Investigation report

C7/2006L

Veering Off the Runway at Seinäjoki Airport on 11 December 2006

Translation of the Finnish original report

OH-ATB

ATR 42-500

Onnettomuustutkintakeskus
Centralen för undersökning av olyckor
Accident Investigation Board

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SUMMARY

An incident occurred at Seinäjoki airport on 11 December 2006 at 20:56 (all times in this report are Finnish time) when an ATR-42 airliner momentarily veered off the side of the runway during its landing roll. There were 27 passengers and 3 crew members onboard. Accident Investigation Board Finland appointed an investigation commission for this occurrence. Investigator Jouko Koskimies was named investigator-in-charge, accompanied by air accident investigator Hannu Melaranta as member of the commission. MSc Markku Roschier and Dr. Päivikki Eskelinen-Rönkä, a phonic expert, were invited to participate in the work of the commission.

At 20:50 on 11 December a Finnish Commuter Airlines' ATR-42, on its scheduled route from Helsinki to Kokkola with a stopover at Seinäjoki, was approaching Seinäjoki runway 32 in gusty crosswinds at dark. According to ATIS information wind was 180 degrees 12 knots, maximum 22 knots. When the aircraft called Outer Marker (PSJ) inbound the AFIS officer reported the previous two minutes' average wind: 190 degrees 10 knots, maximum 16. Because this wind information did not exceed the limitations of the flight manual the captain decided to land on runway 32. Halfway through the landing roll the aircraft suddenly and strongly veered to the left. Despite the flight crew's best efforts at approximately 700 m from threshold the aircraft veered off the 30 m wide runway. The left main landing gear travelled approximately 115 m at ca. 2 m from the edge of the paved surface on the 2.5 m wide sand/gravel runway shoulder, leaving a few centimetres-deep rut in the gravel. The landing gear hit and destroyed two runway edge lights and its anti skid wiring was cut. The captain managed to steer the aircraft back onto the runway, whereafter he taxied to the apron. After the damage to the aircraft was inspected the following leg of the flight was cancelled.

At 22:44 the Seinäjoki AFIS officer reported the occurrence to Area Control Centre (ACC) South Finland, which in turn alerted Accident Investigation Board of Finland (AIBF) at 22:47. At 23:00 AIBF contacted Seinäjoki State local district police and requested that they visit and investigate the scene. Both pilots were breathalysed and their results indicated zero blood alcohol.

The investigation established that the aircraft had no such defect that could have caused the occurrence. At the time of the incident the weather was cloudy and humid. Winds were southerly and gusty. The runway was wet, albeit with good braking action.

A chain of events with several interrelated factors caused the aircraft to veer off the runway. These factors included:

- The decision to make a downwind landing,
- A strong gust of wind from the left, approximately halfway through the landing roll, which caused the aircraft to unexpectedly bear to the left,
- The wetness of the runway, which allowed the aircraft to skid sideways,
- The runway was not wide enough for the flight crew to steer the aircraft back toward the runway centreline,
- The pilot attempted to straighten out the aircraft by using the rudder. However, as speed decreased the rudder effect alone was insufficient,
- The captain did not hear the co-pilot call "70" and, hence, engaged the nose wheel steering too late, and
- The captain's limited experience as pilot-in-command of an ATR.

The investigation commission issued one recommendation to EASA.

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ABBREVIATIONS

AFIS	Aerodrome flight information service
AIP	Aeronautical Information Publication
Annex	Annex of the Civil Aviation Convention
ATIS	Automatic Terminal Information Service
BEA	Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile; the French organisation for technical investigations of civil aviation accidents and incidents
CRM	Crew resource management
CVR	Cockpit voice recorder
DFDR	Digital flight data recorder
DME	Distance measuring equipment
EASA	European aviation safety agency
EFES	Area Control Centre, South Finland
EFSI	Seinäjoki Airport
EGAR	Electronic gross weight analyzer
ESARR	Eurocontrol safety regulatory requirement
FDR	Flight data recorder
FMS	Flight management system
ft	feet
GEN	General
GPS	Global positioning system
hPa	Hectopascal
IAL	Instrument Approach and Landing
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
ILS	Instrument landing system
JAR	Joint aviation requirements
MEL	Minimum equipment list
NDB	Non-directional radio beacon
PHI	Occurrence reporting form (ATS)
QNH	Altimeter setting
VHF	Very high frequency
VOR	VHF omnidirectional radio range

SYNOPSIS

On 11 December 2006 a Finnish Commuter Airlines ATR 42-500 passenger aircraft, registration OH-ATB, was on a scheduled flight from Helsinki to Seinäjoki from where the flight was to continue to Kokkola. The aircraft's callsign was Westbird 287S. There were 27 passengers and 3 crew members onboard.

An incident occurred during landing at Seinäjoki aerodrome when the aircraft veered off the paved runway onto the left side's sand/gravel runway shoulder during the landing roll. The left main landing gear broke two runway edge lights and its anti skid wiring was cut. The captain was able to steer the aircraft back onto the runway. After the damage was inspected the remaining leg to Kokkola was cancelled. The aircraft stayed overnight at Seinäjoki and was flown back to Helsinki the following morning.

All times in this investigation report are Finnish time. The incident occurred at 20:56. The Seinäjoki AFIS officer reported the occurrence to ACC South Finland at 22:44, which in turn alerted Accident Investigation Board of Finland (AIBF) at 22:47. AIBF requested Seinäjoki police to dispatch a patrol to the site. On 12 December AIBF ordered that a preliminary investigation shall be made.

On 15 December 2006 AIBF decided to appoint an investigation commission, C7/2006L, to this occurrence. Investigator Jouko Koskimies was named investigator-in-charge, accompanied by air accident investigator Hannu Melaranta as member of the commission. MSc Markku Roschier and Dr. Päivikki Eskelinen-Rönkä, a phonic expert, were invited to participate in the work of the commission.

The course of events was established from the accounts of both of the pilots and the AFIS officer, landing gear tracks on the runway shoulder, the police patrol report and Cockpit Voice Recorder (CVR) data. Documents were used to determine the situation with the airport and its equipment, the condition of the aircraft, crew proficiency and training as well as the operator's regulations at the time of the occurrence. Because of a malfunction in the Digital Flight Data Recorder (DFDR) it was impossible to download any information recorded on it.

On 15 January 2007 the investigation commission dispatched a Notification of a Serious Incident to BEA, the French aviation accident investigation authority. BEA appointed Mr. Emmanuel Delbarre as their acredeted representative to the investigation.

On 16 January 2007 a written list of shortcomings detected in the Seinäjoki aerodrome communications recorder was sent to the Finnish Civil Aviation Authority.

Pursuant to the Accident Investigation Decree, a draft investigation report was promulgated for statement to the Finnish Civil Aviation Authority, Finavia, Seinäjoki aerodrome, EASA and BEA, and for familiarization and comment, to Finnish Commuter Airlines and other parties concerned. Statements and comments were received by 11.6.2007 and they have been taken into account in the report.

The investigation was completed on 19.6.2007 and the report was translated into English.

The material used in the investigation is filed at Accident Investigation Board of Finland.

1 FACTUAL INFORMATION

1.1 History of the Flight

Westbird 287S departed Helsinki at 20:17. It was the first flight of the flight crew's shift. The aircraft reached flight level (FL) 200 at 20:32. They were cleared to reporting point TALUG, the Initial Approach Fix for an ILS instrument approach to runway 32 at Seinäjoki. At 20:39 the pilots obtained Seinäjoki ATIS information Alfa, which read as follows:

> *"This is Seinäjoki information Alfa 18.20, transition level 60, wind 180 degrees 12 knots, maximum 22 knots, variable between 140 and 250 degrees, visibility 20 kilometres, light rain, few 1300 feet, broken 1600 feet, temperature 5, dew point 4, QNH 990, advise on initial contact you have information Alfa"*

The information was identical to the 20:20 Seinäjoki METAR. In the 20:50 METAR wind was 190 degrees 10 knots, maximum 21 knots. However, the flight crew never received this information.

At 20:44 the ACC gave the following clearance:

> *"Westbird 287S, when ready, cleared for descent, QNH 990, transition level 60."*

The aircraft acknowledged the clearance. At 20:49 the ACC instructed the aircraft to contact Seinäjoki AFIS, whereafter the following radio communication ensued:

> *"Seinäjoki information, good evening, Westbird 287S, we are passing 9000 feet, descending down to 2100, we have QNH 990 and information Alfa, estimate TA-LUG 53."*

> *"Hyvää iltaa, Westbird 287S, Seinäjoki flight information, no reported traffic, QNH 990, transition level 60, runway wet, braking action is good, report PSJ."*

The captain later said that he had informed the AFIS officer of his intention to fly an ILS approach to runway 32. However, no such report is recorded on the CVR. The AFIS officer, too, confirms this in his account. Nevertheless, this can not be heard from Seinäjoki aerodrome communications recordings.

The approach to Seinäjoki runway 32 continued at dark in gusty cross-tailwinds. The flight crew used the EGAR application on their cockpit portable computer and calculated that landing in these conditions on runway 32 was permissible. Further calculations indicated that the maximum wind from 180 degrees could be 20 knots. Otherwise it would push the tailwind component past 15 knots, which is the maximum permissible in the airplane's flight manual. Should the wind exceed 20 knots, they would have to fly a circling approach to runway 14.

The captain said in his account that when they were determining which runway to use, the tailwind component was more critical than the crosswind component. The ATR-42's maximum demonstrated crosswind component is 30 knots. The captain notes in his account that the maximum permissible crosswind component at Seinäjoki is 20 knots. According to him this limitation was marked in the pre-26 November 2006 revision of the

Jeppesen ILS 32 instrument approach chart used by the company. When the flight crew calculated the values for landing they used this limitation.

The flight crew performed the ILS 32 approach checklist. They also double-checked the circling approach weather minimum for runway 14, in case the tailwind component for runway 32 exceeded the maximum. When asked, the captain said that whenever a direct approach to runway 32 was possible they would rather not fly a circling approach, and especially not an NDB approach, to runway 14. Runway 14 is short and equipped with only a low intensity approach lighting system. High intensity approach slope indicators make it, however, easier to establish visual contact with the runway. Only a few NDB approaches are flown to runway 14.

The aircraft passed Outer Marker (PSJ) inbound at 20:54 and reported this to the AFIS officer who, in turn, replied:

> *"Westbird 287S, runway 32 is free, wind now 190 degrees 10 knots, maximum 16 knots, and 10% lights on."*

This wind information corresponded to the previous two minutes' average wind measured by the anemometer and the maximum to the strongest gust detected during this time. The AFIS officer compared this information with the ATIS information and, noting that the data was identical, reported no further weather information. Having received the wind data the captain decided to land on runway 32 because the reported wind was within the permissible range and braking action was good. The crew did not inform the AFIS officer of their decision to land on runway 32. They decided to use approach speeds for icing conditions because the meteorological conditions warranted it. Threshold speed was calculated at 112 knots for their weight.

According to the crew's statement the final approach was fairly bumpy and the weather was light rain. The co-pilot informed the captain that the flight management system calculated the wind at 200 degrees 30 knots at approximately 400 ft. The crew performed the final check as per the manual. Due to gusty winds the captain tried to maintain 120 knots during the approach. This was based on section 2.4.1.7 of the Operator's Manual (OM-B), according to which 1/3 of the wind speed or the total speed of the gust itself is to be added to the approach speed. The approach was flown with the nose pointing into the wind, aligning the aircraft with the runway centreline immediately before touchdown (de-crab technique). During the final stage of the approach the co-pilot called out altitudes as per the manual. Due to the cross-tailwind the pilot made an intentionally firm touchdown on the runway centreline. The crew said that they touched down at the normal point, i.e. approximately 300 m from the threshold. When the co-pilot called "low pitch", the captain prepared to apply reverse thrust. Later, he was not sure whether he had used reverse thrust. The propeller noise in the CVR recording indicates that some reverse thrust was applied. The co-pilot, too, thought that the captain had done so.

The aircraft landed at 20:56. Halfway down the landing roll the nose unexpectedly swung 10-15 degrees to the left. The captain later said that he tried to recover the change of direction by using full rudder. The co-pilot called out "70", indicating 70 knots. This is when the captain is supposed to engage nose wheel steering. The captain did not hear this call and continued using the rudder in an attempt to prevent the aircraft from veering off the runway. Nevertheless, at about 700 m from the threshold, the air-

craft left the paved surface and went onto the approx. 2.5 m wide sand/gravel runway shoulder. The runway edge lights are on this shoulder at 1.4 m from the edge of the pavement. The edge of the pavement is approximately 5 cm above the gravel shoulder, forming a clear lip.

The left main landing gear travelled approximately 115 m on the gravel, 2.2 m from the edge of the pavement at most. The gravel shoulder was wet and here and there the wheels left 2-4 cm deep ruts in the sandy gravel. No nose wheel marks were detected. Two runway edge lights were broken and the left main landing gear anti skid wiring was cut. The captain managed to turn the aircraft back onto the runway by using nose wheel steering. The co-pilot said that when he saw the captain struggling to keep the aircraft under control, he helped a little by applying the right wheel brake and by pushing the control wheel fully to the front and left. They recounted that at this stage they still did not know whether they had departed the paved section of the runway.

As the captain was taxiing to the apron, he asked the AFIS officer whether they had departed the runway. The AFIS officer said that he could not tell for sure but that the aircraft had swerved on the runway *("it looked pretty bad"*). As he vacated the runway, the captain observed that not all of the runway edge lights were on and, therefore, asked the AFIS officer to dispatch someone from airport maintenance to check the situation.

Figure 1. Broken runway edge lights

Airport maintenance checked the runway. Appendix 1 includes the Seinäjoki landing chart (published by Jeppesen) and Appendix 2 shows a diagram of the tracks that the aircraft left, drawn in accordance with airport maintenance personnel observations.

Airport maintenance detected the wheel ruts on the runway shoulder as well as the two broken runway edge lights. The first light that was struck was completely separated from its base. The second light was bent. The AFIS officer reported this information to the captain.

As they were taxiing to the apron, the co-pilot reported that the left main landing gear anti skid warning light was on. When it became apparent that they had hit something, the captain disengaged the CVR circuit breaker to ensure that the recorded data be saved. The flight crew checked the aircraft and noticed the damage on the left main landing gear. The captain reported this to the company. After the damage was noted the passengers disembarked. The following leg of the flight to Kokkola was cancelled.

A mechanic from the company's maintenance department flew on the night flight from Helsinki to Seinäjoki. He inspected the landing gear and the damage. He detected that the anti skid wiring was cut. Furthermore, the landing gear also displayed some minor damage (section 1.2). Pursuant to the Minimum Equipment List (MEL) it was possible to use the aircraft in scheduled traffic even with the anti skid system out of service. The aircraft stayed overnight in Seinäjoki and resumed service on the morning of 12 December, when it was flown to Helsinki as a scheduled flight.

Figure 2. The damage detected on the left main landing gear. The arrow points the damaged anti skid wiring.

Seinäjoki AFIS reported the occurrence to ACC South Finland at 22:44, which relayed the information to AIBF at 22:47. At first the ACC had the impression that the incident

had taken place immediately before they received the report. Approximately 10 minutes later, after having called Seinäjoki AFIS by phone, they learned the correct time of the occurrence. At approximately 23:00 AIBF requested Seinäjoki State district police to visit the site and perform a police investigation and a breathalyzer test on the crew. The breathalyzer test showed zero blood alcohol for both pilots.

The captain recounted the incident to AIBF's Chief Air Accident Investigator over the phone at around 23:00 on 11 December 2006. That same night, in accordance with Finnish aviation regulation GEN M1-4, he also filed a company Occurrence Report. AIBF received the report on 12 December 2006.

The AFIS officer reported the occurrence to the Finnish Civil Aviation Authority by using a GEN M1-4 deviation and occurrence report (PHI form). The CAA forwarded this report to AIBF.

On 12 December the flight data recorders were removed from the aircraft and handed over to AIB Finland.

1.2 Damage to the aircraft

During an inspection the following damage, caused by the aircraft hitting two high intensity runway edge lights, was detected:

- The left main landing gear anti skid wiring was cut,
- Small, spotlike scoring was detected on the innermost left wheel rim,
- There was a dent on the outermost left wheel bearing cap,
- There was a dent on the left main landing gear front shroud, and
- There were small shards of glass or glass dust on brake housings.

There was no other damage to the aircraft.

1.3 Other damage

Two high intensity runway edge lights were damaged on the left side of runway 32 (appendix 2). The outermost wheel on the left main landing gear struck runway edge light no. 49, 720 m from the threshold. This light separated from its base and flew farther away. The wheels of the left main landing gear passed on both sides of the following runway edge light, no. 50. This light, 780 m from runway 32 threshold, was bent. Since the next aircraft to land in Seinäjoki was on its way, the lights were repaired between 22:00-23:00.

1.4 Personnel information

OH-ATB pilot-in-command	Age 27
Licences:	JAR Air Transport Pilot's Licence, valid until 3.11.2011
Medical certificate:	JAR class 1, valid until 20.6.2007
Ratings:	All required ratings were valid.

Flying experience	Last 24 hours	Last 30 days	Last 90 days	Total hours
All types	0.8 h	58 h	154 h	1871 h
Type in question	0.8 h	58 h	154h	612 h

OH-ATB co-pilot Age 31
Licences: JAR Air Transport Pilot's Licence, valid until 31.1.2008
Medical certificate: JAR class 1, valid until 4.1.2007
Ratings: All required ratings were valid.

Flying experience	Last 24 hours	Last 30 days	Last 90 days	Total hours
All types	2.9 h	60 h	173 h	1305 h
Type in question	2.9 h	60 h	173 h	505 h

Seinäjoki AFIS officer: Age 53
Licences: AFIS officer, valid until 18.10.2007.
Commercial pilot's licence, valid until 17.8.2010
Medical certificate: JAR class 2, valid until 24.8.2007
Ratings: AFIS rating for EFSI (Seinäjoki aerodrome), radiotelephony in English, aircraft single-engine land, night rating. The AFIS officer received his AFIS rating in 1995. He had worked as an AFIS officer at Seinäjoki since 1998.

1.5 Aircraft information

Type	ATR 42–500
Registration	OH-ATB
Owner	EPL Aircraft Lease Two Oy
Operator	Finnish Commuter Airlines Oy
Manufacturer	Avions de Transport Régional, France
Serial number	643
Certificate of registration	No. 1942
Certificate of airworthiness	Valid until 28.2.2007

No defects or malfunctions were detected in the aircraft or in its systems prior to the occurrence. After the occurrence, the co-pilot noticed that the left main landing gear anti skid warning light was on.

1.6 Meteorological information

On 11 December a strong southwesterly air flow prevailed over Finland with winds gusting to 30 knots on the coast of the Gulf of Bothnian and to 20 knots inland. The cloud

base in the Seinäjoki area was 1300–1600 ft. Visibility was over 10 km and the weather was light rain.

Observed weather (METAR) at Seinäjoki aerodrome (Finnish time) was as follows:

19:50:
Wind 180 degrees 9 knots, variable between 140-250 degrees, visibility over 10 km, light rain, cloud 1–2/8 1200 ft (360 m), 5–7/8 1500 ft (450 m), temperature +5, dew point +4, QNH 990 hPa.

20:20:
Wind 180 degrees 12 knots, maximum 22 knots, variable between 140–250 degrees, visibility over 10 km, light rain, cloud 1–2/8 1300 ft (390 m), 5–7/8 1600 ft (480 m), temperature +5, dew point +4, QNH 990 hPa.

20:50:
Wind 190 degrees 10 knots, maximum 21 knots, variable between 130–240 degrees, visibility over 10 km, rain, cloud 5–7/8 1400 ft (420 m), temperature +5, dew point +4, QNH 990 hPa.

As the aircraft passed Outer Marker inbound at around 22:54 it was told that the two minute wind average was 190 degrees 10 knots, maximum 16 knots.

21:50:
Wind 190 degrees 11 knots, variable between 090–270 degrees, visibility over 10 km, rain, cloud 5–7/8 1400 ft (420 m), temperature +5, dew point +4, QNH 989 hPa.

22:20:
Wind 190 degrees 11 knots, maximum 22 knots, variable between 130–270 degrees, visibility over 10 km, light rain, cloud 1–2/8 1300 ft (390 m), 5–7/8 1600 ft (480 m), temperature +5, dew point +5, QNH 989 hPa.

Seinäjoki TAF for 20:00–02:00 was as follows:

Wind 180 degrees 11 knots, visibility over 10 km, light rain, cloud 5–7/8 1400 ft (420 m), TEMPO visibility 5 km, cloud 5–7/8 800 ft (240 m).

Wind forecasts for coastal weather stations at the same time were:

- EFPO 200 degrees 16 knots, maximum 28 knots
- EFVA 200 degrees 20 knots, maximum 32 knots
- EFKK 200 degrees 17 knots, maximum 27 knots.

1.7 Communications

Seinäjoki aerodrome (EFSI) radiotelephony communications (VHF 123.600 MHz) as well as the direct landline telephone connection to ACC South Finland (EFES) were working properly.

Radiotelephony and telephone conversations are recorded on aerodrome recorders. The recorder in question is a single reel, 10 channel analogue Magnasync/Moviola communications recorder. It was purchased in 1992. It records radio traffic on the frequencies 123.6, 119.7, 121.5, 131.8 and 445.175 as well as Seinäjoki–EFES and Seinäjoki–Kauhava aerodrome telephone conversations. The timestamp data format is

hour/minute/second. The relevant communications were transcribed for the investigation commission.

EFES recorded EFSI–EFES telephone conversations. They, too, were transcribed for the commission.

Communications had no effect on the occurrence.

1.8 Aerodrome information

Seinäjoki airport is an aerodrome operated by the Rengonharju foundation. There is one asphalt-paved runway: 32/14, 1543 m long and 30 m wide. The size of the grass covered runway strip is 1663 x 150 metres. Elevation is ca. 90 m (300 ft). The bearing of runway 32 is 316º (310 degrees magnetic) and the bearing of runway 14 is 136º (130 degrees magnetic).

An ILS instrument approach system, a two-beacon NDB approach system, high intensity approach path indicators and high intensity approach and runway lights exist for runway 32. A single NDB beacon, low intensity approach lights and high intensity approach path and runway lights exist for runway 14. The aerodrome's navigation equipment was flight-calibrated on 21 August 2006. No irregularities were detected and all equipment was in proper working order. The airport has a navigation equipment maintenance contract with the service provider Finavia.

Seinäjoki airport provides Aerodrome Flight Information Service (AFIS). An AFIS officer provides this service. The Civil Aviation Authority's Air Navigation Services unit had audited Seinäjoki airport on 1 October 2002, 18 May 2005 and on 14 December 2006. Staff qualifications were checked in accordance with ESARR 1. The official instrument procedures are ILS/NDB 32 and NDB 14.

The airport area and equipment have been inspected, with the most recent audit taking place on 7–8 December 2000. The airport does not have a document of certification from aviation authorities. Instead, on 4 January 2006 they were granted an extension until 31 December 2010 to draw up any still required documents and to host a certification audit. On 25 October 2006 FCAA issued a construction permit to the Rengonharju foundation to widen the runway from 30 m to 45 m as well as to extend it from 1540 m to 2000 m. The work is in progress and it is expected to be completed in 2009.

1.9 Flight recorders

OH-ATB was equipped with flight recorders, manufactured by L3-Communications (USA). The recorders were the following type:

- Digital Flight Data Recorder (DFDR), part no. 2100-4043-00, serial no. 00032 6441
- Cockpit Voice Recorder (CVR), part no. 2100-1020-02, serial no. 000354 263

The captain turned the CVR off after the occurrence. Both recorders were removed from the aircraft as it arrived in Helsinki. They were delivered to AIBF.

The CVR was downloaded on 8 January 2007 under the supervision of the investigation commission. The device had worked properly and the quality of the recording was good. The investigation commission's expert analysed the recording. The recording was instrumental in establishing the course of events as well as the actions of the flight crew and the AFIS officer.

The DFDR could not be downloaded due to a malfunction in the device itself.

1.10 Aircraft and occurrence information

Immediately after the occurrence Seinäjoki airport maintenance inspected and photographed the damage to the runway lights. Because the next aircraft was expected to arrive before midnight the damage was repaired by then.

The aircrew and the company's technical personnel inspected the damage to the aircraft immediately after the occurrence. At that time it was noted that the following leg to Kokkola had to be cancelled. The aircraft was towed into a hangar. A company mechanic arrived on the night flight and inspected the landing gear and the damage. The aircraft stayed overnight in Seinäjoki and was flown to Helsinki on the morning of 12 December as a scheduled flight.

AIB Finland requested Seinäjoki police to visit the site. They arrived at approximately 23:00 and investigated the site and photographed the tracks and damage.

1.11 Detailed information

Seinäjoki aerodrome radio communications and EFES telephone communications were analysed by the investigation commission. The recordings helped to establish the course of events. The Seinäjoki communications recorder, however, had not recorded telephone conversations or the timestamp. The investigation commission reported this to the Finnish Civil Aviation Authority in written form. At the behest of the FCAA, the recorder's settings were inspected and adjusted in January 2007.

The downloading of the DFDR in Helsinki did not succeed. A member of the investigation commission took the recorder to a BEA laboratory in France, where it was detected that the device itself was defective and that there was no way to download the data. The flight data recorder was then sent to its manufacturer, accompanied with the request to analyse the recording for the investigation commission. On 26 February 2007 they replied that a serious malfunction had been discovered in the power unit and that this had damaged the memory unit. Therefore, it was not possible to download and analyse the recorded data.

1.12 Organizational and management information

1.12.1 The company

The company uses Helsinki-Vantaa airport as its designated home base. The company's headquarters are in Seinäjoki, where flight coordination and Operations Control also occur. Flight operations management and maintenance are in Helsinki.

The company's Operating Licence (OL), FIN 1/98-1, was in effect until further notice and its Air Operator Certificate (AOC), FI-018, is valid until 15 September 2008. The AOC was linked to a continuous airworthiness monitoring organization for its Embraer 145 and ATR 42-500 fleet.

Previously, the company only operated Embraer 145 and Mitsubishi MU-2 aircraft. The Swedish Golden Air airline operates the SAAB 340 fleet under the auspices of its own AOC. Finncomm Oy designated the crews for Golden Air's scheduled routes in Finland, and also took care of their Operations Control.

In December 2006 the following aircraft comprised the company's fleet:
- 2 Embraer ERJ-145LU
- 4 ATR 42-500
- 4 Saab 340, operated by Golden Air.

The ATR 42 aircraft were introduced in late 2005. In conjunction with the procurement, the company's pilots received type conversion training at the manufacturer's plant in France. For the purpose of providing flight training in Finland, the company established the Finncomm Training Academy, an auxiliary responsible for training flight crews for the ATR fleet on Finnair Oyj's ATR 72 simulator and on Finncomm Oy's ATR aircraft. The company's own instructors as well as Finnair Group's simulator instructors, outsourced from Finnair, provided theoretical and flight training.

CAAA accepted the company's manuals. During 2006 several changes took place in the company's organization, leading to rotations in postholder positions within the company. At the end of 2006 the Flight Operations Manager, the Manager Quality Control, the Training Manager and the Maintenance Manager had only recently assumed their posts. When this incident occurred the postholders' changeover process was still ongoing.

1.12.2 Pilot training

The pilot-in-command

The pilot-in-command had completed the manufacturer's type conversion course during the summer of 2005. Line flying under supervision began on 14 December 2005 and it was successfully completed after 22 flights on 9 January 2006. The line check for co-pilot duties was flown on 10 January 2006.

The pilot-in-command completed captain training in the autumn of 2006. Line flying under supervision was provided 7–11 November 2006 on 22 flights altogether. The line check for captain's duties was flown on 13 November 2006.

According to the company's own OM-A, a JAR rated captain must, among other things, have 1500 total flight hours, of which 500 instrument hours are on a multi-engine and multi-crew aircraft.

The co-pilot

The co-pilot had completed the manufacturer's type conversion course. Line flying under supervision began on 20 February 2006 and was successfully completed after 34 flights on 21 March 2006. The line check for co-pilot duties was flown on 22 March 2006.

2 ANALYSIS

2.1 The technical condition of the aircraft

A technical defect, such as brakes jamming, tyre damage, nose wheel steering malfunction or asymmetric reverse thrust, could have caused the aircraft to depart the runway. However, no malfunctions had been detected prior to the flight. Nor were any such defects detected during the post-flight inspection. The flight crew felt that the aircraft and its equipment functioned as was to be expected. The captain did not recall whether he applied reverse thrust. The co-pilot, however, thought that the captain had used some reverse thrust, and the CVR recording corroborates his opinion. No such defects or malfunctions existed on the aircraft or in the equipment which could have caused the aircraft to veer off the runway.

2.2 Flight characteristics and controllability

According to the flight manual and the pilots the flight characteristics and controllability of the ATR-42 were normal. The crosswind final approach technique entails pointing the nose into the wind in order to remain on the runway centreline. Just before the wheels touch down the aircraft is aligned with the runway (de-crab technique). Sufficient extra airspeed must be maintained in gusty crosswind conditions. On short runways it is recommended that an intentionally firm touchdown be made. With this technique the main landing gear oleo struts compress, the nose wheel can be lowered to the ground sooner and breaking can commence without delay. The pilot has to use quite a lot of physical force in order to control the aircraft during crosswind takeoffs and landings.

The ATR-42's maximum demonstrated crosswind component is 30 knots and the maximum tailwind component is 15 knots. According to the manufacturer the maximum demonstrated takeoff tailwind component during test flights is 24 knots and 22.7 knots during landing, respectively.

The captain notes in his account that the maximum crosswind component at Seinäjoki is 20 knots due to the aerodrome's limitations. According to him this limitation was marked in the Jeppesen runway 32 ILS instrument approach chart that used by the company. The chart which was valid at the time of the occurrence did not list any such limitation. Neither it was in the former chart, which expired on 23 November 2006. Jeppesen answered the question made by AIB that they have never published side wind component limitations on their instrument approach charts. The instrument approach charts published in AIP Finland do not have any crosswind component limitations. Nor was this limitation marked in the company's OM-A or OM-B valid at the time of the occurrence. The crosswind component limitation in OM-B (section 1.4.2.1) refers to contaminated runways and it does not mention runway width. The investigation did not reveal the source of the limitation mentioned by the captain.

According to the ATR-42 flight manual the control column must be pushed fully forward after touchdown. This reduces the angle of attack and lift and increases the efficiency of nose wheel steering. In crosswind conditions it is necessary to use aileron braking to

stay on the runway centreline. This is accomplished by turning the control wheel into the wind. There are no limitations for using flaps.

Due to its narrow track (4,2 metres) and high centre of gravity, the ATR-42 exhibits some lateral instability. A high wing aircraft is sensitive to crosswind gusts. In order to maintain direction the pilot must be alert during takeoff and landing rolls. During landing direction is maintained with the rudder until the speed bleeds off to 70 knots. At this point the captain engages nose wheel steering. According to the manufacturer 70 knots is not a critical limit and nose wheel steering can be used at speeds above that. Nevertheless, one must be careful in order to avoid oversteering. The airplane flight manual, however, does not mention this and only states that nose wheel steering can be engaged at or below 70 knots. Nose wheel steering must be used no later than 40 knots. Wheel brakes can be used whenever required.

Reverse thrust during a downwind landing weakens rudder effectiveness and may also impair directional aerodynamic control.

Suspicions have been raised with regard to the ATR's wing spoilers' negative effect to aileron breaking force in crosswind conditions. The representatives of BEA consulted the aircraft manufacturer and reported that no such adverse effects have been detected.

The aircraft's instrumentation and equipment are fairly versatile. The CVR recording shows that, especially while preparing for approach, the flight crew is kept busy with numerous Flight Management System (FMS) and performance calculation tasks, demanding good system familiarity. The systems and applications, however, are themselves easy to operate.

The ATR-42 is not an especially demanding aircraft to fly, but it is not easy either. Both pilots had logged over 500 flight hours on the ATR. This fulfilled the company's requirement and can be considered sufficient.

2.3 Flight crew and AFIS officer performance and training

Despite the tailwind the captain decided to fly a direct ILS approach to runway 32. When the AFIS officer provided wind data to the aircraft as they were passing Outer Marker inbound the calculated tailwind and crosswind components were within flight manual limitations. Wind velocity in the AFIS officer's report, however, was clearly below that of the ATIS report. If calculated with the values in the ATIS report the tailwind component would have reached the maximum and, possibly, even exceeded it. Therefore, a circling approach to runway 14 would have been justified. Nevertheless, since wind varied between 130–240 degrees there are no grounds to recalculate the actual wind angles or components ex post facto. Since the average wind at the time of the incident was 180–190 degrees the crosswind component would have been roughly the same in a downwind or headwind landing.

The crew later said that they had indeed considered a circling approach to runway 14. However, the wind report they received when passing locator PSJ, 190 degrees 10 knots, maximum 16 knots, allowed them to fly a direct approach without breaking any limitations. Moreover, since the maximum gusts in the previous two hours' weather re-

ports had been 21–22 knots the captain's decision to fly a direct approach to runway 32 might also have included some expectations with regard to the wind remaining in the permissible range.

When it comes to feeder traffic, schedules are generally tight. Direct approaches reduce the time spent in instrument approach procedures and taxiing. This may easily lead to a culture of trying to use every possibility to fly direct approaches. This, in turn, may tempt pilots into taking risks. A company's safety culture must, however, always prefer flight safety before other points of view.

The Seinäjoki runway is only 30 m wide. This, however, fulfils ATR's type requirements. At the time of the occurrence the runway was wet, albeit breaking action was good. The aircraft touched down on the centreline and so there were 15 m of paved surface on both sides on which to correct any possible directional deviation. It can be difficult to recover from an unexpected directional deviation on a narrow runway; hence, one must be alert in order to succeed at it. The pilots said that they cooperated in trying to steer the aircraft back onto the runway. The left main landing gear wheels sank several centimetres into the wet sand/gravel runway shoulder in places which made the aircraft pull to one side and made it more difficult to return it to the paved surface. The aircraft also skidded a little sideways on the runway. The CVR recording playback contains a noise that obviously generated when the left outer wheel hit the runway edge light. The co-pilot said that when he saw the captain struggling to keep the aircraft under control he helped some by applying the right wheel brake. Since the DFDR could not be analysed, it was not possible to estimate at which angle the aircraft veered off the runway, when the captain engaged nose wheel steering, how strong his steering input was and what the effect of this was in managing to steer the aircraft back onto the runway.

The captain had received his ATR captain rating approximately one month before the incident. He had flown as captain for some 60 hours on the left side on the flight deck, where the nose wheel steering is. Even though he had amassed over 1800 flight hours, including 600 hours on the ATR, he was relatively inexperienced as an ATR captain. He had no previous experience with comparable situations, which may have affected his reaction time. Furthermore, he did not hear the co-pilot call "70" which delayed the use of nose wheel steering. Even so, nose wheel steering was effective and, as per the captain's account, it was fairly easy for him to steer the aircraft back onto the runway.

Circling approaches to EFSI are flown in simulator training. However, the flight crew said that crews generally want to avoid flying these because circling approaches, among other things, are considered difficult. A circling approach takes the aircraft over a wooded area where, in the dark and in adverse weather, it is difficult to establish visual cues and it is easy to lose visual contact with the runway. The low intensity approach lighting system for runway 14 is short. However, the high intensity precision approach path lights are good and make it easier to perform the approach.

Pilots who were interviewed consider the single beacon NDB approach to runway 14 difficult and they are rarely flown. The FMS data base doesn't include the NDB 14 approach procedure. Therefore it has to be flown manually. The captain of the aircraft said that he had flown NDB 14 approach only once during the past three years. The same applied to the co-pilot. Since pilots evidently dislike flying circling approaches and NDB

approaches to runway 14, sufficient attention should be paid to practicing them in order to avoid risky alternatives.

Crew Resource Management (CRM) during the approach and landing was conducted as per regulation. The analysis of the CVR proved that the flight crew followed normal procedure. However, the aircraft veered off the runway so suddenly that the pilots acted for the most part on instinct and, when asked, they could not recount everything they did. In this case the analysis of the CVR proved to be beneficial. The DFDR recording could have provided more detailed information on the track of the aircraft, forces of acceleration, directions and control inputs. Unfortunately, it was impossible to download the DFDR.

As regards radio communications it can be said that they did not fully comply with regulations issued for AFIS aerodromes. According to the pilot and the AFIS officer the flight crew reported their intention to fly an ILS approach to runway 32. However, no such report is recorded on the CVR or on the ATC communications recorder. Furthermore, the aircraft omitted the landing report on the short final (Civil Aviation Administration: Aviation VHF radio communications 2004, p. 139). This is, however, a minor shortcoming.

The AFIS officer was very familiar with the airport and its conditions. When it comes to wind information, he only had access to the regular weather monitoring system close to the south-eastern corner of the runway. On the other side of the runway, opposite to the air control tower, there is a windsock which can be illuminated. With it, it is possible to provide a rough estimate of surface wind direction and velocity. According to AIP Finland the windsock's directional accuracy is approximately 30 degrees and velocity accuracy ca. 5 knots. When velocity of surface wind exceeds 10 knots the estimation is no longer reliable. Therefore estimates are generally not used as the grounds for reporting wind data. The AFIS officer acted responsibly and in accordance with valid regulations when he provided the aircraft with information affecting the conduct of flight. The only site from where he received wind speed and gustiness data was at the anemometer, 300 m from runway 32 threshold.

There was some delay with the reporting of this occurrence. As per GEN M1-4 this occurrence constituted a "serious incident", requiring the pilot-in-command to report the occurrence without delay to the relevant ATS organ as well as to AIB Finland by phone. It was not until around 23:00, when the pilot-in-command telephoned, that a representative of AIB Finland got word of the incident. The AFIS officer reported the incident to ACC South Finland at 22:45, even though he should have done so immediately. The ACC reported the incident to AIB Finland at once. The investigation commenced only after this. Nonetheless, no significant harm was done.

2.4 Meteorological information

Flying weather was relatively good. Visibility and cloud base would have permitted a circling approach to runway 14. In the 20:50 METAR wind was 190 degrees 10 knots, maximum 21 knots. As the pilot passed Outer Marker (PSJ) inbound and made his decision to land on runway 32 he did so on the basis of the wind information of the previous two minutes, as was reported to him by the AFIS officer.

Based on the provided wind data the relative wind angle was approximately 135 degrees. Hence, a 16 knot gust would have produced an 11 knot crosswind component as well as an 11 knot tailwind component. Correspondingly, in a 21 knot gust, both wind components would have been 15 knots. These are still within the limitations of the flight manual.

The cup anemometer is at a height of 16.8 m on the ILS localizer tower. The tower itself is 298 m from the runway 32 threshold. It is placed so as to indicate wind direction and speed at the touchdown point. Gusts elsewhere in the movement area go undetected. They may be surprisingly strong and unforeseen in weather patterns that produce high, gusty winds. The Seinäjoki runway is surrounded by trees, which normally generate turbulence during strong winds. The airport buildings are on the west side of the runway and may generate some wind channelling. When the investigation commission travelled to Seinäjoki, a cold front was passing overhead and they experienced very strong, although localized, gusts. These observations support the estimates that a strong and a very localized gust could have developed when the incident occurred. The airport staff, too, has made comparable observations.

Forecasted wind at the time of the occurrence was 180 degrees 11 knots. No specific gustiness was included in the forecast. Seinäjoki METARs, however, show that gusts exceeding 20 knots had been continually observed throughout that evening. Based on this, it is probable that the gust that hit the aircraft was stronger than 16 knots, the last data reported to the aircraft. Gusts exceeding 30 knots were detected at coastal airports. However, surface friction caused by terrain and vegetation slows down the gusts in inland areas.

A strong gust of wind from the left caused the aircraft to veer off the runway. The gust hit the vertical stabilizer and the rudder pushing the empennage and thus turning the nose to the left. The pilot was not able to correct the change of direction in time.

2.5 Aerodrome, runway and aids to navigation

Seinäjoki aerodrome complies with ICAO Annex 14 classification. The airport provides Aerodrome Flight Information Service (AFIS). A CAA-certified AFIS officer provides this service. The main operator at the airport is Finncomm. The airport also endeavours to attract charter traffic. In addition to Finncomm, two other companies as well as a flight club operate from Seinäjoki. In 2005, 1990 landings were made at Seinäjoki and 1699 in 2006. Landings made outside the airport's business hours are not included in these numbers.

The runway is paved with asphalt. On each side of the runway there is an approx. 2.5 m wide sand/gravel shoulder. The bearing capacities of the shoulders vary, especially, when wet. A 150 m wide grass-covered graded area surrounds the runway and shoulders. There are no stopways. One could not even be constructed to the north end of the runway without having to reroute a nearby road. The runway is built on a ridge and its bearing capacity is good. The runway will be widened to 45 m and extended to 2000 m from the southeast end. There is a marshy area at the south-eastern clearway, requiring fairly extensive earthworks. The project is expected to be completed in 2009.

Many of the company's pilots consider landing in Seinäjoki difficult in certain weather conditions. The runway is narrow and the prevailing wind directions often call for cross-wind approaches and takeoffs. In this case the narrowness of the runway was a contributing causal factor to the aircraft's departing the pavement. The runway reconstruction project will improve flight safety at Seinäjoki.

Seinäjoki has an aerodrome operating permit, but the airport has not been audited. The required documents have been delivered to the Finnish CAA and an audit is planned for the near future.

The airport has the aids to navigation required for regular IFR operations. The ILS as well as high intensity approach lights make approaches to runway 32 easy and safe. Once the runway reconstruction project is completed, there are plans to procure new ILS/DME equipment. A GPS-based RNAV approach procedure is expected to be approved by the end of this year. Both modernization projects will make it easier to fly approaches, especially, to runway 14.

The airport does not have an ATS operating permit, but the Finnish CAA Air Navigation Services unit did conduct a safety oversight audit in Seinäjoki on 18 May 2005. They also conducted an audit on 14 December 2006, after the incident in question occurred. As a service provider Seinäjoki airport is responsible for complying with official regulations. As per separate agreement the airport procures the maintenance of navigation equipment, including other relevant services, from Finavia. A new, more extensive contract is being prepared.

Finavia is responsible for organizing aerodrome navigation equipment calibration flights. No aberrations in the functioning of said equipment are reported. Finavia plans and develops the flight procedures.

In Finncomm's OM-A Seinäjoki airport is listed as class A. The aerodrome has a certified instrument approach procedure, the runway has no takeoff or landing limitations, the published circling approach minimum is below 1000 ft and night operations are permitted. No additional or special training is required of flight crews to fly to Seinäjoki.

Finncomm Ltd uses Jeppesen instrument approach charts as they are in its flight operations. To some extent Jeppesen's minima differ from those published in AIP Finland.

Neither the aerodrome classification nor licenses had any effect on the incident.

2.6 Flight recorders

Cockpit Voice Recorder (CVR)

The CVR functioned as it should and it was possible to download and analyse the recording. The CVR recording was done with a Fairchild Solid State flight data recorder. The digital recorder's total capacity was 120 minutes. The memory of the device is partitioned in such way that the data stream for the last 30 minutes of sound is saved in a high quality, unpacked format. The voice data from all audio channels for the remaining time (90 min) is compressed (i.e. packed) and stored on the memory boards.

When it comes to auditive and technical quality of the CVR recordings, unpacked compressed and uncompressed packed audio data are not auditively or qualitatively fully equal. The compression algorithms as well as channel-specific frequency response conversions significantly affect data quality. In the process of compression and combining different channel information, it is especially detrimental for audio analysis when the frequency response of the area channel is being degraded as much as 2 500 Hz. A significant amount of cockpit voice information is lost in the conversion.

Information contained on the memory boards can be directly downloaded to digital file with appropriate software. This way, each channel's audio data is preserved as specified on the recorder. It is also possible to download the entire memory unit as a single analogue audio signal, combining the audio stream from all channels. The use of this download method can introduce problems to audio analysis because the channel-specific information is lost. Based on channel-specific information many important specific analyses and conclusions can be made such as, for instance, identifying the speaker of single word expressions at critical points. Furthermore, it is possible to determine which person performed particular acts on the basis from which side of the cockpit the sounds of pilots' movement came or the sounds of switches etc. came (the FDR does not discriminate between pilots). In addition, the volume of radio transmissions is higher than the volume of intercom communication, because traffic volume is prioritized over spoken information. During busy radio communications the situation is extremely annoying because the louder radio traffic almost completely eclipses the pilots' intercom communication.

Digital Flight Data Recorder (DFDR)

The DFDR was a Fairchild FA2100 solid state digital flight data recorder, manufactured by L-3 Com. It records a minimum of 25 hours of flight data. The device was superficially intact. The downloading process was done in Helsinki with L-3 Com's own portable downloader. Since the process requires onboard electricity, the recorder was not removed from the aircraft. In the end, it was not possible to download the recording. The downloader itself was tested on another DFDR and it was deduced that it was not defective. Since the company did not have the required information for downloading and converting the data into technical units they had to ask the manufacturer for information. This slowed the process down. JAR-OPS 1.160 does in fact require that flight operators have the necessary information at their disposal.

When the data could not be downloaded in Finland the recorder was delivered to a BEA laboratory in France. They attempted to download the data by using the manufacturer's software as well as BEA's own portable downloader, but to no avail. When asked, the manufacturer's representative thought that the DFDR was defective.

After this the DFDR was sent to the manufacturer, accompanied with the request to download the recording for the investigation commission. On 26 February 2007 the manufacturer reported that their repair department found the unit had a catastrophic failure in the unit power supply. This cause several circuit board failures along with the Crash Survivable Memory Unit (CSMU). They said that it was impossible to download the recording and that they would repair the device which was under warranty.

The missing DFDR data hampered the investigation. Furthermore, some of the details of the incident had to be inferred. AIBF has encountered recorded time and location errors in two previous investigations of the same company. The company was not aware that the DFDR was malfunctioning. According to the manufacturer's maintenance manual the device's parameters as well as its functioning must be tested during each C-maintenance. The C maintenance cycle is 4 000 hours, i.e. the same as the manufacturer's recommendation. Finland has not issued national maintenance requirements for DFDRs and, therefore, the manufacturers' recommendations are followed here. The 4 000 hour maintenance cycle corresponds to approximately two calendar years in the airline's operations. The ATR fleet was introduced in November 2005. In other words, the company did not overlook the DFDR's inspection cycle.

Although Annex 6 requires that FDRs be inspected annually, it also states that manufacturers may issue their own instructions. Nevertheless, the DFDR recording is invaluable as it provides so much information with regard to analysing accidents and incidents that operators should make every effort to ensure the proper installation and functioning of this equipment. It is the opinion of the investigation commission that operators, one way or another, should ensure that the flight data recorders always function properly. Otherwise, in the case of an incident or accident, they are of no benefit.

2.7 Already implemented measures

The Finnish CAA intervened in the company's activities and regulations by ordering the airline to review them. On 9 January 2007 the company issued, among other things, the following OM-A amendments, effective immediately:

- Captain and co-pilot rating and flying experience requirements were raised.
- The following wind limitations were added:
    - When the runway is less than 40 m wide, 10 knots are to be subtracted from the crosswind component,
    - On runways less than 2000 m long, the tailwind component limitation is 10 knots.
- An NDB approach to runway 14 in Seinäjoki is a mandatory line training requirement, and
- Flight crews have to review flight procedures.

Regarding long term action the company is planning, among other things, better type conversion syllabi, improvements in aircraft system familiarity and in pilot selection, higher quality company training as well as training for the flight safety manager.

When it comes to Seinäjoki airport, the runway construction project is ongoing, new equipment procurement is planned and the new RNAV approach procedure is forthcoming.

The investigation commission believes that these measures are justified and that they focus on the shortcomings that the commission has brought forward with regard to the incident in question. Therefore, the commission does not list them in its recommendations.

3 CONCLUSIONS

3.1 Findings

1. The airworthiness certificate and the certificate of registration were valid.
2. The pilots had valid licences and the required qualifications.
3. The AFIS officer had a valid licence and an AFIS officer qualification for Seinäjoki aerodrome.
4. Visibility and cloud base were good. However, the wind was extremely gusty and came from the side.
5. The captain's decision to make a downwind landing on runway 32 was based on the reported wind data, which did not exceed the limitations of the airplane flight manual.
6. Shortly beyond the touchdown point during the landing roll, the aircraft suddenly turned to the left.
7. The captain could not manage to recover from the change of direction by applying the rudder.
8. Despite the crew's efforts, the left main landing gear slipped approximately 2 m off the runway asphalt pavement onto the sand/gravel runway shoulder. The aircraft travelled approximately 115 metres on the shoulder.
9. The left main landing gear hit two runway edge lights. The first light (720 m from runway 32 threshold) broke loose and was flung off. The second light (780 m from threshold) was bent.
10. The impact with the second runway edge light cut the left main landing gear anti skid wiring.
11. Once the captain engaged nose wheel steering he managed to steer the aircraft back onto the runway.
12. When they were taxiing to apron the co-pilot noticed that the left main landing gear anti skid warning light was on.
13. After parking the aircraft the captain disengaged the CVR circuit breaker, thus saving the CVR recording.
14. As per GEN M1-4, the captain reported the occurrence on the company's form. However, he did not immediately notify the occurrence to AIB Finland.
15. As per GEN M1-4, the AFIS officer made a deviation and occurrence report (PHI form). However, it was not until two hours later that he reported the occurrence to ACC South Finland.

The ESARR Severity Classification Scheme of this incident is B (safety of the aircraft has been compromised).

3.2 Probable cause

A chain of events, with several interrelated factors, caused the aircraft to veer off the runway. This includes the following (in chronological order):

- The decision to make a downwind landing,
- A strong gust of wind from the left, approximately halfway through the landing roll caused the aircraft to unexpectedly bear to the left,
- The wetness of the runway allowed the aircraft to skid sideways,
- The width of the runway, in deteriorating conditions, was not sufficient to enable correcting the plane's direction of travel,
- The pilot attempted to recover the change of course by using the rudder. However, as speed decreased, the rudder effect alone was insufficient,
- The captain did not hear the co-pilot call ”70” and, hence, he applied nose wheel steering too late, and
- The captain had limited experience as pilot-in-command of an ATR.

4 RECOMMENDATIONS

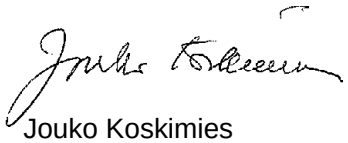
In this report the investigation commission has brought forward shortcomings which bear direct relevance to the incident's causal chain of events. Some of them are physical, beyond human control. Others relate to training or to technical issues, or to aerodrome structures. Since the Finnish Civil Aviation Authority, the company and the airport operator have already implemented corrective action, the investigation commission does not list these shortcomings in its recommendations.

On the basis of observations with regard to flight recorder functioning and the quality control of recordings, the investigation commission makes the following recommendation:

> *1. The investigation commission recommends that EASA investigate the prevalence of flight data recorder malfunctions and, depending on the results, consider shortening the applicable maintenance cycles in order to ensure continuous proper functioning of flight data recorders.*

Justifications: The Digital Flight Data Recorder (DFDR) in question had possibly been damaged during faulty installation. No tests were carried out to ensure the proper functioning of the device. Furthermore, in two other investigations AIB Finland noticed that flight data recorders did not function as required. The aircraft manufacturer has designated 4000 h as the C-maintenance cycle for this equipment, which translates into two calendar years for this type of operations. The investigation commission considers this cycle too long. It is the proper monitoring of the installation and technical condition of flight recorders that ensure their proper functioning and the availability of recorded information for occurrence investigation.

Helsinki 19.6.2007

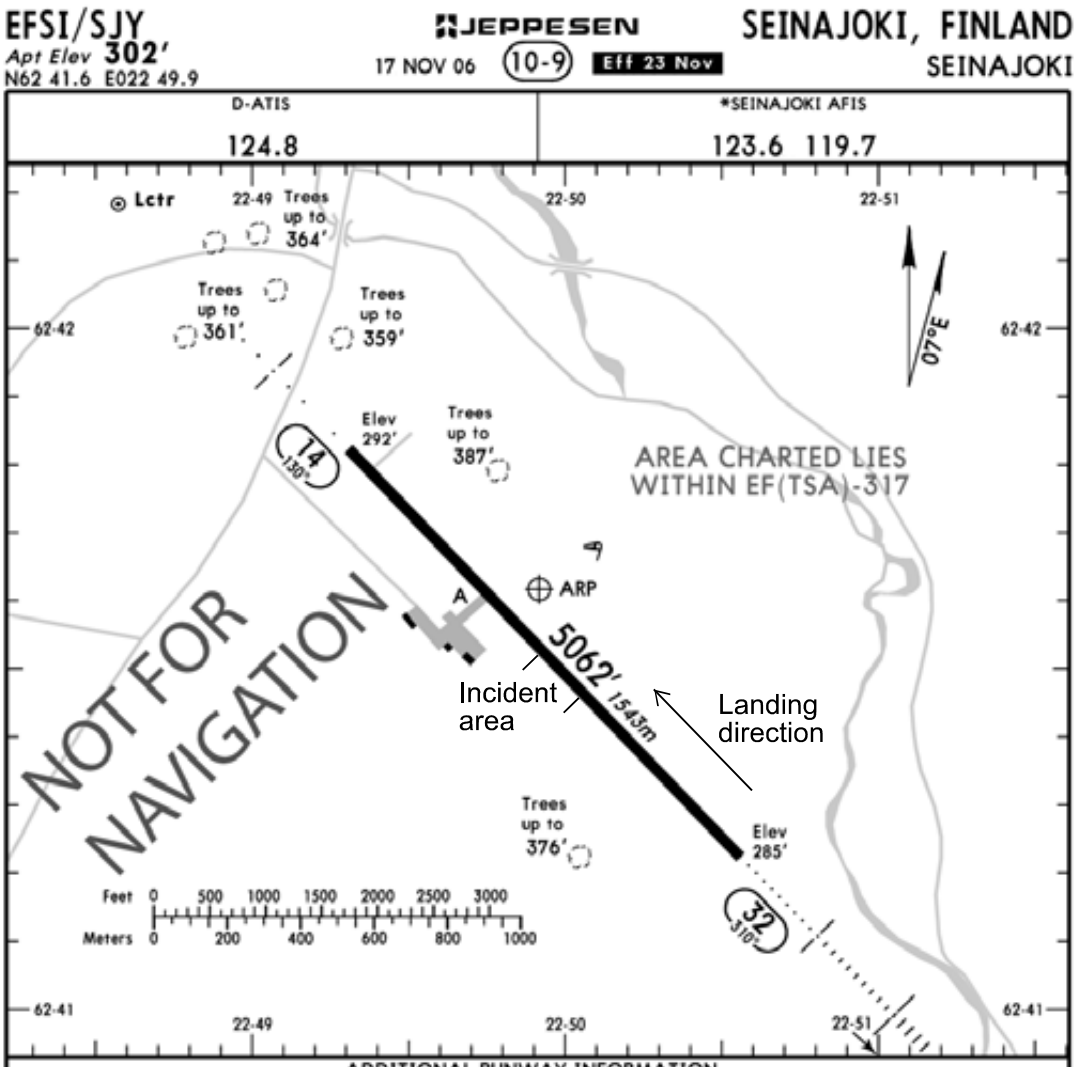


Jouko Koskimies

Hannu Melaranta

Seinäjoki aerodrome landing chart, used by the airline

(Reproduced by courtesy of Jeppesen Sanderson, Inc.)



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS — LANDING BEYOND — Threshold	Glide Slope	TAKE-OFF	WIDTH
14	HIRL ALS PAPI-L (angle 3.0°) RVR			❶	98' 30m
32	HIRL HIALS PAPI-L (angle 3.0°) RVR		4170' 1271m		

❶ TAKE-OFF RUN AVAILABLE
RWY 14:
From rwy head 5062' (1543m)
twy A int 3406' (1038m)

JAR-OPS

TAKE-OFF ❶ & DEPARTURE PROCEDURE

	All Rwys		
	LVP must be in Force		
	RCLM (DAY only) or RL	RCLM (DAY only) or RL	NIL (DAY only)
A B C	250m	400m	500m
D	NOT APPLICABLE		

❶ Operators applying U.S. Ops Specs: CL required below 300m.

OMNIDIRECTIONAL DEPARTURE PROCEDURE

RWY 14: Climb STRAIGHT AHEAD to minimum turning alt 710'.
(CIO) Close-In Obstacle: trees up to 380' (N62 40.9 E022 50.7)
RWY 32: Climb STRAIGHT AHEAD to minimum turning alt 690'.
(CIO) Close-In Obstacle: trees up to 364' (N62 42.1 E022 49.0)

CHANGES: D-ATIS established.

Appendix 2

A diagram illustrating how the aircraft veered off the runway

1. Wheel marks on the runway shoulder begin ca. 15 m before light fixture no. 49. The shoulder is approximately 2.5 m wide. The distance from the edge of the pavement to the light fixture is 1.4 m.
2. Light no. 49 was flung off because the left main landing gear hit it.
3. Wheel ruts continue almost directly toward light fixture no. 50. The maximum distance of the tracks from the edge of the pavement is ca. 2 m.
4. Landing gear wheels pass on both sides of light no. 50. The impact cuts the anti skid wiring.
5. The aircraft returns to the runway approximately 40 m past light no. 50.
6. There are no nose wheel tracks.
7. The main landing gear track gauge is 4.1 m. The track between the nose wheel and the main landing gear is 2.05 m.