidate.

Based on the existing conditions it was quite possible for the co-pilot to begin the landing round out too early. SHK refrains from making any judgements as to whether it was necessary for the commander to try and "help out" by pushing the stick forward or whether the co-pilot himself would have made the proper correction and performed a normal touch-down. It was unfortunate that the co-pilot was led to believe that the commander had taken control of the aircraft, which was not the case. The commander should have briefed the co-pilot prior to landing that he was

going to “follow up” on the controls during the landing. Should it have been necessary for him to take control of the aircraft from the co-pilot then it would have been preceded by the order “My controls”. It is unclear which of the pilots was in control of the aircraft at the point of touchdown.

As indicated in the diagram in section 1.11.1 the landing was somewhat uncontrolled. The first touchdown was made with an unusually nose high attitude. The aircraft then bounced and was airborne for about three seconds before touching down for a second time and then remained on the ground. It is reasonable to assume that it was in connection with the first touchdown that the aft section of the aircraft struck the ground and sustained structural damage.

As it is unclear who was flying the aircraft at the point of touchdown and that the sequence of events happened so quickly, it can be understood why the pilots expressed different views about how they experienced the touchdown. The events indicate that there was a breakdown in communication between the commander and the co-pilot during the landing.

2.2 The Technical Standard

2.2.1 *Reporting of damage to the aircraft*

According to the FDR recording the vertical acceleration at the point of first contact with the ground was measured to be between 0.719g and 2.855g, depending on where in the aircraft it was measured. The actual touchdown happens quite quickly and it can be difficult for pilots to determine just how hard the landing is. There is no way for pilots to objectively determine this. How one experiences the actual touchdown depends on for example the vertical sink rate prior to the landing, where one is sitting in the aircraft and the way the aircraft actually touches down. If the landing is made on the main landing gear first, those sitting ahead of the main gear will experience the landing as less hard than those sitting aft of the main gear. Neither pilot noticed that the tail of the aircraft struck the runway. The cabin attendant, who was positioned in the aft section, told the pilots that she thought the landing was hard. This should have led the pilots to try to obtain more information from her to correctly determine if a note should be made in the aircraft log in accordance with company procedure outlined in the FOM. Additional information may have also led the pilots to more closely examine the aircraft exterior prior to leaving it for the next crew.

2.2.2 *Aircraft inspection before flight*

Inspection of the aircraft by the pilot prior to flight is a CAA requirement, which allows the company to operate its aircraft for up to three days between scheduled maintenance checks by a qualified aircraft mechanic. It is therefore necessary for the pilot to be trained in the correct procedures and instructions to be followed and that the proper equipment is made available to him, if the inspection is to be carried out properly. SHK considers it highly irregular for the aircraft to fly six additional flights after the accident and to be inspected by five different crews before the damage was actually discovered. The fact that damage was to such a vulnerable area of the aircraft and that it was both easily seen and recognized, suggests that the company's routines for completing a PFI need to be closely re-examined. It is hard for SHK to establish whether this is due to the company failing to provide the necessary conditions for the pilots to perform the PFI as mentioned above or due to complacency on the part of the pilots.

As the cabin pressure problem experienced later on the aircraft was most probably due to the earlier structural damage, one can only speculate as to how long the damage would have gone undetected had this fault not arisen to indicate that something was not right with the aircraft.

3 CONCLUSIONS

3.1 Findings

- a) The pilots were qualified to perform the flight.
- b) The aircraft had a valid Certificate of Airworthiness.
- c) The touchdown on the runway was somewhat uncontrolled.
- d) The first touchdown was with an unusually nose high attitude.
- e) There was a breakdown in the communication between the pilots.
- f) There have been faults in the way PFI's are carried out prior to flight.

3.2 Causes

The accident was caused by a breakdown in communication between the pilots in connection with the landing. Factors that also contributed to the accident were that the landing was carried out in darkness, that the co-pilot was inexperienced in landing from the left seat and that the landing was made with a 35 degree flap setting.

4 RECOMMENDATIONS

None.