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## **Report RL 2000:36e**

***Accident with aircraft SE-INI  
At the Gällivare Airport,  
BD County, Sweden  
On 22 November 1999***

**Case L-104/99**

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2000-10-16

L-104/99

Swedish Civil Aviation Administration

601 79 NORRKÖPING

**Report RL 2000: 36e**

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The Board of Accident Investigation (Statens haverikommission, SHK) has investigated an aircraft accident that occurred on the 22 November 1999 at the Gällivare airport, BD County, Sweden, involving an aircraft with registration SE-INI.

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

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| <b>APPENDIX/APPENDICES</b>               |                                                                                                               |
| 1                                        | Extracts from Register of Licences regarding the pilot<br>(to the Swedish Civil Aviation Administration only) |
| 2                                        | Transcript of radio communication (Not in the Internet version)                                               |

## Report RL 2000:36e

### L-104/99

Report finalised 2000-10-16

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|                                            |                                                                                                                                                                       |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Aircraft: registration, type</i>        | <b>SE-INI</b> , Beech 200                                                                                                                                             |
| <i>Class/airworthiness</i>                 | Normal, airworthy                                                                                                                                                     |
| <i>Owner/Operator</i>                      | SOS Flygambulans AB, Säve Airport Rd.<br>423 73 Säve                                                                                                                  |
| <i>Date and time</i>                       | 22-11-1999 at 1553 hrs in darkness<br><i>Note: All times in the report are given in Swedish normal time (SNT) = UTC + 1 hour</i>                                      |
| <i>Place of occurrence</i>                 | Gällivare airport, BD County,<br>(Pos 6707N 2048E, 312 m above sea level)                                                                                             |
| <i>Type of flight</i>                      | Non scheduled flight/Air ambulance                                                                                                                                    |
| <i>Weather</i>                             | As reported at 1550 hrs. : Wind 150°/12 knots gusting to 23 knots, visibility 9 km in snow, cloud 5-6/8 stratus at 600 ft., temp -2 °C/dew point -3 °C, QNH 1008 hPa. |
| <i>Persons on board: crew</i>              | 2/1                                                                                                                                                                   |
| <i>passengers</i>                          | 1                                                                                                                                                                     |
| <i>Injuries to persons</i>                 | One person reported back pains.                                                                                                                                       |
| <i>Damage to aircraft</i>                  | Substantially damaged                                                                                                                                                 |
| <i>Other damage</i>                        | None                                                                                                                                                                  |
| <i>Commander:</i>                          |                                                                                                                                                                       |
| <i>age, certificate</i>                    | 59 years, ATPL                                                                                                                                                        |
| <i>total flying time</i>                   | 21,466 hrs, of which 2,600 hrs on type                                                                                                                                |
| <i>flying hours previous 90 days</i>       | 164 hrs, all on type                                                                                                                                                  |
| <i>number of landings previous 90 days</i> | 164                                                                                                                                                                   |
| <i>Co-pilot :</i>                          |                                                                                                                                                                       |
| <i>age, certificate</i>                    | 38 years, CPL                                                                                                                                                         |
| <i>total flying time</i>                   | 588 hrs, of which 210 hrs on type                                                                                                                                     |
| <i>flying hours previous 90 days</i>       | 78 hrs, of which 75 hrs on type                                                                                                                                       |
| <i>number of landings previous 90 days</i> | 69, of which 65 on type                                                                                                                                               |
| <i>Nurse :</i>                             | employed since 1981                                                                                                                                                   |

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The Board of Accident Investigation (SHK) was notified on 24 November 1999 that an aircraft with registration SE-INI had been involved in an accident at 1553 hrs on the 22 November 1999 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, Swedish Civil Aviation Administration (Luftfartsverket or LFV).

### Summary

The flight departed the Luleå/Kallax airport at 1510 hrs.

As the flight approached the Gällivare airport the crew contacted the tower and were advised that runway 12 was in use.

After passing the outer marker outbound in a full procedure approach to runway 12 they descended to 3300 feet. Having completed the inbound turn towards the airport the aircraft became established on the approach centre line far too late, causing the crew to commence a missed approach and to set up for a new procedure.

The second approach was then established on the approach centre line. The crew extended the landing gear and selected the flaps to the first detent before descending towards the minimum descent altitude for the approach. The commander reported to the tower that they were on final and was advised that the high intensity runway lights were at 100%, that the wind was blowing from 150 degrees at 13 knots, gusting to 21 knots and that the runway was free.

As the aircraft was descending through 2400 feet it started to drift off the approach centre line to the right, which the co-pilot corrected for. The commander then made visual contact with the runway. As the co-pilot turned back towards the centre line and made contact with the runway lights he noticed that the aircraft was approaching a little too low and corrected by raising the nose, causing the speed to decrease.

Shortly before passing the runway threshold the commander noticed that landing flap had not been selected whereby he extended the flaps to the correct position. The co-pilot attempted to correct for the trim change caused by extending the landing flaps by abruptly lowering the aircraft nose from a few meters height. The commander attempted to counteract the increased sink rate by increasing thrust on the engines. The aircraft made a hard landing.

Before turning off the engines the aircraft de-icing boots were used to remove a 6-7 mm. thick layer of ice from the wing leading edge.

During a later inspection of the aircraft structural damage was discovered.

The accident was caused by improper speed control during the landing, which was carried out in difficult weather conditions. The commander's lack of supervision during the approach and landing combined with the co-pilot's inexperience with night flying were also contributing factors.

## **Recommendations**

None.

## 1 FACTUAL INFORMATION

### 1.1 History of the flight

The aircraft departed the Luleå/Kallax airport at 1510 hrs to complete an air ambulance flight to the Gällivare airport with a patient onboard. The co-pilot was the flying pilot for the leg.

After about 20 minutes flight time as the aircraft was approaching Gällivare the crew contacted the AFIS<sup>1</sup> operator in the tower, who suggested runway 12 for landing. The weather was reported as follows: surface wind 150 degrees at 13 knots with gusts to 20 knots, visibility 9 km in moderate snowfall, clouds 3-4/8 at 500 ft. and 5-6/8 at 900 ft., the temperature and dewpoint both  $-1$  °C and the QNH 1008 hPa. The braking action was reported as being .50/.52/.51 on a sanded runway covered by a couple of millimetres of new snow.

As the aircraft passed the TG outer marker to commence a full procedure NDB<sup>2</sup> approach to runway 12 it descended to 3300 ft. (see section 1.8). After turning inbound towards the airport the aircraft became established on the approach centre line so late that the crew decided to break off and attempt a new approach.

During the second approach the aircraft was established on the approach centre line at about 6 nm<sup>3</sup> from the runway. The crew extended the landing gear and selected the landing flaps to the first detent before descending to the minimum descent altitude of 1620 ft. The commander reported to the AFIS operator that they were on final and was told that the high intensity runway lights were on 100%, the wind was blowing from 150 degrees at 13 knots, gusting to 21 knots, and that the runway was free.

As the aircraft was descending through 2400 ft. it started to drift off centre line to the right. The co-pilot corrected this by turning left, decreasing the crab angle into the crosswind from the right. The commander made visual contact with the runway slightly to the left of the flight path at about 2200ft. When the co-pilot had turned back onto the approach centre line and made contact with the runway PAPI<sup>4</sup> lights he noticed that the aircraft was too low and raised the nose, causing the speed to decrease.

Shortly before passing the runway threshold the commander noticed that the correct landing flap had not been selected whereby he selected the flaps to full. The indicated speed was 105 knots and the height above threshold was normal. The aircraft then sank abruptly as the co-pilot lowered the nose in an attempt to correct for the trim changes caused by the flaps being extended. The commander attempted to counteract the increased sink rate by increasing the thrust on the engines. The aircraft however made a hard landing.

The commander took over control after landing and taxied to the terminal. Before the engines were shut down the aircraft de-ice boots were used to remove a 6-7 mm thick layer of ice on the wing leading edge.

A later inspection of the aircraft revealed structural damage. The accident occurred at position 6707N 2048E, 312 m above sea level.

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<sup>1</sup> AFIS – Aerodrome Flight Information Service

<sup>2</sup> NDB – Non-directional radio beacon

<sup>3</sup> nm – nautical mile (1852 meters)

<sup>4</sup> PAPI – Precision approach path indicator

## 1.2 Injuries to persons

|         | <i>Crew</i> | <i>Passengers</i> | <i>Others</i> | <i>Total</i> |
|---------|-------------|-------------------|---------------|--------------|
| Fatal   | –           | –                 | –             | –            |
| Serious | –           | –                 | –             | –            |
| Minor   | 1           | –                 | –             | 1            |
| None    | 2           | 1                 | –             | 3            |
| Total   | 3           | 1                 | –             | 4            |

## 1.3 Damage to aircraft

Substantially damaged.

## 1.4 Other damage

None.

## 1.5 Personnel information

### 1.5.1 Commander

The commander was 59 years old at the time and had a valid ATPL.

#### *Flying hours*

|           | <i>previous</i> | <i>24 hours</i> | <i>90 days</i> | <i>Total</i> |
|-----------|-----------------|-----------------|----------------|--------------|
| All types |                 | 6.3             | 164            | 21,466       |
| This type |                 | 6.3             | 164            | approx 2,600 |

Number of landings this type previous 90 days: 164.

Flight training on type concluded in 1986.

Latest periodic flight training (PFT) carried out in September 1999 on a Beech 200.

### 1.5.2 Co-pilot

The co-pilot was 38 years old at the time and had a valid CPL.

#### *Flying hours*

|              | <i>previous</i> | <i>24 hours</i> | <i>90 days</i> | <i>Total</i> |
|--------------|-----------------|-----------------|----------------|--------------|
| All types    |                 | 6.3             | 78             | 588          |
| This type    |                 | 6.3             | 75             | 210          |
| Night flying |                 |                 | 18             | 40           |

Number of landings this type previous 90 days: 65.

Flight training on type concluded in June 1999.

Latest periodic flight training (PFT) carried out during the type conversion course.

### 1.5.3 Cabin crew

A nurse, employed with the company since 1981, was part of the crew.

#### 1.5.4 The pilot's previous duty periods

During the week prior to the accident the pilots had the following duty:

| <i>Commander</i> |                | <i>Co-pilot</i> | <i>Number Flights</i> |
|------------------|----------------|-----------------|-----------------------|
| 16 Nov 99        | Off-duty       | Off-duty        |                       |
| 17 Nov 99        | Off-duty       | Off-duty        |                       |
| 18 Nov 99        | Off-duty       | Off-duty        |                       |
| 19 Nov 99        | Duty 0800-1815 | Duty 0900-1815  | 4                     |
| 20 Nov 99        | Standby        | Standby         |                       |
| 21 Nov 99        | Duty 1100-2225 | Duty 1100-2225  | 4                     |
| 22 Nov 99        | Duty 0800-1700 | Duty 0800-1700  | 4                     |

### 1.6 Aircraft information

#### AIRCRAFT:

|                                             |                                          |
|---------------------------------------------|------------------------------------------|
| <i>Manufacturer:</i>                        | Beech Aircraft Corp.                     |
| <i>Type:</i>                                | B200                                     |
| <i>Serial number:</i>                       | BB687                                    |
| <i>Year of manufacture:</i>                 | 1980                                     |
| <i>Gross weight:</i>                        | Max authorised 5,670 kg, actual 5,293 kg |
| <i>Centre of gravity:</i>                   | Within limits                            |
| <i>Total flying time:</i>                   | 11,529 hrs                               |
| <i>Number of cycles:</i>                    |                                          |
| <i>Flying time since latest inspection:</i> | 12 hrs                                   |
| <i>Fuel loaded before event:</i>            | JET A1                                   |

#### ENGINE:

|                           |                 |
|---------------------------|-----------------|
| <i>Manufacture:</i>       | Pratt & Whitney |
| <i>Model:</i>             | PT6A-41         |
| <i>Number of engines:</i> | 2               |

| <i>Engine</i>                         | <i>No 1</i> | <i>No 2</i> |
|---------------------------------------|-------------|-------------|
| <i>Total operating time, hrs:</i>     | 10,292      | 11,095      |
| <i>Operating time since overhaul:</i> | 220         | 3,634       |

#### PROPELLER:

|                                             |                      |
|---------------------------------------------|----------------------|
| <i>Manufacture:</i>                         | Hartzell HC-133TN-3N |
| <i>Operating time since latest overhaul</i> |                      |
| <i>Propeller 1:</i>                         | 1,432 hrs            |
| <i>Propeller 2:</i>                         | 1,432 hrs            |

The aircraft had a valid Certificate of Airworthiness.

### 1.7 Meteorological information

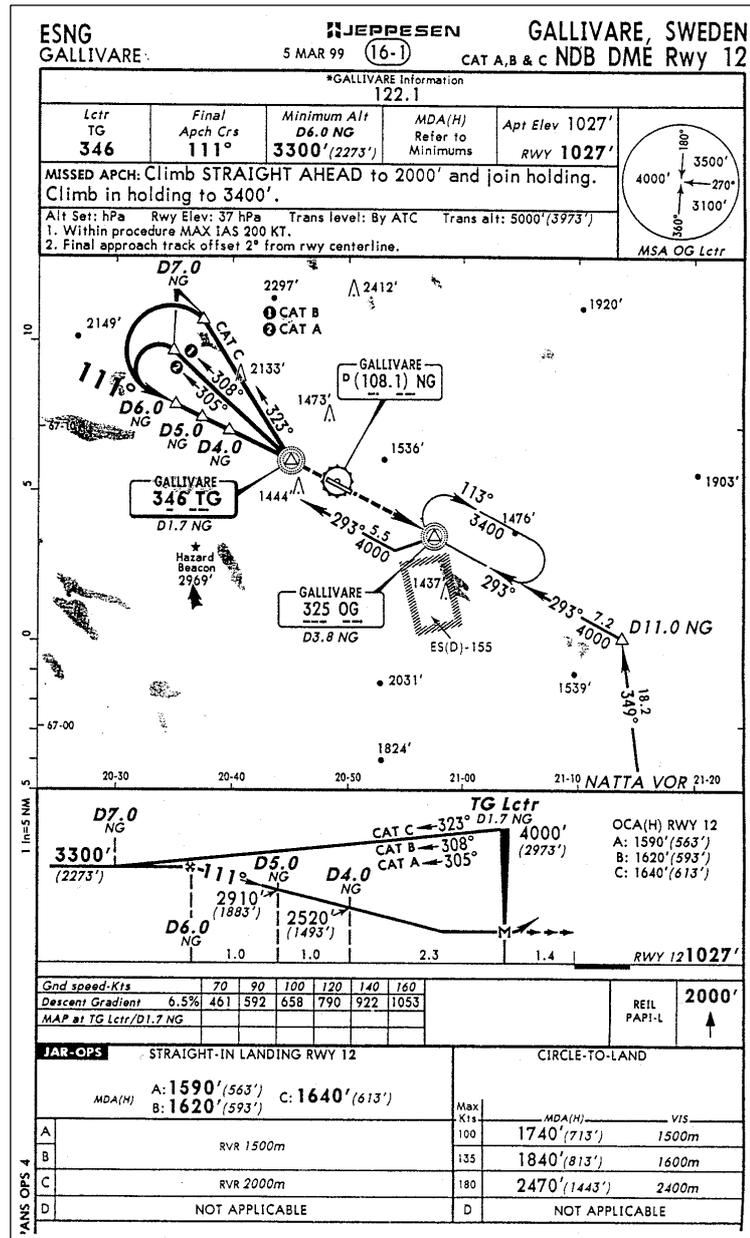
A frontal system was moving across northern Sweden. The prevailing wind was from the Southeast and gusting. Precipitation in the form of snow, corn snow and freezing rain and drizzle was observed. Moderate icing, with pockets of heavy icing, was reported in the Gällivare area. Moderate wind shear could be expected in the gusting winds associated with the front.

According to the Sveriges Meteorologiska och Hydrologiska Institut (SMHI) the Gällivare weather reported at 1550 hrs was: wind 150° at 12 knots with gusts to 23 knots, visibility 9000 m in snow, clouds 5-6/8 stratus based at 600 ft., temperature -2 °C, dew point -3 °C, QNH 1008 hPa.

About an hour after landing the crew visited the tower and noted that both wind indicators (one for each runway) indicated about a 10-knot difference. The AFIS operator on duty at the time of the accident reported however that the difference between the indicators had then been small.

### 1.8 Aids to navigation

Runway 12 at the Gällivare airport (ESNG) was equipped with NDB and DME<sup>5</sup>. The aircraft was equipped for instrument flight. A full procedure NDB/DME approach flown under IMC<sup>6</sup>.



The Instrument Approach Procedure chart used. (Including landing aids, visual ground aids etc.)

<sup>5</sup> DME – Distance measuring equipment

<sup>6</sup> IMC – Instrument meteorological conditions

## 1.9 Communications

The radio communication between the crew and the AFIS operator was normal and the transcript is available in appendix 2.

## 1.10 Aerodrome information

All airport information was contained in the Swedish AIP. Runway 12 has a PAPI and REIL<sup>7</sup> but no approach lights.

## 1.11 Flight recorders

There was no requirement to carry a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR) on board the aircraft and neither was fitted.

## 1.12 Accident site and aircraft wreckage

### 1.12.1 Accident site

The hard landing occurred about 150-200 m down the runway.

### 1.12.2 Aircraft wreckage

Damage occurred to the left engine mount and the left wing.

## 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

The Emergency Locator Transmitter (ELT) of type Narco ELT 10 was not activated in the accident.

The nurse sat fastened in a three-point harness in a forward facing seat on the left side of the aircraft. She reported back pains after the hard landing.

## 1.16 Tests and research

No technical faults were found with the aircraft.

## 1.17 Organisation and Management

### 1.17.1 General

SOS Flygambulans AB has its headquarters in Gothenburg and is responsible for about 3500 air ambulance flights a year, both domestically and

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<sup>7</sup> REIL- Runway (approach) End Identification Lights (stobes)

abroad. The company's fleet is comprised of five Beech Super King Air 200 aircraft that are specially configured for the role. The crew normally consists of two pilots and a nurse. Through an agreement with the University Hospital in northern Sweden, specialist doctors and nurses can be contracted when patients requiring intensive care are transported.

#### 1.17.2 *Operational Procedures*

The company's Flight Operations Manual (FOM), which had been submitted to the Swedish CAA on 28 June 1999 and after certain revisions approved on 30 March 2000, describes all the company's operational procedures. The company had amongst other things removed the requirement for simulator training, which is not required by regulation but was used during conversion training and PFT. The company has since stated that it will reinstate the practice of simulator training.

There are no limitations contained in the FOM for take-off and landing in difficult weather conditions for inexperienced pilots. It is the decision of the commander at the time. The company does however strive to introduce new pilots into line flying during the summer months.

Crosswind limits are only mentioned in the Aircraft Flight Manual (AFM). The maximum demonstrated crosswind component for the type is 25 knots on a dry runway. With the introduction of common European Joint Aviation Regulations, JAR-OPS, a new section will be introduced that also governs operations on contaminated runways.

### 1.18 **Additional information**

#### 1.18.1 *The commander's statement*

The pilots had flown together during two occasions previously during the week and were not very familiar with each other. The commander was aware that the co-pilot was inexperienced but that he was not aware of how little night experience he had. He had previously only landed in darkness once at the Umeå airport, flying an ILS<sup>8</sup> approach with approach lights. The commander felt that the co-pilot showed signs of being overloaded during the approach, missing the normal calls for landing flaps and gear extension. In retrospect the commander realised that with the demanding conditions that existed he should have taken over control of the aircraft at an earlier stage.

#### 1.18.2 *Reporting of wind changes*

The average time period between wind observations should be two minutes. Temporary changes shall be reported to the aircraft if the total difference in wind direction is greater than 60 degrees and/or the wind velocity varies more than 10 knots from the average during a ten-minute period. The existence of wind shear shall also be reported if a significant difference in wind direction and velocity exists, significant meaning that the above-mentioned differences and changes occur between different measuring instruments.

## 2 **ANALYSIS**

The weather conditions at the airport during the landing were difficult with a risk for icing, crosswind, turbulence, wind shear, low cloud base and

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<sup>8</sup> ILS – Instrument Landing System

snowfall. The co-pilot was the flying pilot and the landing would be made from an NDB-procedure in darkness. The commander was aware that the landing would be difficult for the relatively inexperienced co-pilot but did not consider it necessary to take control himself. He was however not aware that the co-pilot only had 40 hours of night flying experience. Not even after the first missed approach did he consider taking control himself and at no point did the co-pilot consider handing over control to the commander.

It is understandable that the commander would allow the co-pilot to attempt the landing in difficult conditions to gain the necessary experience. This of course places greater responsibility on the commander to closely supervise the progress of the flight. He should therefore have briefed the co-pilot about the risk for icing, wind shear and the need to maintain a good margin to minimum speeds.

In a stabilised approach configuration there is normally no need for further flap settings or adjustment on final. The selection of full landing flaps shortly before passing the threshold is an indication that the aircraft was not stabilised. Whether a new missed approach should have been initiated at this point or not is difficult to say. The commander should however have informed the co-pilot of the existing flap condition and of his intention to select full landing flap, prior to actually doing it.

The co-pilot's limited experience with night flying and the absence of approach lights most probably caused him to incorrectly judge his height above the runway and to initiate the round out prior to landing too early. The commander's unannounced selection of full landing flaps at this point caused the nose to pitch up, making an already extremely difficult landing for the co-pilot even worse. All indications point to the fact that very little margin to stall speed remained, taking into consideration the turbulence experienced and the risk for wind shear late in the approach. This resulted in an uncontrollable high sink rate. The presence of ice on the wings also most likely contributed to higher than normal stall speed. When the sink rate became uncontrollable the commander was unable to counteract it fast enough by increasing engine thrust before hitting the runway.

The accident highlights the need to regularly train for the proper management of unusual attitudes in the simulator.

### **3 CONCLUSIONS**

#### **3.1 Findings**

- a) The pilots were qualified to perform the flight.
- b) The aircraft had a valid Certificate of Airworthiness.
- c) No technical fault was found with the aircraft that could have had an effect on the outcome of the accident.
- d) The weather conditions at the time of the landing were difficult.
- e) A 6-7 mm thick layer of ice had formed on the wing leading edge.
- f) The co-pilot who was the flying pilot had limited night flying experience.
- g) The commander did not correctly supervise the co-pilots performance.
- h) The commander did not make himself properly aware of the co-pilots limited experience flying in difficult conditions, such as crosswind, darkness, an NDB approach and the lack of approach lights.

#### **3.2 Causes**

The accident was caused by improper speed control during the landing, which was carried out in difficult weather conditions. The commander's

lack of supervision during the approach and landing, combined with the co-pilot's inexperience with night flying, were also contributing factors.

#### **4 RECOMMENDATIONS**

None.