

## *Final report RL 2014:01e*

**Serious incident at Pajala Airport on 13 February 2013 involving the aircraft ES-PJB of model Jetstream 3102 operated by AS Avies.**

File No L-38/13

2014-02-07

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## General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aimed at preventing a similar event from occurring again, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim to answer three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. Where appropriate, these issues are dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

Investigations of aviation incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation and the Accidents Investigation Act (1990:712). The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

## The investigation

On 5 April 2013 SHK was informed that an incident involving one aircraft with the registration ES-PJB had occurred at Pajala Airport, Norrbotten County, on 13 February 2013 at 17.53 hrs.

The incident has been investigated by SHK represented by Mr. Hans Ytterberg, Chairperson, Mr. Stefan Christensen, Investigator in Charge, Mr. Peter Swaffer, Operations Investigator, and Mr. Staffan Jönsson, Technical Investigator until 21 August 2013.

The investigation team of SHK was assisted by Mr. Jens Haug as an accredited representative of the Estonian Safety Investigation Bureau (ESIB), and Mr. Marcus Cook as an accredited representative of the UK Air Accidents Investigation Branch (AAIB).

The investigation was followed by Mr. Jan Eriksson of the Swedish Transport Agency.

The following organizations have been notified:

International Civil Aviation Organization (ICAO), Estonian Safety Investigation Bureau (ESIB), Air Accidents Investigation Branch (AAIB), European Aviation Safety Agency (EASA), and European Commission – Aviation Safety (EC).

Investigation material:

A meeting with the interested parties was held on 18 December 2013. At the meeting SHK presented the facts discovered during the investigation, available at the time.

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Aircraft:	
Registration, type	ES-PJB, BAe Systems (Operations) Ltd., Jetstream 3102
Class, Airworthiness	Normal, Certificate of Airworthiness and Valid Airworthiness Review Certificate (ARC) <sup>1</sup>
Owner/Operator	Solmar Limited/AS Avies.
Time of occurrence	2013-02-13, 17.53 hrs in darkness Note: All times are given in Swedish standard time (UTC <sup>2</sup> + 1 hour)
Place	Pajala Airport, Norrbottens county, (position 6714.5N 02304.1E, 165 meters above sea level)
Type of flight	Commercial air transport
Weather	According to SMHI's analysis: wind SE 5-10 kts, visibility at times down to 1,500 meters in snow, clouds 6-8/8 with the cloud base at 400-700 ft, temperature/dewpoint -5/-5 °C, QNH <sup>3</sup> 1031 hPa
Persons on board:	15
Crew members	2
Passengers	13
Injuries to persons	None
Damage to aircraft	None known damage
Other damage	None
Commander:	
Age, licence	64 years, ATPL <sup>4</sup>
Total flying hours	11 960 hours, of which 4 860 hours on type
Flying hours last 90 days	46 hours, all on typ
Number of landings last 90 days	54
Co-pilot;	
Age, licence	44 years, CPL <sup>5</sup>
Total flying hours	457 hours, of which 198 hours on type
Flying hours last 90 days	37 timmar, all on type
Number of landings last 90 days	43

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<sup>1</sup> ARC (Airworthiness Review Certificate).

<sup>2</sup> UTC (Universal Time Co-ordinated) is a reference for worldwide time.

<sup>3</sup> QNH indicates barometric pressure adjusted to sea level.

<sup>4</sup> ATPL (Airline Transport Pilot License) authorizes a pilot to act in commercial air traffic as Commander of large aircraft.

<sup>5</sup> CPL (Commercial Pilot Licence) authorizes a pilot to act as co-pilot in commercial air traffic.

## SUMMARY

At landing on Pajala airport the aircraft – a Jetstream 31 from AS Avies – touched down with nose wheel and right main wheel outside of the asphalt edge of the runway. After rolling approximately 200 meters partly outside the runway the aircraft was steered up onto the runway. No runway edge lights were damaged and no damages were reported to the aircraft.

The runway was covered with snow and approach and runway lights were illuminated to a maximum of 10%. The weather was overcast with low cloud base and reduced visibility in snow showers. The wind was light with drifting snow over the runway.

After the incident the Commander undertook an external inspection of the aircraft without finding any damages. According to the Maintenance Manual of the aircraft, a technical inspection shall be carried out by a type certified technician after occurrences with hard or abnormal landings. No such inspection was performed and the aircraft was dispatched for traffic the following morning with another crew.

The Commander called Avies Flight Operations and reported about the incident but no written report was sent to the relevant authorities. The airport reported the occurrence to the Swedish CAA (Transportstyrelsen) 50 days after the incident.

Based on the safety deficiencies identified with respect to the operator in this investigation, as well as deficiencies identified in another investigation concerning the same operator, SHK has made a decision to call attention to these deficiencies by means of an official letter addressed to the Estonian and Swedish regulatory authorities for civil aviation.

The letter contained a safety recommendation to both regulatory authorities to – separately or jointly – carry out a full operational and technical audit of the operator.

The incident was caused by deficient directional control during the final stage of the landing, probably with perceptual illusions from drifting snow and dazzling by high-intensity lights as contributing causes.

## Recommendations

In light of the recommendation that SHK has already submitted to the Estonian regulatory authority and to the Swedish Transport Agency during the course of the investigation, and to the responses received from these authorities (see Section 1.18.2), SHK finds no reason to submit any further recommendations in this matter.



## 1. FACTUAL INFORMATION

### 1.1 History of the flight

#### 1.1.1 *The flight*

The aircraft, a BAe Jetstream 31 from AS Avies with flight number AIA 2094, took off from Luleå/Kallax Airport for a scheduled flight to Pajala Airport. There were 13 passengers and two pilots on board. The take-off and the flight towards Pajala were performed according to normal procedures with the commander as PF<sup>6</sup>.

On account of the current weather situation with a low cloud base and reduced visibility conditions, an instrument approach was carried out to runway 11 at Pajala Airport. According to interviews with the pilots, the approach procedure was performed without problems and in accordance with normal procedures. No icing had been noted on the aircraft.

During the final approach phase towards the runway, the approach and runway lights were illuminated to a maximum of 10%. The runway was covered with hard-packed snow. When the aircraft came in over the runway and commenced the flare, the PF reduced engine power on both engines to flight idle. At this point, the aircraft began to drift across towards the right side of the runway. The touchdown took place with the majority of the aircraft outside the asphalt edge of the runway.

During touchdown and the initial rollout, the aircraft's nose wheel and right main wheel were outside the right runway edge. After a distance of just over 200 meters, the aircraft was successfully steered up onto the runway and the remaining part of the rollout was performed normally.

#### 1.1.2 *Events after the incident*

When the aircraft had been taxied in and parked, the commander contacted the ground staff about the incident that had occurred. Together with the ground staff, the crew went out to the area of the runway where the excursion had taken place. It could then be concluded that the aircraft's nose wheel and main wheels had been outside the right runway edge and that the main wheels had passed very close to the runway edge lights. However, no damage to any lighting installations could be found.

The commander subsequently undertook an external visual inspection of the aircraft but could not see any damage. After the inspection, the commander called the company's Head of Flight Operations and reported the incident. However, this report did not mention that the

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<sup>6</sup> PF (Pilot Flying) - the pilot who is maneuvering the aircraft.

aircraft had been outside the runway. No report from the operator regarding the incident was submitted to the regulatory authority.

No information about the incident was communicated to the air traffic control personnel in the tower. Due to darkness and the distance to the touchdown zone on runway 11, (approximately 2 km), the personnel in the tower had not noticed the event. The aircraft was back in service with another crew on the morning the day after the incident. No further technical examination of the aircraft had been performed prior to this flight.

The incident occurred at position 6714.5N 02304.1E; 165 meters above sea level.

### **1.1.3 Interview with the crew**

The commander on the flight in question has been interviewed by SHK. The route between Pajala and Luleå had been flown previously by the commander. He was familiar with the airports and had not experienced any general difficulties or problems in connection with the flights on the route.

He further stated that the approach had taken place in accordance with normal procedures for an instrument approach and that no malfunctions of any kind could be observed on board. All systems were functioning normally, and the commander did not experience any problems or deviations regarding maneuverability or trimming of the aircraft. The commander estimated that during the final stage of the approach they broke through the cloud cover at an altitude of about 500 feet with the aircraft's heading centered in the direction of the runway and with the correct approach speed according to the operator's concept for stabilised approach.

Visibility was experienced as relatively good and contact with approach and runway lights was made immediately when the aircraft came under cloud. The commander stated that the runway was "white" and that light drifting snow could be observed over the surface of the ground. He also said that the runway lights were dazzling and that this had affected the assessment of the aircraft's position relative to the runway centre. The commander could not remember whether he had ordered dimming of the brightness of the runway lights.

When the thrust levers were closed just before touchdown, the commander noticed that the aircraft had drifted out towards the right edge of the runway. The touchdown took place partially to the right of the runway edge, and the commander's understanding was that he had immediately steered the aircraft up onto the runway again. He had no recollection of the nose wheel also having been outside the runway edge.

SHK has not had the opportunity to interview the co-pilot, but has obtained his written testimony about the incident. This report agrees in all material respects with the commander's account. The co-pilot stated that the lateral heading deviation to the right had occurred at the same moment as the power levers were closed. He has, however, stated that both thrust levers had been closed entirely and at the same time, and that no difference between the engines' power was perceived when the thrust levers were in the flight idle position.

## 1.2 Injuries to persons

	Crew members	Passengers	On board, total	Others
Fatalities	-	-	0	-
Seriously injured	-	-	0	-
Injured	-	-	0	Not applicable
No injuries	2	13	15	Not applicable
<b>Total</b>	<b>2</b>	<b>13</b>	<b>15</b>	<b>-</b>

## 1.3 Damage to the aircraft

No known damage to the aircraft has been reported.

## 1.4 Other damage and environmental impact

None.

## 1.5 Personnel information

### 1.5.1 Commander

The commander was 64 years old and had a valid PL-2136-ATPL (A) Licence. During the incident, the commander was PF.

Flying hours				
Last	24 hours	7 days	90 days	Total
All types	3.5	9.5	46	11,960
This type	3.5	9.5	46	4,860

Number of landings this type previous 90 days: 54.

Type rating concluded on 1 January 1996.

Latest PC<sup>7</sup> carried out on 15 March 2013 on J31.

<sup>7</sup> PC (Proficiency Check).

### 1.5.2 *Co-pilot*

The co-pilot was 44 years old and had a valid EST-6910200575-CPL (A) Licence. During the incident, the co-pilot was PM<sup>8</sup>.

Flying hours				
Last	24 hours	7 days	90 days	Total
All types	3.5	9.5	37	457
This type	3.5	9.5	37	198

Number of landings this type previous 90 days: 43.  
 Type rating concluded on 1 January 2012.  
 Latest PC carried out on 28 February 2013 on J31.

### 1.5.3 *Cabin crew members*

Not applicable.

### 1.5.4 *The pilots' duty schedule*

Both pilots' hours of duty were in accordance with current regulations. The commander and the co-pilot were on the third and fourth days of their work cycles respectively. When the incident occurred, the flight was the day's fourth and last for the crew.

## 1.6 *Aircraft information*



Figure 1 - BAe Jetstream 31, ES-PJB. Photo: Jevgeni Ivanov.

### 1.6.1 *General*

BAe Jetstream 31 is a twin-engine aircraft with turboprop engines. The first version came in 1969. Its passenger capacity is 18 passengers and the model is normally manned with two pilots, but no cabin attendants.

<sup>8</sup> PM (Pilot Monitoring) - the pilot assisting the PF (Pilot Flying).

### 1.6.2 *Airworthiness and maintenance*

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#### ***Aircraft***

TC-holder	BAe Systems (Operations) Ltd.	
Type	Jetstream 3102	
Serial number	622	
Year of manufacture	1984	
Gross mass, kg	Max authorised start/landing mass 6,600 actual 4,546	
Centre of gravity	Within limits (215,9 inches aft)	
Total flying time, hours	33,268	
Flying time since latest inspection, hours	11.3	
Number of cycles	30,736	
Fuel loaded before event	1,000 kg Jet A1	

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#### ***Engine***

TC-holder	Honeywell	
Type	TPE331-10UF-513H	
Number of engines	2	
Engine	<i>Nr 1</i>	<i>Nr 2</i>
Serial number	P-42149	P42036C
Operating time since latest inspection, hours	11.5	11.5

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#### ***Propeller***

TC-holder	Dowty propellers	
Type	R333/4-82-F/12	
Propeller	<i>Nr 1</i>	<i>Nr 2</i>
Serial number	DAP0011	DRG/1348/85
Total operating time, hours	11,721	25,767
Operating time since latest overhaul, hours	749	749
Number of cycles since latest overhaul	1,236	1,236

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***Outstanding remarks*** No known entries.

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The aircraft had a Certificate of Airworthiness and a valid Airworthiness Review Certificate (ARC).

### 1.6.3 *Inspection after abnormal landing*

According to information from the Type Certificate Holder, a landing outside – or partially outside – the runway is categorised as an abnormal landing. Regulations concerning technical measures in these

cases are described in the aircraft's AMM<sup>9</sup>. In incidents with a hard or abnormal landing, a technical inspection of the aircraft is to be performed in accordance with AMM Chapter 05-50-10-6. This inspection is to be performed by a type-certified technician. In the present case, no such inspection of the aircraft was performed.

## **1.7 Meteorological information**

According to SMHI's analysis: wind SE 5-10 kts, visibility down to 1,500 meters in snow, clouds 6-8/8 with the base at 400-700 ft, temperature/dewpoint -5/-5 °C, QNH 1031 hPa.

It has not been possible to obtain details of the prevailing, observed, weather at the time of the landing as these data have not been saved by the airport.

## **1.8 Aids to navigation**

The approach to runway 11 at Pajala Airport under instrument flight conditions is based on the procedure with ILS<sup>10</sup>/DME<sup>11</sup>. The procedure entails the pilots being able to see on their ILS instruments the relation of the aircraft to the runway's extended centre line and to a nominal glide path of 3.0° leading down to the ideal touchdown point about 300 meters into the runway. Via DME, the pilots can also read the distance to the transmitter's location at the airport.

No fault or abnormality has emerged with regard to ground equipment or the aircraft's navigation equipment.

## **1.9 Communications**

Radio communications between aircraft and air traffic control at Pajala Airport are normally registered on recording equipment and stored for 30 days. In the case in question, a period exceeding 30 days had elapsed before SHK received information about the event and could request access to the tape recordings. At this point in time, the recordings had been deleted and it has not been possible to recreate them.

## **1.10 Aerodrome information**

### **1.10.1 General**

The airport had operational status in accordance with the Swedish AIP<sup>12</sup>. Runway 11/29 has the measurements 2,302 x 45 meters and is equipped with high-intensity approach and runway lights. The runway has an asphalt surface and has a painted centre line marking, but does not have centre line lighting. The approach lights are of international

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<sup>9</sup> AMM - Aircraft Maintenance Manual.

<sup>10</sup> ILS - Instrument Landing System.

<sup>11</sup> DME - Distance Measuring Equipment.

<sup>12</sup> AIP - Aeronautical Information Publication.

standard (Barette) and extend over 900 meters. The runway edge lights are of an omnidirectional type and are located 2.8 meters outside the runway edge with 60-metre intervals between each lamp and have a height of 30 centimetres above the ground surface.

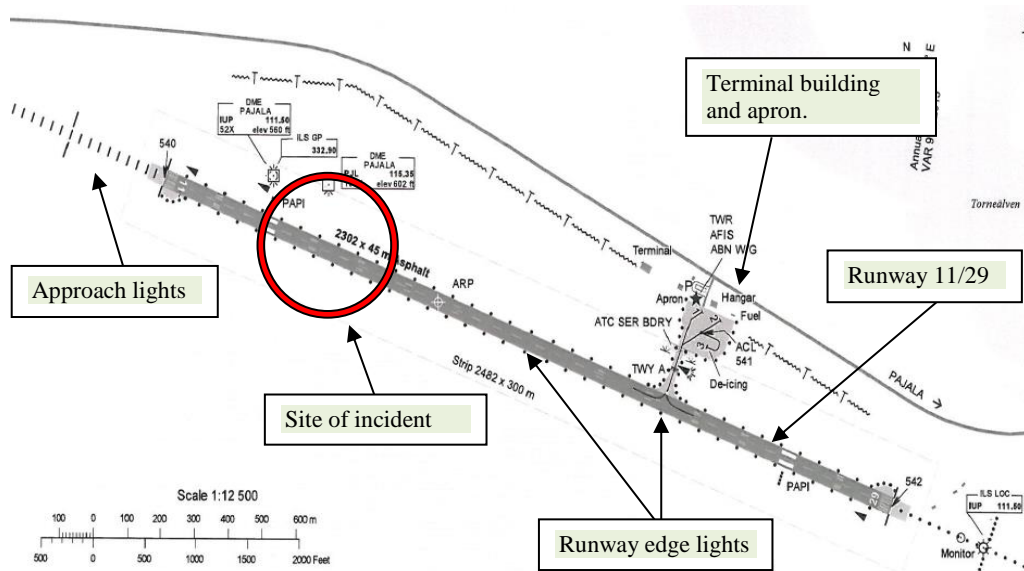


Figure 2 - Sketch of Pajala Airport from AIP.

The brightness of the approach and runway lighting is regulated by the personnel in the air traffic control tower. The airport's operations manual contains tables for setting the brightness in different weather and visibility conditions. Under certain conditions, classified in the operations manual as *when special reasons are deemed to be at hand*, the brightness recommended in the table may be raised.

In the present case with a very low cloud base, in combination with snow-covered ground and runway, the operations manual states that the brightness can be selected between 3% (low-intensity light, LI) and 10% (high-intensity light, HI). During the interview, the air traffic controller could not recall which brightness had been used for the approach and landing in question, but stressed that up to 10% HI may have been used.

**1.10.2 Runway conditions**

On the day in question, the airport had a “winter runway”, that is, the runway was covered with a thin layer of hard-packed snow. Due to the prevailing weather with snow at times, there had been some clearing of the runway during the day. In connection with snow clearing, the strip area outside the runway is also cleared as shown in figure 3.

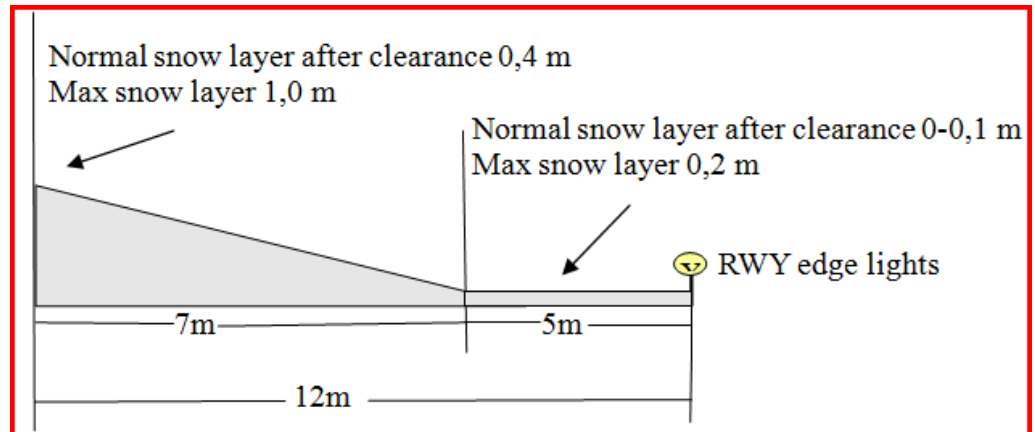


Figure 3 - Snow clearing profile at Pajala Airport.

According to information from the airport, the painted centre line marking on the runway was not visible – or was visible only to a limited extent – under the prevailing conditions with a snow-covered runway. It has not been possible to determine in retrospect, the conditions of the runway with respect to measured friction coefficients.

### 1.10.3 Reporting of the event

In connection with the event, the crew did not report what had occurred over the radio to air traffic control at the airport. The AFIS<sup>13</sup> officer in the tower first found out about the event when the crew and ground staff later went out onto the runway to the area where the incident had occurred.

The AFIS officer inquired from the airport manager whether a DA<sup>14</sup> should be written with reference to the event. However, the question was forgotten and was noticed much later when the Swedish Transport Agency asked a question about a possible event at the airport in Pajala.

The airport manager then remembered the inquiry from the AFIS Officer, and a DA could be written. The delay meant that the event – which occurred on 13 February – was not reported to the Swedish Transport Agency until 4 April and came to SHK's attention on 5 April 2013, entailing a delay of 50 days.

## 1.11 Flight recorders

The aircraft was equipped with both a FDR<sup>15</sup> and a CVR<sup>16</sup>. In order to read the information on these recorders, each piece of equipment must be removed from the aircraft. This had not been done by the operator following the incident in question.

<sup>13</sup> AFIS - Aerodrome Flight Information Service.

<sup>14</sup> DA (Driftstörningsanmälan) - Operational Disturbance Report.

<sup>15</sup> FDR - Flight Data Recorder.

<sup>16</sup> CVR - Cockpit Voice Recorder.



When the incident came to SHK's attention, the information available on the recorders had been erased.

### 1.12 Site of occurrence

After the incident, the ground staff and the crew inspected the site of the incident. According to the commander, this took place mainly to ensure that none of the aircraft's wheels had collided with a runway edge light. In connection with the inspection, the tracks were measured by the ground staff and documented in the sketch in figure 3 below.

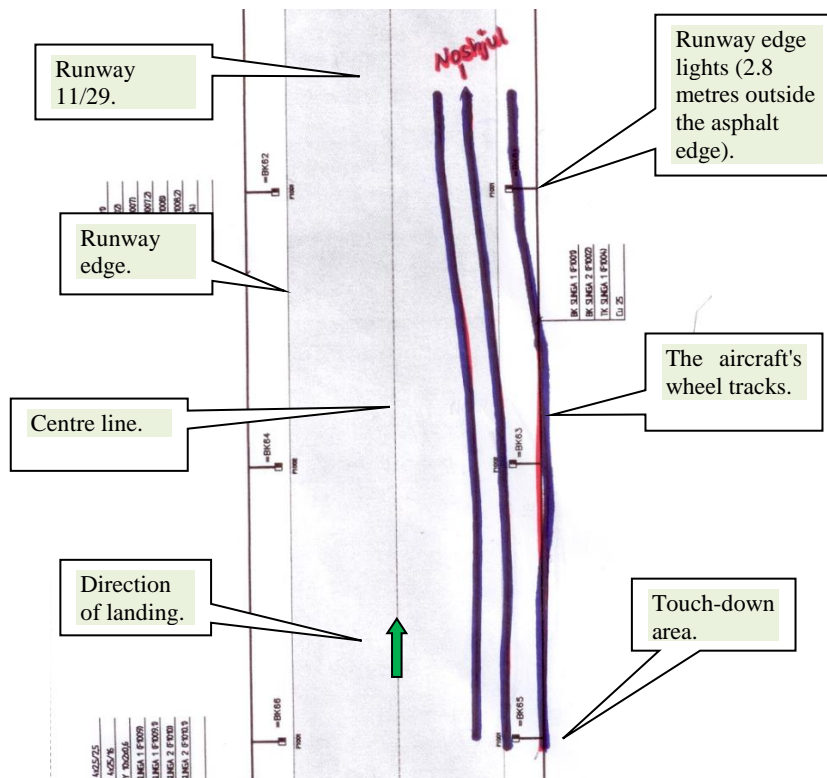


Figure 4 - Sketch of the aircraft's tracks.

The sketch in figure 4 shows that the touchdown was made with the nose wheel and the right main wheel outside the runway's asphalt edge. The aircraft has then rolled parallel to the runway for about 100 meters, passing on the outside of two runway edge lights with the right main wheel. The aircraft then passed another runway edge light with the right main wheel rolling between the light and the runway's asphalt edge.

After passing the third runway edge light, the aircraft could be steered up onto the runway again. According to the information, the total distance when any of the aircraft's wheels was situated outside the runway's asphalt edge was just over 200 meters.

### 1.13 Medical information

Nothing indicates that the mental and physical condition of the pilots were impaired before or during the flight.

## **1.14 Fire**

Did not occur.

## **1.15 Survival aspects**

### ***1.15.1 The rescue operation***

No rescue operation took place. The ELT<sup>17</sup> of type Kannad 406 AS was not activated in the incident.

## **1.16 Tests and research**

None.

## **1.17 Organisational and management information**

### ***1.17.1 General***

AS Avies is an Estonian airline whose registered office is in Tallinn. The company was founded in 1991 and conducts flight operations of both a regular and non-regular nature. The non-regular traffic consists mainly of charter flights and air taxi and is operated using smaller jet aircraft of the types Hawker and Learjet.

The regular traffic consists of scheduled services in various countries and is operated using aircraft of the type Jetstream 31/32. In Sweden, the company operates a number of routes, including Pajala-Luleå, for the Swedish company Avies Sverige AB, which acquired the traffic rights on these routes following a tender procedure.

### ***1.17.2 Public tender of air traffic***

The basic principle within the EU is that all Community air carriers are entitled to freely exercise traffic rights on all air routes within the Union. The principle is established in article 15(1) of *Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community (Recast)*.

A departure from the principle of the right to freely operate air traffic concerns routes being considered vital for the economic development of a particular region and which are not possible to operate solely on the basis of usual commercial interests. For such routes, as provided for in Article 16 of the same Regulation, a public service obligation may instead be imposed. That means, in so far as is relevant in this case, that a single air carrier is awarded the exclusive right to operate air traffic on the route in question. An exclusive right of this kind must be offered through a public tender procedure (Articles 16 and 17 of the Regulation).

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<sup>17</sup> ELT - Emergency Locator Transmitter.

Air traffic on the route in question between Pajala and Luleå is not operated on the usual commercial basis. Instead, a public service obligation applies on the route. The airline *Avies Sverige AB* has been awarded the exclusive right to air traffic following a public tender procedure. The authority responsible for the tender procedure is the Swedish Transport Administration. *Avies Sverige AB* has in turn engaged the Estonian operator *AS Avies* to conduct the air traffic as a subcontractor.

### **1.17.3 *Operating prerequisites***

A prerequisite for a company to be allowed to operate air traffic within the EU is that it holds an operating licence. Under Article 4 of Regulation 1008/2008, the company is entitled to obtain an operating licence if it holds a valid air operator certificate (AOC). An issued AOC certifies that the company has the professional ability and organisation to ensure the safety of operations. In order to obtain the operating licence, it is furthermore required that the company demonstrates that it has access to aircraft and that the company, and the persons who stand behind it, meet certain requirements with regard to insurance and good repute, including not having been declared bankrupt, and other financial conditions.

An operating licence is issued by the competent authority of the EU country in which the company is registered. From Article 15(2) of the Regulation follows that a Member State may not subject a Community air carrier that holds an operating licence and an AOC to any further licensing requirements to be allowed to exercise air traffic within the Union. Under Article 6 of *Council Regulation (EEC) No 3922/91 of 16 December 1991 on the harmonisation of technical requirements and administrative procedures in the field of civil aviation*, Member States shall recognise such certifications issued by another Member State in respect of legal and natural persons engaged in, among other things, the operation of aircraft.

At the time of the Swedish Transport Administration's tender procedure for air traffic on the route in question, *AS Avies* held a valid operating licence and AOC issued in accordance with EU law. Thus there was no basis for the Swedish Transport Administration to undertake additional controls or place other demands on the company from a safety perspective.

## **1.18 Additional information**

### **1.18.1 *Perceptual illusions***

It is well known that it is possible to perceive a relative movement that is different to the case in reality, such as a passenger perceiving that the train is moving, when in fact it is the neighbouring train that is moving. Similarly, a false impression of lateral movement can be

given when travelling in a car at night in the winter and the snow is sweeping across the road in the headlights.

Correspondingly, in winter, snow may be sweeping across an airfield giving a false impression of relative movement, which in turn can give rise to inappropriate flight control movements<sup>18</sup>. SHK has not been able to find any information in the operator's manual (OM A<sup>19</sup>) regarding guidance or risk factors for operations under conditions of blowing snow on snow-covered runways.

### 1.18.2 *Measures taken*

Based on the safety deficiencies identified with respect to the operator in this investigation, as well as deficiencies identified in another SHK investigation concerning the same operator (see SHK's Ref no L-46/13), SHK has made a decision to call attention to these deficiencies by means of an official letter addressed to the Estonian and Swedish regulatory authorities for civil aviation.

The letter contained a safety recommendation to both regulatory authorities to – separately or jointly – carry out a full operational and technical audit of the operator in question. In this context, it should be mentioned that it is the Estonian authority – in the capacity of responsible issuer of the operator's AOC – which has regulatory responsibility for the company. The Swedish Transport Agency has no regulatory responsibility, but has the opportunity, among other things through SAFA<sup>20</sup> inspections, to check parts of the operation's safety and quality.

The following arises from the responses to SHK of the regulatory authorities concerned.

The Estonian regulatory authority has ordered the operator to improve its safety programme and to appoint a Flight Safety Programme Manager for the company's flight operations. Together with a representative from the Swedish Transport Agency, the Estonian authority's technical department has also carried out an audit at one of the operator's technical bases in Sweden. In addition to this, the authority has also stated that greater attention is being paid to the operator and that the development of the prescribed safety programme will be carefully monitored.

The Swedish Transport Agency has opened a dialogue with the Estonian regulatory authority with reference to the safety recommendation issued by SHK and has also called attention to the deficiencies at a meeting with the European Commission's Air Safety Committee (ASC). As mentioned, the Swedish Transport Agency has

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<sup>18</sup> *Human factors in flight*, Frank H. Hawkins, Ashgate, 2005.

<sup>19</sup> OM - Operations Manual.

<sup>20</sup> SAFA (Safety Assessment of Foreign Aircraft) - random checks of foreign aircraft with respect to air safety.

also participated in a technical audit at one of the operator's technical bases in Sweden. The Agency has also stated that in 2012, it carried out a number of SAFA inspections of the operator, with high load figures as a result.

### **1.19 Useful or effective investigation techniques**

Not applicable.

## **2. ANALYSIS**

### **2.1 Execution of the flight**

#### **2.1.1 Operational**

SHK has found no deficiencies in the operational planning nor in the manner in which the flight was performed. The pilots were familiar with the airports and the route of the service. The instrument approach to runway 11 appears to have been executed in accordance with current regulations and the procedures applied by the operator.

The commander has also stated that the aircraft – taking into account configuration, heading and speed – had been fully stabilised when contact with the approach and runway lights was obtained at an altitude of approximately 500 feet. For this reason, it is unlikely that contributory factors to the deviation in heading will be found in the conditions that prevailed during the flight phases before the flare at the landing stage.

The degree of difficulty of the instrument approach – in the weather-related conditions that prevailed – cannot be assessed as high. The cloud base was about 500 feet and visibility relatively good. The winds were light, and the pilots have stated that there was no icing during the flight or the approach.

Overall, it cannot be considered likely that the pilots were under a particularly high workload during the final stage of the flight or that they were working at the limit of their ability. The flight in question – including approach and landing – can be considered to constitute an example of both a normal and expected workload for a professional cockpit crew under the prevailing conditions.

#### **2.1.2 Technical**

The technical documentation examined by SHK does not indicate any technical malfunctions or other technical deviations in the aircraft that could have influenced the sequence of events.

The interview with the commander has also not revealed anything to indicate that technical causes could have contributed to the event or otherwise affected the pilots' possibility for control and manoeuvring of the aircraft.

### **2.1.3 Runway conditions**

In an approach with reduced visibility conditions, it is of great importance that the aircraft's directional control is stable. When the pilots are transitioning to fly on visual references, at or shortly before the minimum altitude, the landing runway's conditions regarding markings and lighting are the most important aid for a safe landing.

On runway 11 in Pajala, there are no centre line lights on the runway, and the white-painted centre line marking was not visible at the time due to snow. These conditions probably contributed to the pilots realising too late that the aircraft at touchdown was situated far out to the right of the runway's centre line. The fact that the runway edge lights are located almost three metres outside the runway's edge may also have contributed to the pilots not realising in time that they were close to the runway edge.

It is also likely that approach and runway lights had been at 10% brightness during the entire landing sequence. The commander has stated that he had been dazzled by the lights during the landing stage.

## **2.2 The incident**

### **2.2.1 General**

Although the approach and landing took place in darkness and in instrument approach conditions towards a winter runway, the conditions cannot – as previously mentioned – be categorised as other than expected and normal.

However, what has emerged during the investigation is that additional factors may have had an effect on the sequence of events. The fact that the runway was covered in snow and did not have centre line lighting may, together with drifting snow, have produced a perceptual illusion that resulted in the aircraft drifting off towards the right side without the pilots noticing this.

The risks of such an illusion may have been significantly reinforced if the approach and runway edge lights were set at a brightness of up to 10%. A possible dazzling effect from the lights may have contributed to the fact that neither of the pilots noticed in time the drift off towards the right runway edge. SHK has been unable to clarify the reasons why the pilots did not request the lights to be dimmed.

At touchdown, the aircraft came to position itself with the row of runway edge lights between the right main wheel and the nose wheel. When the commander managed to steer the aircraft onto the runway again, a collision with the runway edge lights was only avoided with the smallest possible margin.

### 2.2.2 **Risk factors**

#### *Yawing effects*

In excursions outside the edge of a runway, the risk of serious consequences immediately arises. Areas between the asphalt edge and runway lights normally consist of gravel and sand of varying bearing resistance, but should be free of other obstacles. However, in winter conditions – where snow clearing of the runway constitutes a recurring feature of airport operations – there may be snow banks adjacent the runway edge lights.

Even if the intention is to keep the area outside the runway cleared, snow banks and drifts may occur under varying meteorological conditions like snowfall and strong winds. If one pair of wheels on an aircraft hits a snow bank, this can cause a yawing effect entirely outside the crew's control with incalculable consequences as a result (see for example SHK's report RL 2012:18).

#### *Puncture*

If any of the aircraft's wheels had hit one or more runway edge lights, there would have been a manifest risk of wheel damage and/or a puncture. In such situations – with an unstable surface as an aggravating factor – control of the aircraft can be lost (see for example SHK's report RL 2007:10).

In the present case, the fact that the aircraft “missed” all the runway edge lights during the approximately 200-metre long passage outside the runway can probably be attributed to fortunate circumstances.

### 2.3 **The operator's handling**

The commander's decision to only verbally notify the Head of Flight Operations about what had happened probably resulted in the extent of the event being toned down and the incident not being followed up with a report to the relevant authority. Furthermore, the fact that no information was provided in this context concerning the aircraft's excursion outside the runway edge probably contributed to the fact that the information about the incident was not forwarded.

One consequence of this shortcoming in the reporting was that the appropriate control measure – a technical inspection of the aircraft after an abnormal landing (AMM Chapter 05-50-10-6) – was never carried out.

These circumstances suggest clear deficiencies in the operator's systematic safety work. In SHK's opinion, there is cause for the operator to take strong measures to rectify these deficiencies, particularly with regard to internal regulations and information concerning occurrence reporting.

There is also reason to remind the Estonian regulator of its responsibility to ensure the operator's compliance with its statutory reporting obligations.

## **2.4 The airport's reporting**

The incident in question was first reported to the authorities 50 days after it had occurred. For SHK, this meant that the work to ascertain the causes of what had happened were significantly hindered. Not having access to data from the FDR and the CVR and to the recording of the tower's radio communication with the aircraft impairs the opportunities for SHK to reach a satisfactory final result in the investigation.

SHK has not examined in detail the reasons for the delay in the airport's report, but notes that there is probably room for improvement in this area.

Also in this respect, SHK would like to underline the regulator's (in this case the Swedish Transport Agency) responsibility for ensuring compliance with the reporting obligations.

## **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 aircraft had no technical remarks or known malfunctions.
- d) The runway has no centre line lights and was covered in snow during the event.
- e) High-intensity lights were probably illuminated to a brightness of 10% during the landing.
- f) Blowing snow and limited visibility prevailed during the event.
- g) The touchdown took place with the nose wheel and right main wheel outside the runway edge.
- h) The commander notified the Head of Flight Operations about the event verbally.
- i) The operator did not submit any written report to the relevant regulatory authority.
- j) No technical inspection of the aircraft was carried out after the event.
- k) The airport first reported the event to the Swedish Transport Agency 50 days after the incident.

### **3.2 Causes**

The incident was caused by deficient directional control during the final stage of the landing, probably with perceptual illusions from drifting snow and dazzling by high-intensity lights as contributing causes.



#### **4. RECOMMENDATIONS**

In light of the recommendation that SHK has already submitted to the Estonian regulatory authority and to the Swedish Transport Agency during the course of the investigation, and to the responses received from these authorities (see Section 1.18.3 ), SHK finds no reason to submit any further recommendations in this matter.

On behalf of the Swedish Accident Investigation Authority

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