Statens haverikommission
Swedish Accident Investigation Authority

Interim statement

Interim statement in accordance with Article 16(7) of Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation.

Serious incident at Torsby Airport, Värmland county on 31 January 2014 involving the aircraft ES-PJR of the model BAe Jetstream 3200 operated by AS Avies.

File no L-0018/14

30/01/2015

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring again, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

The report is also available on SHK´s web site: www.havkom.se

ISSN 1400-5719

This document is a translation of the original Swedish report. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the report.

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Content

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 aiming 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. These issues are, when appropriate, dealt with by judicial authorities or e.g., by insurance companies.

Nor does the task of SHK include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Nor are measures in support of such individuals by the social services, for example in the form of post crisis management, 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 by the Accident Investigation Act (1990:712). The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

According to Article 16(7) of the EU Regulation, the safety investigation authority shall on the anniversary after the accident or incident release an interim statement in those cases where a final report has not been published after 12 months.

The statement contains – besides a report of the sequence of events – information on the progress of the investigation and relevant parts of the factual material gathered in the case. Publication of the interim statement takes place during a phase where the investigation has not yet been completed, for which reason the content of the material now presented may come to be supplemented, amended or omitted in the final report.

The interim statement has not undergone the consultation process that precedes the publication of a final report. Hence, SHK cannot guarantee that everything presented in this interim statement will be part of – or be identical to – the content in the final report on the event subsequently published.

The investigation

SHK was informed on 31 January 2014 that a serious incident involving one aircraft with the registration ES-PJR of the model BAe Jetstream 3200 had occurred at Torsby Airport in Värmland county, on the same day at 20.59 hrs.

The incident has been investigated by SHK represented by Mr Hans Ytterberg, Chairperson, Mr Stefan Christensen, Investigator in Charge and Operations Investigator, Mr Christer Jeleborg, Technical Investigator, and Mr Urban Kjellberg, Investigator Fire and Rescue Services.

The investigation team is being assisted by several external experts. Besides Sweden, two countries are participating in the investigation through accredited representatives.

The Swedish Transport Agency (Transportstyrelsen), the European Aviation Safety Agency (EASA) and the EU have been provided with continuous information on the investigation.

A fact finding presentation meeting with the interested parties was held on 10 December 2014. At the meeting SHK presented the facts discovered during the investigation, available at the time.

Interim statement

Aircraft:	
Registration, type	ES-PJR, BAe SYSTEMS Jetstream
Model	Jetstream Series 3200
Class, Airworthiness	Normal, Certificate of Airworthiness and Valid Airworthiness Review Certificate (ARC)[1]
Time of occurrence	31/01/2014, 20.59 hrs Note: All times are given in Swedish standard time (UTC[2] + 1 hr)
Place	Torsby Airport, Värmland county, (position 600917N 0125937E, 120 metres above mean sea level)
Type of flight	Commercial air transport (commissioned traffic)
Weather	According to Metar Torsby 20.40 hrs.: wind variable 03 knots, visibility 2 000 metres in snow, vertical visibility 1 900 feet, temperature/dewpoint M05/M06 °C, QNH[3] 1013 hPa
Persons on board:	17
crew members including cabin crew	2
passengers	15
Injuries to persons	None
Damage to aircraft	No known damage

[1] ARC (Airworthiness Review Certificate).
[2] UTC (Coordinated Universal Time).
[3] QNH (Barometric pressure at mean sea level).

1. FACTUAL INFORMATION

1.1 History of the flight

The flight was a scheduled flight from Stockholm/Arlanda to Torsby Airport in Värmland with a Jetstream 3200 (J32), see Figure 1, from the Estonian airline AS Avies with flight number AIA 205D. Due to the prevailing weather conditions with heavy snow, departure from Arlanda was delayed by about one hour.

Figure 1. ES-PJR, BAe Jetstream 32. Photo: AS Avies.

After landing at Torsby, refuelling was to be performed during a short ground stop. The plan was that the aircraft would then continue to the company's home base in Tallinn. There were 15 passengers and two crew members on board.

The take-off – where the co-pilot had been designated PF[4] – was further delayed due to snow clearance and took place at 20.07 hrs. Nearly the whole of the region of Svealand was covered on the day in question by a snowfall area with low visibility values and icing conditions.

The flight towards Torsby proceeded without any known disruptions, and the pilots planned for an instrument approach to runway 16[5]. The prevailing weather at Torsby Airport was 2 000 metres visibility in snow. Friction tests on the runway were carried out 1 hour and 40 minutes before the estimated landing with measured friction coefficients 0.25, 0.25 and 0.23. Snow clearance was commenced during continued snowfall, and the next friction measurement was carried out 19 minutes before landing with the coefficient results 0.30, 0.31 and 0.33.

[4] PF (Pilot Flying) – the pilot who is flying the aircraft.
[5] The figure 16 means that the runway's magnetic compass direction is about 160°, i.e. a south-southeasterly direction.

The approach was performed manually with the co-pilot as PF. When the aircraft passed the outer marker TH on the way in, the approach – according to interviews with the crew – was stabilised. The aircraft landed about 800 metres into runway 16 with a touchdown speed of about 140 knots.

After having taken over control, the commander commenced braking and also set the engine controls at full thrust reversal. However, the aircraft could not be brought to a stop – or manoeuvrable speed – before the taxiway in to the station building. The commander attempted to turn off to the right onto the taxiway, but the aircraft ran off the runway in the corner between the landing runway and the taxiway and came to stand in a snowdrift with the nose 6-7 metres from the edge of the taxiway, see Figure 2.

Figure 2. The aircraft after the excursion. Photo: Torsby Airport.

1.2 Interviews with the crew

The pilots were well acquainted with the airport and the flight route and had flown together for a long time. The pilots did not observe any notable icing during the flight. Prior to landing, it had been decided that flap 35° and V_{REF}[6] at 115 knots would be used.

The altitude had been corrected during the approach as the visual glide path system had indicated that the aircraft was too low. The co-pilot stated during the interview that it was hard to remember if any control of ice on the wings was performed, but said that no addition to V_{REF} had been agreed. Despite this, the co-pilot had decided to maintain a somewhat higher speed during the approach.

[6] V_{REF} – Reference speed when the aircraft passes 50 feet above the runway threshold.

In addition, the co-pilot could not recall that the expression "stabilised approach" had been used during the approach in question and also said that the concept of stabilised approach was included neither in training nor in daily flying.

There had been no discussion between the pilots concerning runway conditions and the friction coefficients that had been reported. The reason for this, according to the co-pilot, was that the company's manuals described no procedures concerning corrections for contaminated surfaces.

The crew's perception was that touchdown had taken place 300 – 400 metres into the runway. The commander said in the interview that he experienced the surface as "very slippery" when braking and noted that the runway end was approaching fast. When he realised that the runway would not be sufficient to stop the aircraft, he had two choices, to continue straight ahead and run off in the extension of the runway or to attempt at high speed to turn onto the taxiway.

1.3 Aircraft information

1.3.1 General

Jetstream 32 is described in the type certificate as a low-wing turboprop aircraft intended for passenger traffic. Two turboshaft engines mounted conventionally above the wings drive the four-bladed propellers.

TC-holder	BAe Systems (Operations) Ltd
Model	Jetstream 3200
Engines	Honeywell TPE331-12UHR-702H
Year of manufacture	1991
Gross mass, kg	Max authorised take-off/landing mass 7350/7080, actual 7342/7059.

1.3.2 Technical remarks

Commission Regulation (EC) No 2042/2003, M.A. 403, concerning the handling of aircraft malfunctions, states that any aircraft defect that seriously endangers the flight safety shall be rectified before further flight. Any defect not rectified before flight shall be recorded in the aircraft technical record system or the operator's technical logbook.

SHK has reviewed the notes in the aircraft's technical log at the time of the incident, as well notes regarding the periods immediately before and after the incident.

During the period from 27 January to 31 January (the day of the incident), there were no remarks noted in the section of the log intended for technical remarks or notes (Defect Report Details). Through interviews with the crew, however, it could be established that the aircraft had some technical defects that were known both to the pilots and the company's technical department.

These remarks had been reported to the company by the pilots but not entered in the aircraft logbook. An internal document, "Maintenance request", which is managed by the company's technical department, contained the following technical remarks regarding the aircraft in question, dated 29 January 2014:

- Crew reported: R/H propeller deicing U/S[7],
- Crew reported: R/H Cabin window lights are working only 2-3 seconds,
- Crew reported: Missing some pitot covers.

The day after the incident in Torsby, the aircraft was flown to Tallinn for planned maintenance (A-check). In the technical log for this flight were two of the points noted above – *propeller de-icing U/S* and *Cabin Lighting U/S*.

The company's system for handling technical remarks has been previously investigated by SHK (see Report RL 2014:07e). It was noted there that the operator's system for this not only deviates from existing regulations; it must also be described as remarkable from a safety perspective.

1.4 Aerodrome information

Torsby Airport has an asphalted runway with the dimensions 1,590 x 30 metres, see Figure 3. The runway is equipped with high-intensity runway edge and approach lights in both directions. For instrument approach, there are Non-Directional Beacons (NDB) and localiser transmitters (LLZ) installed in both approach directions.

The airport is also equipped with a distance transmitter (DME), placed in the centre of the airport area. Light ramps with visual glide path information (PAPI) are placed on the left side at the respective runway start. Electronic glide path information is not installed.

During the incident, the airport had operational status in accordance with the Swedish AIP[8].

[7] U/S – Unserviceable.
[8] AIP – Aeronautical Information Publication.

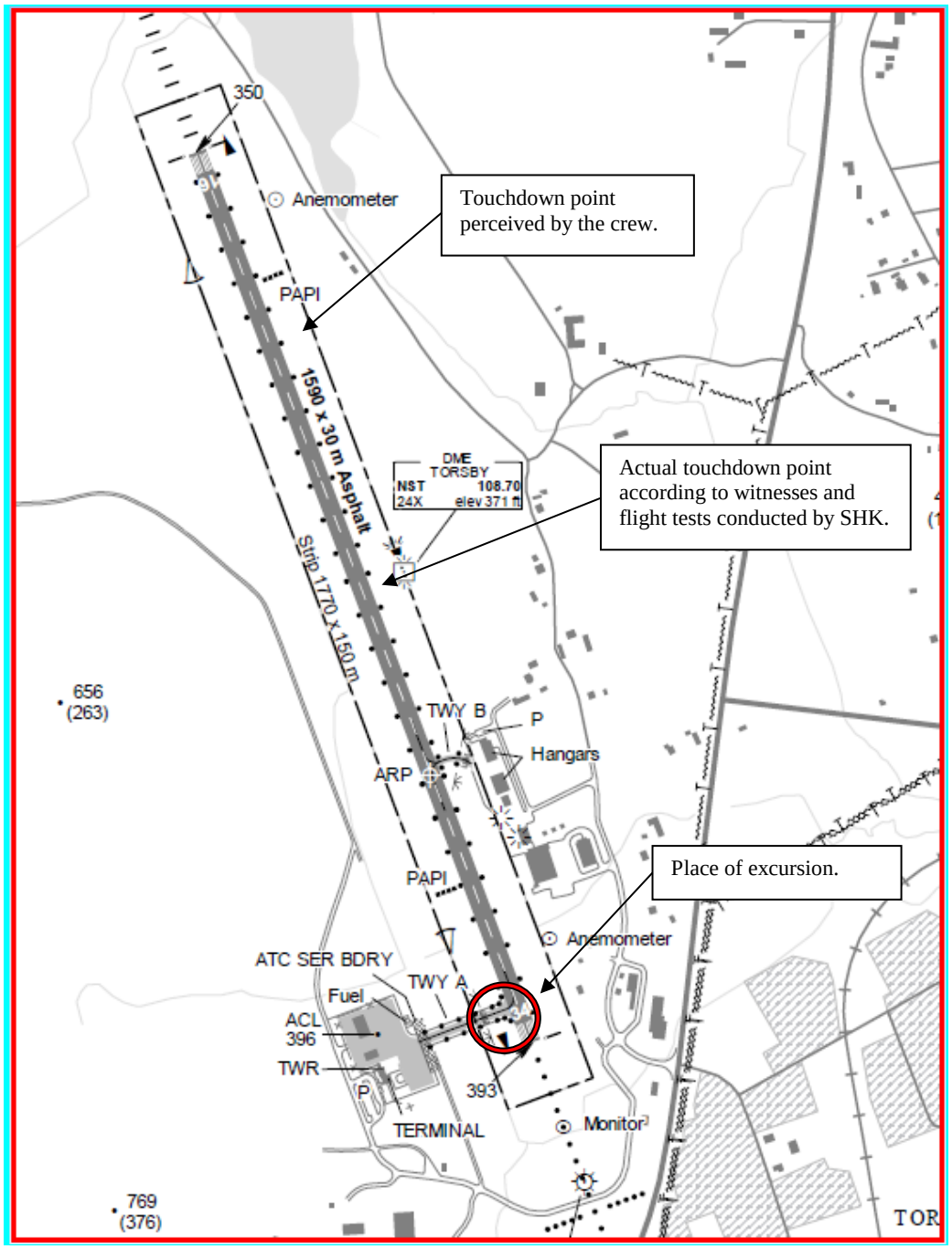

Figure 3. Map of Torsby Airport marked with facts of the event.

1.5 Examinations conducted

1.5.1 Recordings

Flight Data Recorder FDR.

The aircraft was equipped with a flight data recorder (FDR[9]) of type Fairchild F1000 with the capacity to record up to 19 different parameters, where information from the last 25 recorded hours is saved in binary form on internal memory chips. The flight data

[9] FDR – Flight Data Recorder.

recorder is placed in the rear part of the aircraft and has the task of recording flight data for use in the event of a safety investigation by an accident investigation authority.

The FDR in the aircraft had recorded data over the entire sequence of events. However, the operator lacked the necessary documentation to enable a correct read-out. Data on several parameters were not representative and thus not reliable.

The parameters concerned included: speed, the engine rpm and torque, lateral acceleration and outside air temperature. This deficiency was previously known to the operator and was discussed e.g. in SHK Report RL 2014:07e.

Because of the operator's inadequate documentation, SHK has had the FDR data analysed and has performed calculations and corrections in order to establish correct values.

These calculations show that the recorded speed was probably correct and that the probability is high that the touchdown speed was 140 knots.

It is also clear from FDR data that the flight was not stabilised. The values for altitude and speed show that large variations of these parameters have been recorded during the entire approach phase.

Cockpit Voice Recorder – CVR

The aircraft was equipped with a cockpit voice recorder (CVR[10]) of type Fairchild A100A. Sound from microphones in the cockpit is recorded and saved on a protected magnetic tape. The tape consists of a closed loop with a recording time of 30 minutes.

Section 11 of the operator's operations manual, OM A[11], contains instructions addressing both pilots and maintenance personnel to cut the power supply to the aircraft's CVR in the event of an incident deemed to be “serious” in order to avoid stored information being recorded over when the unit is powered up again.

All sounds recorded from the flight in question was however overwritten as the power supply to the cockpit voice recorder was not turned off in time following completion of the flight. The only recordings that remained were of telephone conversations between the commander and the company's technical department some time after the incident. These conversations have been analysed by SHK but have not yielded any factual information of significance to the investigation.

[10] CVR – Cockpit Voice Recorder.
[11] OM A – Operations Manual.

Recordings of radio communications with the air traffic control tower

The radio communication between the aircraft and the air traffic control tower in Torsby has been recorded and secured by SHK. This shows that the current weather and measured friction coefficients were communicated to the aircraft about 15 minutes before the landing.

After the excursion, a dialogue took place between the pilots and the tower regarding assistance from the airport's rescue services, among other things. Other parts of the radio communication confirms the information given by witnesses, but do not add any new factual information to the investigation.

1.5.2 Practical flight tests

In order to establish the probable touchdown point during the landing, SHK has conducted practical flight tests at Torsby Airport. The two airport employees who were witnesses to the event participated at the time of the tests.

By means of the completed flight tests, it has been possible to establish a probable touchdown point of about 800 metres from the end of runway 16.

1.5.3 Runway friction

Friction measurement on the runway was carried out at 18.17 hrs, i.e. 1 hour and 40 minutes before the estimated landing. The values that were measured at that time were 0.25, 0.25 and 0.23. On the basis of this information the snow clearance manager decided that snow clearance operations would be commenced.

Snow clearance was commenced during ongoing snow fall, and at 19.40 hrs a new friction measurement was carried out with the results 0.30, 0.31 and 0.33. Snow clearance then continued for about another 10 minutes. According to interviews with the field staff, this time was mainly devoted to clearance of the edges in order to increase the ploughed width of the runway.

From the last measurement, 17 minutes elapsed during continuous snow fall. For calculation reasons, SHK has therefore made the assumption that the friction coefficient at landing had deteriorated to 0.275, which represents a reasonable value between the previously measured coefficients.

1.5.4 Landing on contaminated runways

General

The regulations regarding landing on wet and contaminated runways contained in the regulations EASA-OPS[12], CAT.POL.A.235 (a) govern only performance calculations for operations on dry and on wet surfaces.

If operations on other surfaces are to be performed, the regulations in Ops CAT.POL.A.235 (b) refer to calculations to be performed in accordance with approved landing data for contaminated surfaces.

Since the data provided by the aircraft's type certificate holder does not contain any calculations for operations on contaminated surfaces, these must instead be performed by the operator if operations will be conducted on runways with contaminated surfaces.

Calculations

The operator is thus responsible for producing operational performance data if activities are to be conducted in areas with winter conditions, where there is a risk of contamination of runways.

The types of contamination caused by meteorological winter conditions that usually require take-off and landing distances to be corrected can be summarised as follows:

- Frost
- Dry, wet or compacted snow,
- Slush
- Dry or wet ice

Normally, air traffic control reports data to aircraft that are taking off and landing regarding the surface of the runway, together with the measured friction coefficient or braking action.

Besides correction of the required runway length with reference to the reported friction coefficient or braking value, correction shall also be made for the type of contamination and the thickness of the covering.

The values reported from air traffic control are used by the crew as initial values for two alternative calculations:

- Calculation of maximum authorised landing mass for a given runway length.
- Calculation of required runway length for a given landing mass.

[12] EASA – European Aviation Safety Agency.

These calculations are usually based on tables for the runway on which the landing is to be performed. These tables contain fixed values such as runway length and runway slope. In addition to adjustments for the condition of the runway (friction coefficient and type of surface) and current landing mass, corrections are also to be made for aircraft configuration (selected flap position and V_{REF}), as well as prevailing meteorological conditions such as wind, temperature and air pressure.

The operator's performance data

During its investigation of the incident with the excursion at Torsby Airport, the investigation team has examined the performance data used by the operator for operations on contaminated runways.

The data has been produced by an external performance calculation company and approved by the national regulator. For the calculation of landing performance, the operator uses tables by which the maximum authorised weight in varying conditions can be derived.

It is evident from the data that a choice can be made only between a dry runway (DRY RWY) and a wet runway (WET RWY) for various flap configurations and wind components. There are no further correction factors for the calculation of maximum authorised landing mass in the operator's data.

Analysis of the performance data used by the operator

In order to analyse the performance data used by the operator, SHK has engaged special expertise. Besides a review of the data, the task of the experts has included calculations regarding the landing in question.

The prevailing weather and current mass upon landing, as well as the friction coefficient 0.275 and V_{REF} 125 knots, have been used as the basis for the calculations.

On the basis of this review, the investigation team has been able to conclude that the operator has not been using any performance calculations for landing on contaminated runways, which in turn must lead to the conclusion that landing under such conditions must not take place.

The review has also shown that the required runway length under the conditions that prevailed would have entailed a minimum allowable length of 1,473 metres. Compared with the available runway length of 1,590 metres, this would have entailed a calculation margin of 117 metres.

However, this margin was not available during the landing in question because the speed was V_{REF} +25 knots, and the touchdown took place 800 metres into the runway.

1.6 Stabilised approach

Under current regulations in the European aviation provisions, all approaches shall be performed according to the concept of "stabilised approach". This is characterised by the approach being controlled within established limits regarding speed, sink rate, deviations from the runway's inbound heading and nominal glide path, engine power and aircraft configuration.

Depending on the aircraft model and type of approach, the operator then establishes the frames of reference and divergences that shall apply for those criteria during the final stage of the approach towards a runway. This results in instructions to be applied at check altitudes , usually at 1,000 and 500 feet respectively above the runway threshold.

At these check altitudes, the pilots verify that the aircraft is stabilised within the limit values that have been established. If the aircraft for some reason is outside these values, i.e., is not stabilised, the approach should be aborted and a "go around" commenced.

The picture in Figure 4 shows how an operator may illustrate the company's application of a stabilised approach. At the FAF (Final Approach Fix) – or where the final approach begins – the aircraft shall be configured according to the established policy, and speed, attitude, position and other parameters shall be within permitted tolerance values.

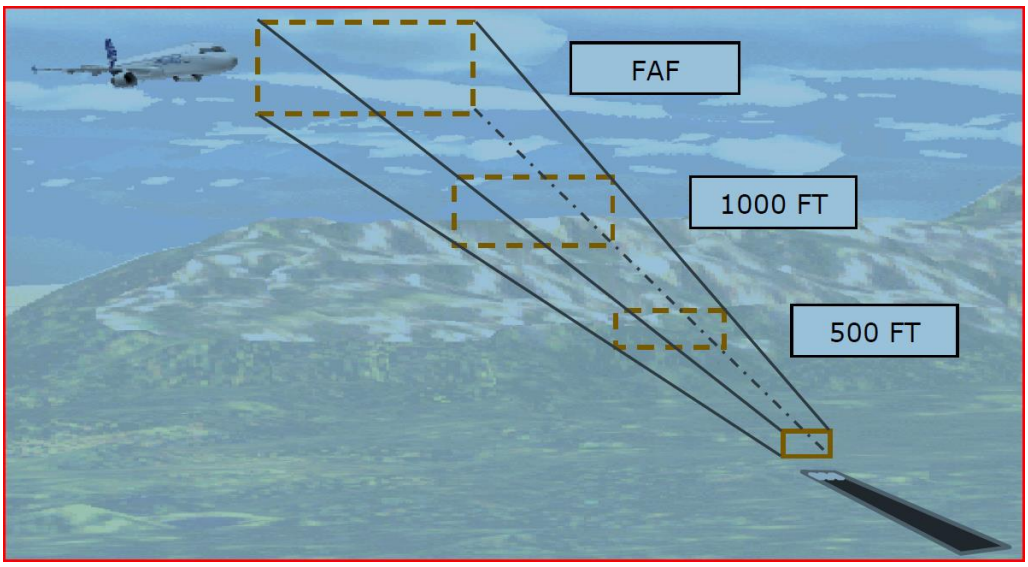

Figure 4. Stabilised approach. Source FAA[13].

These "windows" become gradually smaller at the check altitudes of 1,000 feet and 500 feet in order to be at the ideal values when passing the runway threshold. Some operators also set limit values for the last checkpoint when passing the threshold at 50 feet height.

[13] FAA (Federal Aviation Administration) – the aviation regulator of the United States.

The approach to runway 16 in Torsby was not stabilised with respect to height and speed. Interviews with the crew also made clear that the operator does not apply – or train its crews with respect to – any concept for stabilised approach using check altitudes.

This information given by the crew has been verified against the Operations Manual (OM A) of AS Avies. The manual establishes that all approaches shall be performed as "stabilised approaches". The concept is described in a text which refers to tolerance values for certain parameters. However, the operator lacks a coherent concept for stabilised approach in which established tolerances for pertinent parameters are checked at predetermined altitudes. There are also no directions to the crew regarding procedures to follow if the approach is not stabilised.

1.7 Actions taken – safety recommendation

In its ongoing investigation, SHK has called attention to significant shortcomings of the operator by way of a letter addressed to the Estonian and Swedish civil aviation regulators.

In this context, it should be mentioned that it is the Estonian authority – in the capacity of responsible issuer of the operator's AOC[14] – which has regulatory and oversight responsibility for the company. The Swedish Transport Agency has no such responsibility but may, for example through SAFA[15] inspections, check the safety and quality of different aspects of the operations.

The letter contained a safety recommendation to both regulators to conduct relevant operational inspections of the operator, whether separately or jointly, or take other appropriate measures to ensure that relevant performance calculations for operations on contaminated take-off and landing runways are used by the operator.

The responses of the concerned regulators can be summarised as follows:

The Swedish Transport Agency has, with reference to this recommendation, conducted SAFA inspections of the operator, specifically focused on performance calculations. Through these it was possible to note shortcomings in the data for such calculations. The report from this inspection has been followed up with a letter to the Estonian regulator, Lennuamet, in which the Swedish Transport Agency requests that immediate measures be taken to ensure that the operator uses a correct basis for performance calculations, or that Lennuamet limit or revoke the Air Operators Certificate of AS Avies.

The Estonian regulator Lennuamet has, with reference to the safety recommendation, responded that AS Avies has demonstrated that

[14] AOC – Air Operators Certificate.
[15] SAFA – Safety Assessment of Foreign Aircraft.

relevant performance calculations are used by the operator to secure operations on contaminated take-off and landing runways.

1.8 Actions taken – the operator

After the safety recommendation issued by SHK, a manual with performance data has been produced on behalf of AS Avies for operations on contaminated surfaces. The manual was developed by a hired consultant and contains tables and correction data for the operator's aircraft of the models BAe Jetstream 31/32.

The performance data produced was submitted by the operator to the regulator Lennuamet on 24 October 2014 for review and approval. Already on that same day, the response was given to the operator that the proposed correction tables were approved for use and that the data was to be distributed to the pilots.

The manual is of a generic type, i.e. only general calculation bases have been produced. This means that the pilots must enter all conditions manually for operations at a specific airport, such as runway lengths, slopes, height above sea level, etc.

It is standard that operators present this kind of information in an RPM (Route Performance Manual) containing all the airports to which an operator flies in the form of separate pages for each runway. In this way, the pilots can quickly consult tables for the runway in question and, for example, find the mass they can land with under the prevailing conditions.

However, as far as is known, the operator still does not use complete performance calculation data in the form of an RPM.

1.9 Time plan

SHK's work continues with some supplementary fact-gathering and analysis work.

The final report is expected to be published in the spring of 2015.

On behalf of the Swedish Accident Investigation Authority,

Hans Ytterberg Stefan Christensen