Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2009:18e

Incident to Aircraft LN-RPA at Luleå/Kallax airport, Norrbotten county Sweden, on 27 February 2007

Case L-02/07

SHK investigates accidents and incidents with regard to safety. The sole objective of the investigations is the prevention of similar occurrences in the future. It is not the purpose of this activity to apportion blame or liability.

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Statens haverikommission (SHK) Swedish Accident Investigation Board

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Statens haverikommission
Swedish Accident Investigation Board

2009-12-04 L-02/07

The Swedish Transport Agency

SE-601 73 NORRKÖPING, Sweden

Report RL 2009:18e

The Swedish Accident Investigation Board has investigated an incident that occurred on 27 February 2007 at Luleå/Kallax airport, BD län (Norrbotten county), to an aircraft registered LN-RPA.

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

The Swedish Accident Investigation Board will be grateful to receive, by 1 July 2010 at the latest, particulars of how the recommendations included in this report are being followed up.

Göran Rosvall Lars Alvestål

Stefan Christensen

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Appendices:

1. Transcript of radio communication

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L-02/07
Report finalised 4 December 2009

Aircraft; registration and type	LN-RPA, Boeing 737-600
Class, airworthiness	Normal, valid Certificate of Airworthiness
Registered owner/Operator	Luleå Co, Cayman Islands/SAS, Scandinavian Airlines
Time of occurrence	27.02.07, time 06:20 in darkness Note: All times are given in Swedish standard time, UTC + 1 hour)
Place	Luleå/Kallax airport, BD län (Norrbotten county), (posn. 65° 32.6'N, 022° 07.4'E, 20 m above sea level)
Type of flight	Commercial air transport
Weather	According to the SMHI (Swedish Meteorological and Hydrological Institute) METAR at 06:20: Wind 30°/03 knots, visibility 800 m in snow grains, RVR runway 14: 1500 m, broken cloud with base at 300 feet, temp./dewpoint M04/M04°C, QNH 1005 hPa
Persons on board:	
crew members	5
passengers	88
Injuries to persons	None
Damage to the aircraft	None
Other damage	None
Commander:	
Age, licence	44 years, ATPL
Total flying time	9200 hours, of which 3800 hours on type
Flying hours previous 90 days	185 hours, all on type
Number of landings previous 90 days	44
Co-pilot:	
Age, licence	45 years, CPL
Total flying time	6050 hours, of which 2500 hours on type
Flying hours previous 90 days	101 hours, all on type
Number of landings previous 90 days	31
Cabin crew members	3

The Swedish Accident Investigation Board (SHK) was notified on 5 March 2007 that an aircraft with registration LN-RPA had an incident at 06:20 hours on 27 February at Luleå/Kallax airport, BD län (Norrbotten county).

The accident was investigated by SHK represented by Göran Rosvall, Chairperson, Stefan Christensen, Investigator in Charge and Lars Alvestål , operations investigator from 6 September 2007. On 1 August 2008 Lars Alvestål took over the responsibilities of the Investigator in Charge. Stefan Christensen thereafter acted as operations investigator. From 1 October 2009 Pia Jacobsson acted as MTO[1] investigator. Ola Svenson and Hans Landström were MTOexperts.

The investigation was followed by Ulrika Svensson, Swedish Transport Agency, Aviation Department (previously the Swedish Civil Aviation Authority).

[1] Människa Teknik Organisation – Man-Technology-Organisation (Human Factors)

Summary

The flight concerned. with callsign SK001, was planned from Luleå/Kallax airport to Stockholm / Arlanda with departure at 06:00. Shortly before departure the commander programmed the aircraft's computer system for runway 32 according the data obtained during the initial contact with air traffic control. At the same time, the co-pilot conducted an external inspection of the aircraft.

When the aircraft left the gate the commander requested taxi to the de-icing ramp. During taxiing to the de-icing the ATCO asked if SK001 wanted runway 14 for take-off instead. Because of interference from simultaneous communication activities, the response from SK001 is not possible to discern from the recorded conversation from air traffic control, which was been secured in connection with the incident. SK001 was given a time slot when the flight must be airborne, which was found to have had a stressful effect on the course of events.

When the aircraft requested clearance to taxi to the holding point at runway 14, this was acknowledged by the crew. During the same period, the visibility at the airport had deteriorated to such an extent that the ATCO could not see the aircraft. When the aircraft came out to the taxiway it turned left and taxied towards runway 32, while the ATCO gave route clearance with departure route for runway 14. The names of the departure routes for runway 14 and 32, consists of seven characters of which six are identical. The crew had conducted four performance calculations for the flight, where the last calculation was for runway 14 during taxiing to the runway 32.

When the aircraft was approaching runway 32 the crew notified that they were ready for take-off at full length runway 14. The ATCO gave clearence for take-off runway 14 which is also was acknowledged correctly by the crew. At 06:20 SK001 took off from runway 32.

The investigation was hampered due to the recorded conversation from the cockpit was not available since the incident was first reported the day after it happen when the recording had been overwritten. Interviews with those involved and the analysis of the recordings from the airport's communication have not proved to be sufficient to give a definitive answer regarding the causes of the incident.

The various alternatives that may have prompted the incident shows clearly that the interaction between pilots (CRM - Crew Resource Management), has not worked satisfactorily at the take-off. The cause of the incident were deviations from the CRM concept, mainly with regards to internal and external communications.

Recommendations

It is recommended that the Swedish Transport Agency should:

- Nationally and internationally work for to develop the system of naming SIDs with the aim of minimising the risk of them being confused, (RL 2009:18 *R1)*

- Consider present existing recommendations relating to route clearance at the gate are upgraded to specifications. (RL 2009:18 R2).

- Investigate the feasibility of the introduction of stop bars at relevant Swedish airports, (RL 2009:18 R3).

- Investigate the feasibility for implementation of systems – at relevant Swedish airports - that will allow ATCO to determine where an aircraft is situated at the airport. (RL 2009:18 R4)

- Ensure that signage for take off positions at Swedish airports to be reviewed in order to minimize the risk of taxiing incorrectly, (RL 2009:18 R5).

1 FACTUAL INFORMATION

1.1 History of the incident

The flight concerned, call sign SK001, took off from runway 32 despite the crew having been given permission to take off from runway 14.

The flight was the first of the day for both the crew and the aircraft. It was also the first departure of the day from Kallax. The flight crew checked in at the airport at 05:15.

The flight crew planned the flights for the day and agreed that the commander would be the Pilot Flying (PF) for this particular flight. The co-pilot carried out the External Inspection (EI) of the aircraft that was required before flying.

The air traffic control officer (ATCO) began the shift at 19:30 the evening before the incident. There was a room available for resting at the control tower, and after some delays the ATCO could go to bed at about 01:00. The ATCO was then able to sleep until about 04:40 in the morning, and then to prepare for the first arrival. The ATCO felt “normally tired” on that particular morning.

At 05:44 the commander requested information from the control tower concerning the current weather, etc. He was told that runway 32 was in use, that the wind was at 050 degrees, 2 knots, air pressure 1005 hPa, temperature minus 3°C and dewpoint minus 4°C. The braking coefficients [3] on the runway were 39, 31 and 41 with rime frost, and there was a risk that the braking coefficients for the taxiways could fall to 20. There is no information on whether the co-pilot was in the cockpit or outside conducting the external inspection, EI, while the commander was receiving this information.

The slot time[4] that had been allocated was 06:05, which meant that the take-off would have to be no later than 10 minutes after that time, i.e. no later than at 06:15.

After having received this first information from the control tower, the commander programmed the aircraft computer system (FMS[5]) for a take-off from runway 32 and also for the departure route via the expected climb out procedure called VERAG 3 C (see Figure 5). The computer system in the aircraft is so designed that a runway must be selected before one can select a standard departure route (SID[6]). In addition, the checklist for this particular aircraft type, a Boeing 737, is arranged so that the crew is assumed to programme the runway and departure route into the computer system before the engines are started.

The crew did not request any operational clearance while the aircraft was standing at the gate.

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[3] The braking coefficient is a measure of the friction measured on the runway. Braking coefficients of 30-40 are defined as moderate to good, while a braking coefficient of 20 is defined as poor.
[4] Slot time: Specific times assigned to departures. The aircraft must take off no more than 5 minutes before and no later than 10 minutes after this time. The purpose of slot times is to control the traffic flow, for example in airspace or arrival time at destination.
[5] FMS: Flight Management System, an on-board computer system that is programmed with flight routing, weights, etc.
[6] SID: Standard Instrument Departure. Verag 3C is for example an SID.

Soon after the information had been received from the control tower, the flight deck crew performed a first performance calculation (TODC[7]) before the forthcoming take-off. This first calculation was performed while the aircraft was still parked at the terminal and was in respect of runway 32; the calculation was for a dry runway. The commander decided that the whole runway would be used for take-off.

Altogether four TODC calculations were performed before the actual take-off, of which two were in respect of runway 32 and two of runway 14. All four calculations were made on the basis of the entire runway being used. The calculations are included in the radio traffic transcript at Appendix 1. It has not been determined whether the two calculations that were carried out in connection with the de-icing - the first for runway 32 and the other for runway 14 – were performed by the commander or the co-pilot. In situations like the present, where taxiing permission has not yet been obtained, it can be considered as practice to perform calculations for the various options that may be possible at take-off.

At 05:53 the ATCO telephoned to SAS Ground Services (SGS), the ground servicing organisation for SAS, and asked whether anyone had sent a delay message regarding SK001. According to the interview, the ATCO was at that stage quite sure that SK001 would not manage to meet its slot time.

At about 05:57, SK001 requested permission to start engines, push back and taxi to the de-icing ramp.

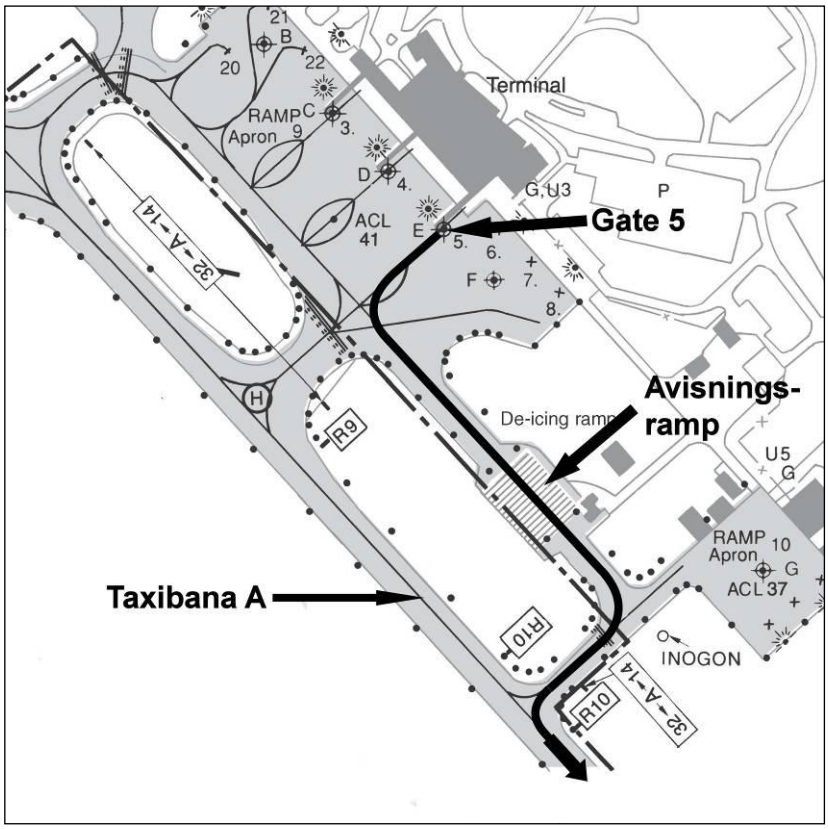

Figure 1. The civil aircraft ramp area at Kallax and the actual taxi route of SK001

[7] Take-Off Data Calculation. A calculation that is performed before each take-off showing such factors as maximum take off mass, flap setting, take off speeds, etc.

(Figure annotations:
Gate 5
De-icing ramp
Taxiway A)

The ATCO could see the aircraft during the push back manoeuvre. After this the visibility reduced considerably.

The scheduled departure time for SK001 was 06:00. The aircraft left gate 5 at 05:58.

After the request from SK001 to taxi to the de-icing ramp, the ATCO provided new braking figures, 41-31-39. When the new braking figures had been acknowledged from the aircraft, the ATCO invited the crew to take off from runway 14 by saying: "You may use runway 14 for take-off." Neither the crew nor the ATCO remembered in detail the response to this invitation. The commander seemed to remember that he asked the co-pilot to answer "stand by" (wait) to this invitation, but the exact response that was given is not clear, nor is it possible to discern it from the recorded conversation, since the ATCO was at the same time talking on the telephone about a slot time. SK001 then taxied to the de-icing ramp. The ATCO felt that at this particular time there was time pressure and it was somewhat stressful.

De-icing began at 06:03. It took just over 12 minutes. During de-icing the pilots were able to listen to both the de-icing communications and air traffic control. The ATCO talked at that time with, among others, the weather observer and a landing aircraft.

While the aircraft was being de-iced, performance calculations (TODC) numbers 2 and 3 were performed. Calculation no. 2 was in respect of runway 32 with 2 mm of snow and a friction coefficient of 0.31. Calculation no. 3 was in respect of runway 14, also assuming 2 mm of snow and a friction coefficient of 0.31.

At 06:12 SK001 received a request from the control tower concerning the estimated remaining time for de-icing, and pointed out that the slot time would expire in three minutes. SK001 responded with "doing the tail now"

After a conversation between the ATCO and FMP[8] the latter gave permission to SK001 to exceed its slot time, without providing any further time limit.

When after this SK001 at 06:15 requested taxiing from the de-icing ramp, they received permission to taxi to the holding point at runway 14 - "SK 001 taxi to holding point runway 14". This permission was acknowledged by: "Taxi to holding point 14, SK 001. May we have an extension?" This question was in respect of the slot time. They received an undefined extension, i.e. without a later limit time.

[8] FMP, Flow Management Position. An ATC unit at Stockholm Arlanda that manages slot times.

At 06:15:49 the aircraft began to taxi from the de-icing ramp. Figure 1. The civil aircraft ramp area at Kallax and the actual taxi route of SK001 illustrates the taxiing route of the aircraft.

According to the ATCO, visibility reduced severely during the time period 06:00 to 06:20. The visibility became so poor that the ATCO could not see taxiway A, nor the runway. (Fig. 2 below shows the view from the control tower in clear weather.)

As the crew left the de-icing ramp the commander turned right on to taxiway R10. Soon afterwards (at 06:16:14) the crew was asked to report when they were ready to receive take-off clearance. The crew replied that they were ready immediately.The subsequent radio communication is described below in fig. 4 and in the table after that.

The commander continued to taxi along R10, and then turned left out on to taxiway A, i.e. heading towards runway 32. The distance between the control tower and taxiway A is just under 600 m.

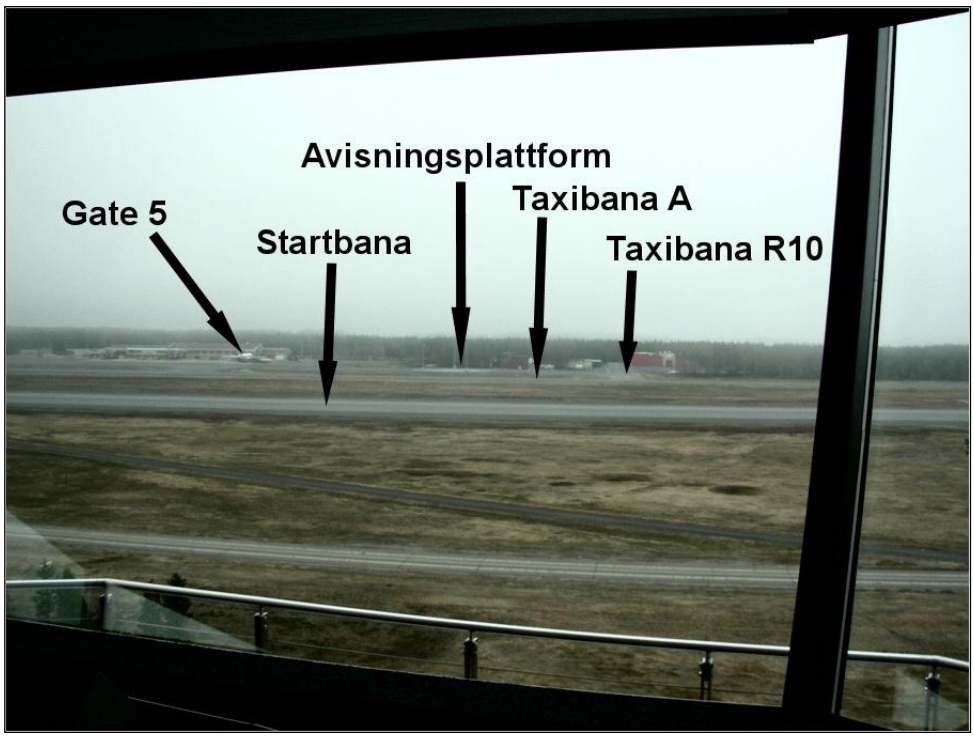

Figure 2. The view from Kallax control tower in clear weather

(Figure annotations:
Gate 5
Runway 14/32
De-icing ramp
Taxiway A
Taxiway R10)

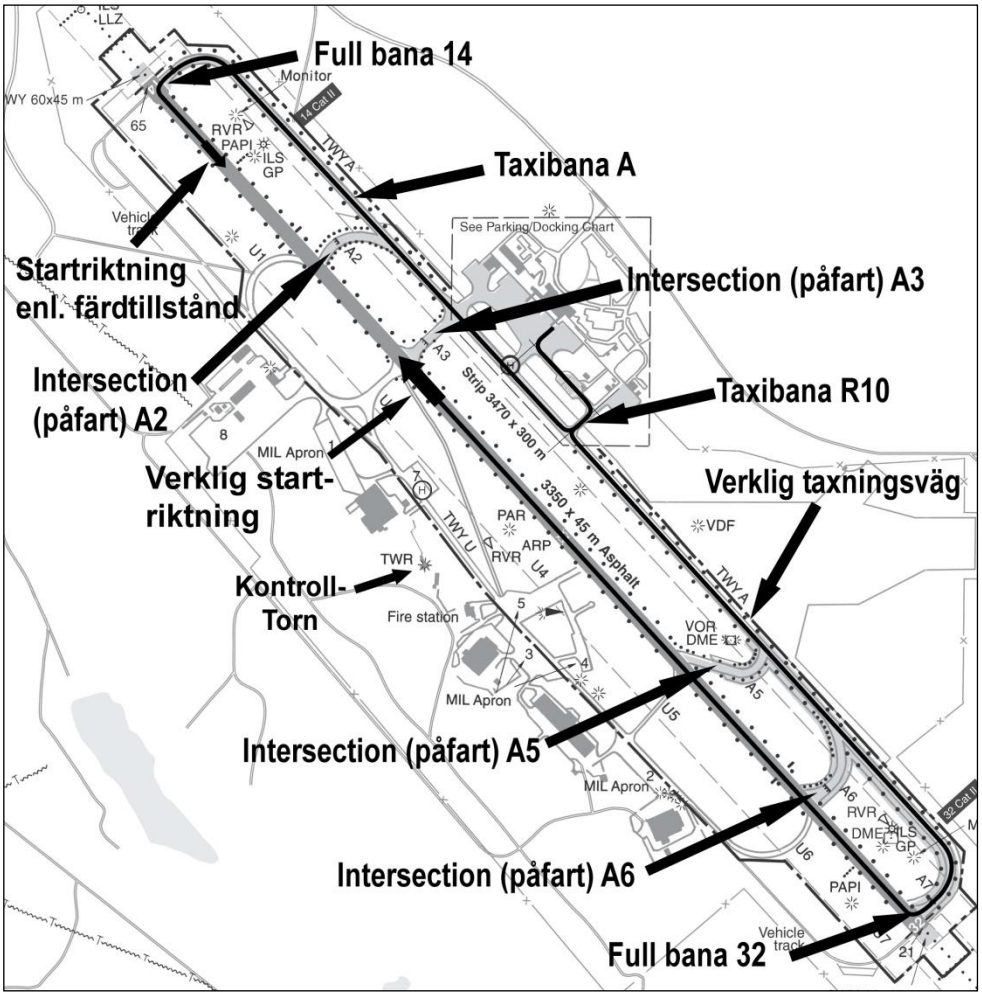

Figure 3. AIP description of the runway layout illustrating the direction of take-off

(Figure annotations:
Full runway 14
Taxiway A
Direction of take-off according to operational clearance
Intersection A3
Intersection A2
Taxiway R10
Actual direction of take-off
Actual taxi route
Control tower
Intersection A5
Intersection A6
Full runway 32)

Fig. 3 above shows an overview of the runway layout and the route along which SK001 actually taxied , and the route it had been cleared to taxi.

Fig. 4 below shows by means of small squares a segment of the aircraft taxi route according to data from the aircraft on-board recorder (QAR[9]), where each square represents one second. The commander taxied the aircraft and the co-pilot managed the radio communications. The numbers 1-5 show the equivalent locations in the radio traffic table. It can be seen that the co-pilot conducted extensive radio communications with the ATCO during the time

[9] QAR = Quick Access Recorder

period that the commander taxied along R10 and turned left out on to taxiway A.

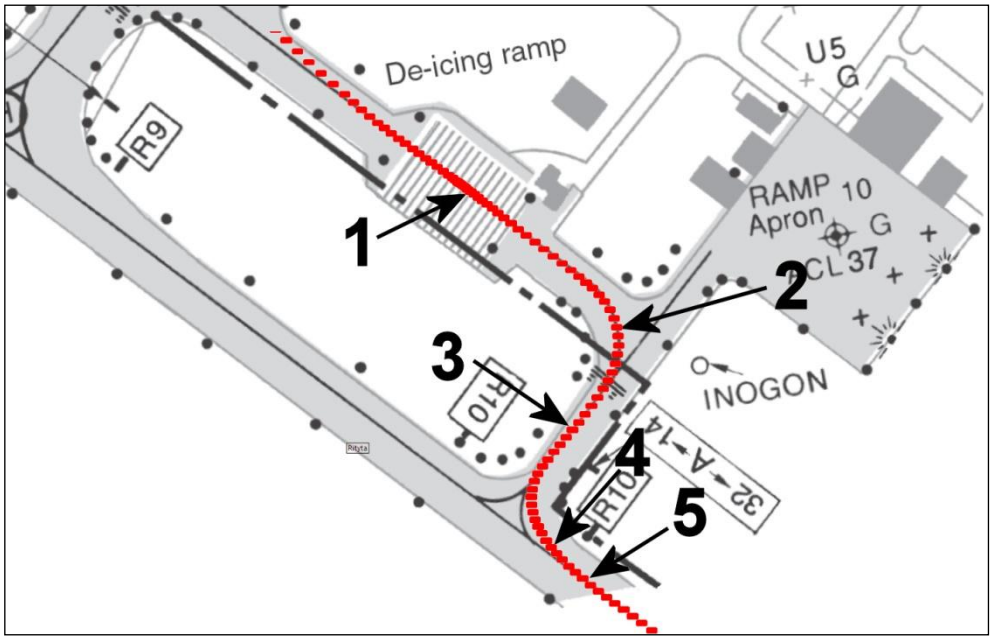

Figure 4. Taxi route according to the QAR, and locations while communicating

The numbers in the above illustration correspond to selected parts of the radio communications in accordance with the table below The arrow head indicate when transmission was started:

Item	Time	Radio traffic
1	06:15:35	ATCO: “Scandinavian 001 taxi to holding point runway 14.”
1	06:15:37	SK001: “Taxi to holding point 14, SK 001. May we have an extension?”
2	06:16:20	ATCO: “Clearance Stockholm Arlanda, VERAG 3 B departure, UT31, flight level 400, squawk 1004.”
3	06:16:29	SK001: “Cleared Stockholm Arlanda, VERAG 3 B departure, UT31, flight level 400 and squawk 1004, Scandinavian 001.”
4	06:16:46	ATCO: ”Scandinavian 001 report ready. All intersections are available.”
5	06:16:52	SK001: ”001 wilco”

The co-pilot noted the clearance to Arlanda correctly on the flight plan.

During taxiing on Taxiway A, about half way between taxiway R10 and intersection A5 (see fig. 3), a final TODC calculation, i.e. the fourth and final, was performed at time 06:17:35This was in respect of runway 14 with 2 mm of snow and a friction coefficient of 0.26The only difference between the two last calculations was the friction coefficient. None of the parameters, except for the friction coefficient, needed to be entered actively at this stage, since the other data was already present since the previous calculation.

While taxiing was proceeding, the ATCO had radio contact with the airport snow sweeping vehicles to confirm their position at the northern operational road. The ATCO also activated the special procedures (LVP[10]) that applies at

[10] LVP = Low Visibility Procedures.

an airport when the visibility reduces below a certain predetermined level, since the ATCO realised that the visibility not was sufficient.

At 06:19:45 SK001 reported that was ready for take-off along the complete runway - “We are ready at full runway”. They received take-off clearance from the control tower - “SK001, runway 14 cleared for take-off”. The crew read back “14, cleared for take-off, SK001”.

Remark.
Most of the communication between the aircraft and ATCO took place in English. However Swedish was used concerning de-icing, runway conditions and the invitation from ATCO regarding changing to runway 14 for take-off.

The taxi speed from the time SK001 entered taxiway A until the beginning of the right turn towards the runway at the end of the taxiway was on average 17.5 knots. During the 180 degree turn towards the runway the speed was reduced to 7.5 knots after just over half way through the turn.

SK001 performed a rolling take-off, i.e. the aircraft did not stop on the runway. The take-off began from runway 32 at 06:20:19. The ATCO related during the interview that it was heard when SK001 increased engine power for take-off and thought that the noise came from the south, i.e. that they were on runway 32. The ATCO thought at the time that no other traffic could come into conflict with SK001, and chose not to ask SK001 to abort their take-off.

At 06:21:43 the aircraft sent an automatic message via ACARS[11] to SAS that SK001 had taken off. After this, at 06:25, SK001 was handed over to area control.

Fig. 5 below shows in the left part of the illustration the departure route followed by SK001, and the right part shows the cleared departure route.

[11] ACARS = Aircraft Communication Addressing and Reporting System. A data link system for communication.

The SID SK001 flew along take-off from runway 32

The SID SK001 was cleared to fly along with runway 14

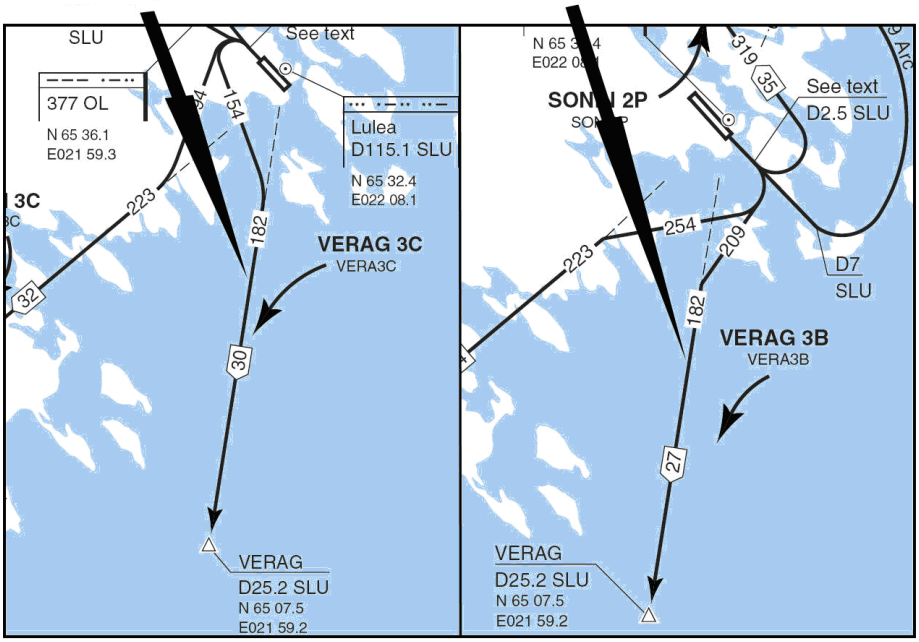

Figure 5. Departure routes (SID) to the south when taking off from runway 32 (left), and from runway 14 (right)

The ATCO filed a report on the event the following day.

The crew was told at lunch time on the following day that the take-off the day before had been from the wrong runway. By that time the crew had carried out seven further flights and an overnight stop since that particular flight from Kallax.

The incident occurred at 65° 32.6′N, 022° 07.4′E; 20 m above sea level.

1.2 Injuries to persons

None.

1.3 Damage to the aircraft

None.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 The commander

The commander was 44 years old at the time and had a valid ATPL[12].

Flying hours			
previous	24 hours	90 days	Total
All types	3:15	185	9200
This type	3:15	185	3800

Number of landings this type previous 90 days: 44.
Flight training on type carried out in December 1999.
Latest PC/OPC (Proficiency Check/Operator Proficiency Check) carried out on 10 January 2007.

1.5.2 Co-pilot

The co-pilot was 45 years old at the time and had a valid CPL[13].

Flying hours			
Previous	24 hours	90 days	Total
All types	3:15	101	6050
This type	3:15	101	2500

Number of landings this type previous 90 days: 31.
Flight training on type carried out in March 1999.
Latest PC/OPC (Proficiency Check/Operator Proficiency Check) carried out on 10 October 2006.

1.5.3 Cabin crew members

Three Cabin attendants.

1.5.4 The crew members' duty schedule

The crew in the cockpit had gone off duty at 12:45 on the day before the incident. They had checked in at 05:15 on that particular morning.

1.5.5 Interviews with the crew

The crew was interviewed some time after the incident. Both the commander and the co-pilot had difficulty in remembering details of the incident.

Interview with the commander

During the interview with the commander, he said that his strategy for this particular take-off was as far as possible to eliminate all factors that could be stressful or a burden. When the crew was asked whether to use runway 14 instead of runway 32, his intention was to wait before answering. The normal procedure, according to the commander, was to involve the co-pilot in connection with such decisions. His later recollection was however that the intention had always been to take-off from runway 32, and that he had not reacted to the information he had received that indicated that they should have taken off from runway 14.

[12] ATPL: Air Transport Pilot Licence Pilot licence permitting the holder to act as pilot-in-command in commercial air carrier services.
[13] CPL: Commercial Pilot Licence. Pilot licence permitting the holder to act as co-pilot in commercial air carrier services.

In respect of the question that the ATCO had offered a take-off from any intersection, (meaning intersection A2, A3 or the whole of runway 14, see fig 3), the commander considered that they should not stress, and that they would have time enough to taxi all the way down to the runway end. He thought this was also in line with his strategy to not add any unnecessary deviations or changes, such as changing the runway.

Interview with the co-pilot

The co-pilot could not remember which of the pilots had been "pilot flying" (PF) for that particular flight. Guided by the notes on the flight plan the co-pilot came to the conclusion that it had been the commander who was PF, and that the co-pilot had managed the radio communications.

1.6 The aircraft

The aircraft		
Manufacturer	Boeing Aircraft Company	
Type	B737-600	
Serial number	28290	
Year of manufacture	1998	
Gross mass	Max. authorised take-off mass 59874 kg, actual 53798 kg	
Centre of mass	MAC 28%, LITOW 47,	
Total flying time	18288 hours	
Number of cycles	13573	
Flying time since latest inspection	884 hours	

Engines		
Manufacture	CFMI	
Engine model	CFM56-7B20 DAC	
Number of engines	2	
Engine	*No. 1*	*No. 2*
Total operating time, hrs	15146	15447

The aircraft had a valid Certificate of Airworthiness.

1.7 Meteorological information

On that particular morning Luleå was situated in a widespread low pressure area in which there was both light snowfall, snow grains and freezing drizzle, with areas of fog or mist. The winds were weak and the clouds were low or close to the ground. During the incident the visibility deteriorated, and at the time of take-off, 06:20, the visibility was about 700-800 m.

According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis: Wind 2 knots, visibility 700-800 m, 8/8 low stratus or fog, temperature/dew point -4/-4 °C, QNH[14] 1005 hPa.

[14] QNH: An altimeter on which QNH has been set shows the height above sea level.

The actual weather for Kallax at various times on the morning of 27 February 2007:

- 05:20: VRB02KT 1000 R14/P1500N R32/P1500N –SN VV003 M03/M04 Q 1005 *(Time 05:20 variable wind 2 knots, visibility 1000 metres, runway visual range for runway 14 more than 1500 metres, no change, runway visual range for runway 32 more than 1500 metres, no change, light snowfall, vertical visibility 300 feet, temperature -3 degrees, dewpoint -4 degrees, air pressure 1005 hPa)*

- 05:50: VRB03KT 0700 R14/P1500N R32/P1500N –SN VV003 M03/M04 Q 1005 *(Time 05:50 variable wind 3 knots, visibility 700 metres, runway visual range for runway 14 more than 1500 metres, no change, runway visual range for runway 32 more than 1500 metres, no change, light snowfall, vertical visibility 300 feet, temperature -3 degrees, dewpoint -4 degrees, air pressure 1005 hPa)*

- 06:20: 030003KT 0800 R14/P1500N –SN SG BKN003 M04/M04 Q 1005 *(Time 06:20 wind 30 degrees 3 knots, visibility 800 metres, runway visual range for runway 14 more than 1500 metres, no change, light snowfall, snow grains, broken clouds at 300 feet, temperature -4 degrees, dewpoint -4 degrees, air pressure 1005 hPa)*

On that day sunrise was at 06:52, i.e. it had not risen at the time of the incident.

1.8 Aids to navigation

Not applicable.

1.9 Communications

1.9.1 General

The table in Appendix 1 shows the communications recorded in the tower at that time.

At the time of the message concerning a possible change of runway at 06:02:47, the transmission/reply from SK001 on the recording was distorted by a simultaneous telephone conversation in the control tower. Since the CVR[15] recording was not available, and neither of the parties could remember exactly what was said, it is not possible to review the radio communications at that precise time.

The control tower communicated with airfield staff on a radio channel to which the aircraft flight deck crew could not listen.

[15] CVR: Cockpit Voice Recorder. Recording equipment that records the radio communications and sounds in the cockpit.

1.9.2 Methodology for determining point of time

In determining the point of time of various events, three different sources were available.

1. Registered QAR data where many technical parameters are registered. E.g. recorded speed, engine parameters, and when the pilots transmitted on radio. The point of time for a given value is recorded by the aircraft's registration equipment.

2. Recorded audio information from air traffic control. Information is time-determined by the starting time of each audio file (data file with audio) indicated. The point of time is recorded by the computer equipment that at the same time records the audio.

3. Registered data traffic to and from the aircraft (ACARS: Aircraft Communications Addressing and Reporting System). Data traffic is routed via radio to the operator's computer system. Messages are partly automated, such as when the aircraft takes off from runway, partly manual, e.g. when the crew calls for a TODC. The point of time for a message is registered by the operator's computer equipment on the ground.

The clocks of the various recording equipment are more or less different, and during analysis the differences between the clocks are attempted to be determined. The difference in time between the QAR data and audio information from air traffic control has been possible to determine with good accuracy. This has been done by correlating the point of transmission and the duration (recorded in QAR) for certain messages with recorded messages when received by air traffic control. Note that there is no entry in the QAR of received messages.

In the analysis of all audio files (audio messages) recorded by air traffic control, software is used in which all messages are added on various tracks e.g. that may represent different radio stations or people. The presentation is graphic, and allows for an analysis of the events that have occurred in parallel but recorded in different places. A typical case is when the CVR (Cockpit Voice Recorder) is available and will be added along with the recording from air traffic control. In this study however, there is no CVR available.

The point of time registered by ACARS equipment can not be correlated to any of the other equipment, as no registration of ACARS message are made in QAR or flight management systems.

1.10 Aerodrome information

1.10.1 Ground radar and beacon

There was no ground radar at the airport. There was a beacon so that the direction to a transmitting radio station could be seen, but this was out of order and not used. According to information from air traffic control, the beacon has never been used to see the position of an aircraft on the airport due to its position at the airport.

The taxiway system is of conventional type with signs and markings painted on the asphalt. There is no type of stop bars[16] installed at the airport. Lighted stop bars may normally not be passed by aircraft or vehicles, but must first be switched off by air traffic control.

Eurocontrol has published a report, "Runway Incursion Contributory Factors Study" (Swedish version May 2009), which, e.g. shows results from trials with "H24 use of runway stop bars". The trail, which involved a use of stop bars in all light and weather conditions, was found to involve a number of improvements in air safety, while the increase in workload for air traffic controllers were considered acceptable.

1.10.2 Operations manuals

Extract from the Kallax local operations manual:
"Clearance to civil aircraft is from the gate to the destination via a suitable SID for the runway in use at the requested height. Any changes to the clearance and the transponder code are reported while taxiing out."

The ANS[17] Manual of Air Operations – in which applicable procedures are stipulated - states:

"Departing IFR[18] traffic must be given route clearance before taxiing out when this is practically possible, or at another occasion that does not carry with it an increased risk of runway incursion.
Remark. This reduces the workload on pilots while they are taxiing out, and thereby the risk of unintentional runway incursion or incorrect taxiing. Incorrect programming of the FMS and incorrect briefing are also prevented."

1.10.3 LVP, Low Visibility Procedures

LVP is applied by limiting the number of aircraft in the manoeuvring area. In practice, only one aircraft at a time may move within the manoeuvring area. Before an aircraft is permitted to land, previous aircraft must have left the manoeuvring area.

According to the ANS operations manual part 3 section 7 chapter 5. preparations for LVP activation must take place so that it can be inforce before the Runway Visibility Range, RVR, falls to below 550 m.

1.10.4 Signage

According to the AIP[19] the exits from the ramps to taxiway A are marked by signs that indicate "A" and arrows pointing to runway 32 and runway 14 respectively. (**32←A→14**). In actual fact the signs only indicated their positions by arrows, i.e. "**←A→**" (see Figure 6. Sign at taxiway R10
The distances from R10 to either runway end are approximately equal.

[16] Stop bar: Installation with row of submerged red lights at e.g. an entrance.
[17] ANS: Air Navigation Services. Air traffic control.
[18] IFR: Instrumental Flight Rules. Flight made according to instrumental flight rules.
[19] AIP: Aeronautical Information Publication Officially published information of a permanent character applicable to airfields, flight routes, etc.

Figure 6 below at the left shows what the actual sign looked like placed by taxiway R10, at its left side, just before taxiing out on to taxiway A. SK001 passed this sign immediately after de-icing was completed, and at about the same time as the co-pilot was receiving the clearance to Stockholm/Arlanda. , The illustration to the right is from the AIP.

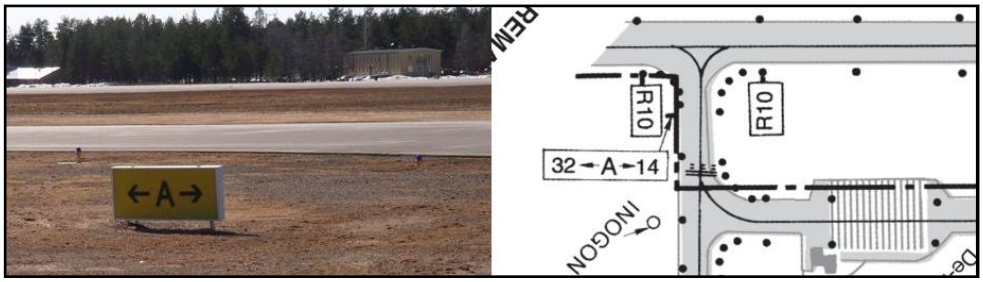

Figure 6. Sign at taxiway R10

The description of the sign in the AIP does not correspond with the sign's actual layout.

Figure 7. Holding position for runway 32 in CATII conditions
below shows the sign that is located by taxiway A close to intersection A7 (at the full length of runway 32). When CATII[20] is in force, this is the "holding position" for runway 32.

Figure 7. Holding position for runway 32 in CATII conditions

[20] CATII: Category 2 landing, meaning that certain minima apply, including visibility for being allowed to land. CATI has the lowest and CATIII the highest requirements.

Figure 8. Sign at runway 32, full length
below shows the sign just before entering runway 32, full length.

Figure 8. Sign at runway 32, full length

There are no stop bars at any entry point to the runway. A stop bar is a row of red lamps submerged into the taxiway that can be lit or extinguished from the control tower. A row of lit red lamps may not normally be passed by an aircraft, until they have been turned off from the control tower.

1.10.5 SID (Standard Instrument Departure)

General
In the Chicago Convention Annex 11, Appendix 3 of the Chicago Convention states how a SID must be named. A SID consists of three parts:

1. a "basic indicator",
2. a "validity indicator", and
3. a "route indicator".

For example, in the name ***VERAG 3 C*** , ***VERAG*** is the "basic indicator", ***3*** is the "validity indicator" and is the version number, and finally ***C*** is the "route indicator". Chapter 2.1.2 in Appendix 3 of the Chicago Convention states that the basic indicator shall be the name or designation of the significant waypoint where a standard instrument departure ends or a standard instrument approach begins.

This means, going back to the VERAG example, that the name VERAG must form part of the SID name, as the SID goes to the waypoint called VERAG.

The two SIDs pertaining to this incident are VERAG 3 B and VERAG 3 C. The difference between them is that they relate to different take-off directions. Both however end at the same waypoint, i.e. VERAG.

1.11 Flight recorders and voice recorders

1.11.1 Flight Data Recorder (FDR, QAR)

Data from the aircraft's FDR[21] (QAR) was available for the investigation.

[21] FDR: Flight Data Recorder, recording equipment that records a number of flight parameters.

1.11.2 Cockpit Voice Recorder (CVR)

The CVR information was not available to SHK, since it had been overwritten by the time the incident had been reported. The recording time is 120 minutes.

1.11.3 ICAO Annex 6

ICAO Annex 6, Operation of Aircraft Chapter 6.3 contains the international regulations concerning Flight Recorders. In Chapter 6.3.9.1 it is stated that the basic requirement for a CVR is that it shall record at least the most recent 30 minutes. There is a requirement for 2 hours of recording time for aircraft that have received their Certificates of Airworthiness granted after 1 January 2003 (in accordance with Chapter 6.3.9.3).

It is stated in Chapter 6.3.11 that flight recorders (including the CVR) must not be switched off in flight.

The fact that the operator is responsible for the recorded information is stated in Chapter 11.6. There it states that if an aircraft becomes involved in an accident or an incident, all the recorded information must be secured by the operator as far as possible, in accordance with Annex 13.

1.12 Incident site

The incident occurred at 65° 32.6′N, 022° 07.4′E; 20 m above sea level, at Kallax airport outside Luleå.

1.13 Medical information

Nothing was discovered to indicate that the psychological or physical condition of the pilots was degraded before or during the flight.

1.14 Fire

There was no fire.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

None.

1.17 Organisational and management information

1.17.1 The company procedures and rules

Cockpit (or Crew) Resource Management (CRM)
CRM is a general term that among other things concerns how a flight crew can best co-operate and utilise all the available resources, both inside and outside the aircraft, to achieve safe and efficient operation. CRM is not about technical knowledge or knowing how to fly an aircraft, but about how as a person you

interact with the outside world to maintain or regain control of a sequence of events.

An important aim of CRM is to understand how it is possible to communicate so that those involved understand each other and have the same approach to what is happening or is expected to happen. The term also covers leadership and decision-making. Training in CRM and refresher training is mandatory for all commercial pilots in Sweden. SAS has such a training programme.

Routines and procedures described in the manuals pilots use must support good CRM.

During training the following headings are to be found under the term CRM:

1. Human factors and CRM in general
2. Human failings and human reliability
3. A culture of flight safety
4. Behaviour patterns
5. Stress and stress management
6. Being awake, asleep and fatigued
7. Information management
8. Situational awareness
9. Communication
10. Groups and leaders
11. Decision-making
12. Automation
13. Case studies

Operational procedures

The normal procedure at many airports is that the flight crew receive clearance for the whole flight while the aircraft still is parked at the gate. This enables the crew to programme the correct runway and current SID before engine start. If route clearance is not provided before engine start, SAS OM-A[23] 8.4.3/1 regulates what the crew should do.

The briefing and preparations for the expected route may be carried out in advance. After the flight crew has received the actual clearance, the previously expected clearance will be either confirmed or altered.

Before each take-off there will be a short briefing that covers the current situation, i.e. a departure briefing, in which the commander states his/her intentions in the case of abnormal events during take-off.

The pilot who is to fly (PF) must clearly define:

- his/her intentions and to ensure that his/her colleague is fully aware of the received clearance, including the limits of the route clearance, radio frequencies, the navigational aids settings and what procedure is expected to be followed in the case of the loss of an engine.
- what checks would possibly need to be made during the departure
- how he/she intends to use automated aids
- when the altimeters should be reset (on being cleared to a new flight level)

[23] OM-A: Operations Manual part A. The manual that describes the operator's general rules for how flight operations must be carried out. This manual is not tied to any particular type of aircraft.

All communication between the aircraft and other aircraft or ground stations must be in English.

When an aircraft is at the end of the runway ready to take off, according to the SAS OM-A 8.3.10/4.5 the pilot in the left seat is to check the compasses to see if they match the runway direction and that the performance calculations apply to the actual runway and take-off position. The pilot in the left seat must confirm this by stating the name of the runway and the take-off position, and that the compasses have been checked, e.g. “Zero four right Bravo, compasses checked.” The pilot in the right seat must confirm this information and then announce “checked.” In this case the pilot in the left seat was the commander.

When one of the pilots receives the route clearance (OM-C, Company Info, Chapter 13.3-3 Handling of air/ground communication) he/she must ensure that the other pilot also heard the message and can confirm that the read-back was correct. Significant parts of the message must be repeated by the other pilot. This applies to all types of clearance.

In respect of taxiing there are some directives in the crew training manual (FCTM[24]). This states that the normal taxiing speed is to be 20 knots, adjusted to suit the prevailing conditions. It is recommended that speed is reduced on a dry taxiway to about 10 knots before all turns that are tighter than the high speed exit from a runway.

1.18 Other aspects

1.18.1 Equal opportunities aspects

This event has also been examined from the point of view of equal opportunities, i.e. against the background that there are circumstances to indicate that the actual event or its effects were caused by or influenced by the women and men concerned not having the same possibilities, rights or obligations in various respects. Such circumstances were however not found in this particular case.

1.18.2 Environmental aspects

This particular incident had no environmental aspects.

1.18.3 Slot time management

In the Transport Agency regulations concerning special rules for flow planning (ATFM) it states that:

10 § *Air traffic control units at airports must ensure that flights that have been assigned a slot time for departure (Calculated Take-Off Time, CTOT) adhere to these. Slot times have a permitted time window from minus 5 to plus 10 minutes. The slot time shall be notified to the aircraft on the first radio contact. If the aircraft cannot meet the slot time due to unforeseen events, the air traffic control unit must report this as soon as possible to the flow planning position (FMP).*

….

13 § Together with the operator, the air traffic control unit is responsible for the slot time being adhered to at the take-off location.

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[24] FCTM: Flight Crew Training Manual. A document that describes the routines and procedures for operating the Boeing 737.

1.18.4 Reporting

The requirement for the reporting of accidents, serious incidents and incidents are stated in the Transport Agency's rules concerning general regulations for Air Navigation Services (ANS), Airspace Management (ASM) and Air Traffic Flow Management (ATFM) 8§:

Reports concerning accidents, serious incidents and incidents must be sent to the Transport Agency within 72 hours.

1.18.5 Investigation of SID

At the EASS (European Aviation Safety Seminar) in March 2008 an investigation was presented called "An Investigation Into Standard Instrument Departure (SID) Deviations"[25]. From the NLR ATSI 's database containing over 270,000 events, 345 were selected in which there were significant deviations from the SIDs involved. A couple of the conclusions from the investigation were that:

- Significant deviations from SIDs have many causes. However, by far the most usual cause was that pilots had used the wrong SIDs.
- The probability that an incorrect SID is used by pilots increases when there are several SIDs with similar names.

In the final chapter of the investigation, among other things there was a strong recommendation that the use of similar names for SIDs should be avoided at airports.

1.18.6 Measures taken

AIP has been revised with regards to signage at Luleå /Kallax Airport, documentation is now in accordance with actual conditions.

1.18.7 Previous events

SHK has in previous reports (e.g. RL 2003:32 and RL 2003:47) pointed out deficiencies partly on signage at Swedish airports, and partly on poorly designed taxiway maps in the AIP. In one of these reports, SHK recommended LFV[26] the following:

"The LFV is recommended to review current regulations concerning the design of taxiway maps in the AIP Sweden and information signs regarding the risk of misinterpretation."

The LFV announced that it intended to comply with the recommendation as follows:

"Lr was commissioned to review the rules of the BCL-F relating to the design of those signs involved in the investigation and special signs that contain combined information."

[25] Investigation carried out by Gerard W.H. van Es, Alfred L.C. Roelen and Arun K. Karwal with data from NLR ATSI (NLR Air Transport Safety Institute) Air Safety Database.
[26] LFV is responsible for air navigation services in Sweden.

2 ANALYSIS

2.1 General

SK001 took off from runway 32 despite clearance being given for take off from runway 14.

In the first contact with the control tower it was stated that runway 32 was in use. The commander then planned the flight for take-off on that runway and programmed in all the necessary data to the FMS. After a request to taxi to the de-icing ramp, the ATCO provided new braking figures, 41-31-39. It is probable that these figures were in respect of runway 14, since their order was reversed in comparison to the occasion when the ATCO read out the braking values for runway 32. This fact implies that the ATCO had already at that stage mentally "changed runway" and assumed that SK001 would take off from runway 14. However no communication concerning runway 14 had yet taken place with SK001. This took place somewhat later, in connection with clearance to taxi from the gate to the de-icing ramp.

It is however not clear as to how the offer to change runways was answered. Neither the crew nor the ATCO followed up on the offer, either. The ATCO then provided clearance in respect of runway 14, but without the runway name being explicitly included in the clearance (VERAG 3 B); nor did it need to be included in accordance with the applicable rules. SK001 received however taxi clearance and take-off clearance with runway number 14 included, which was read back correctly, so there was no reason for the ATCO to question whether the crew had understood and accepted runway 14 for take off.

2.2 SK001 – The flight crew

2.2.1 CRM, Crew Resource Management

From 06:02:29 it seems that the ATCO believed that SK001 would take off from runway 14. In respect of the crew there are at least three alternatives. Either both pilots were under the impression that they would take off from runway 32, or else they both thought that they would take off from runway 14. A third possibility is that the commander and co-pilot had different understandings of which runway they would use for take-off, but that they never realised that they had different ideas on this issue.

Alternative 1
If it was the case that both believed they would take off from runway 32, the co-pilot both heard runway 14 at least twice on the radio, read back runway 14 and wrote down the clearance that applied to runway 14 without reacting to the fact that the information applied to the wrong runway. The commander was also able to hear the radio traffic, during which runway 14 was named several times, and could also hear the co-pilot's read-back. According to the CRM concept and normal routines, the commander should also repeat the most important parts of clearances - "holding point runway 14", "cleared take-off runway 14", etc. If this happened, the commander would have said "runway 14" several times and the co-pilot would have heard "runway 14" several more times, without reacting to their plan to use a different runway. Taxiing in that case was "correct", i.e. the pilots taxied in accordance with their intentions and all visual information, from the instruments and the surroundings agreed with

their joint understanding that they would take off from runway 32, despite this being in fact the wrong runway.

Alternative 2
If it was the case that both pilots believed that they would take off from runway 14, but that the commander taxied wrongly, the actions of the co-pilot seem more likely, i.e. the co-pilot's understanding agreed with all the information exchanged by radio. Also the commander's actions were more probable, taking into account the communication in the cockpit, since his repetition of the co-pilot's clearances were able to be done correctly. In that case, what led to the take-off taking place from the wrong runway would have been due to the commander turning out into the wrong direction on to taxiway A, which perhaps was not noticed by the co-pilot since she was busy with radio communications. In such a case the deficient signage of R10 could have contributed to the incident. The FMC was not reprogrammed and a new departure briefing was probably not made after it had become evident that they would take off from runway 14 instead of from runway 32.

This explanation also assumes that neither of the pilots saw the signs beside the taxiway that showed they were taxiing towards runway 32. This could however have been due to the poor visibility, concentration on steering the aircraft since it probably was slippery, and that the co-pilot was busy preparing a new performance calculation (TODC) for runway 14. The final check on the runway ("runway 14, compasses checked") was either poorly or not done at all, due to time pressure and the fact that they performed a rolling take-off. In this possible scenario all the instruments and all the take-off programming would match each other.

Alternative 3
In respect of the third possibility, i.e. that the pilots had differing opinions concerning from which runway they would take off, where the commander thought that they would take off from runway 32 and the co-pilot thought that it would be runway 14, even here the co-pilot's actions seem more probable compared to alternative 1. All the information exchanged by radio agrees with the understanding that they would take off from runway 14. On the other hand, the communication between the pilots must in this case have been inadequate and the CRM concept has functioned poorly or not at all. If the commander repeated the important parts of the clearances this was in conflict with his intentions. If he did not repeat the important parts, the CRM concept was broken.

In respect of taxiing, the commander in this case taxied "correctly", i.e. he taxied in accordance with his intention to use runway 32. The signage, etc. would in this case have been correct as far as the commander was concerned, but not for the co-pilot, who at this stage was focusing more on the radio traffic and the TODC calculation. The departure briefing was probably not carried out, since it is very probable that if it had been, the pilots would have realised that their opinions differed as to which runway was to be used. What also supports the thesis that co-pilot had the perception that they would take-off from runway 14, is the fact that the last TODC-calculation - performed during taxiing on taxiway A – is applicable to runway 14

In each of the alternatives the check of clearance VERAG 3 B against what had been programmed into the FMS could not have been correctly carried out.

It is not known whether the co-pilot was present in the cockpit when the commander received the first information that runway 32 was in use. The co-

pilot could very well have been out performing the EI at this time. If the co-pilot was present in the cockpit while the commander was receiving the information about runway 32, this supports the alternative that they were both agreed that they would take off from runway 32. If on the other hand the co-pilot was not present, and the commander did not communicate the information correctly, the co-pilot did not have a preconception for any particular runway, and it would have thus been easier to accept runway 14 for take-off. This would in that case support the two latter alternatives given above.

It has not been possible to determine which of the alternatives is correct. However all of the alternatives assume that CRM in the cockpit in any case did not function satisfactorily.

One factor that could have played a part in the events was that the commander was busy taxiing at the time that the co-pilot was receiving and acknowledging the clearance (se Figure 4). Since the visibility was limited and it was slippery on the taxiway, the taxing probably demanded a great deal of the commander's attentionHe may therefore not have paid so much attention to the radio trafficAt that time the co-pilot was virtually alone in communicating with the ATCO, and the commander was managing the taxiing himselfIt was at this critical moment that the commander turned left out onto taxiway A, towards runway 32.

Alternative 4
SHK is aware that there is also a theoretical fourth alternative, that the commander had a preconception to use runway 14 and the co-pilot runway 32. This option is deemed not to be realistic, thus no analysis has been undertaken.

2.2.2 The message to the crew concerning the incident

Since it took more than a day after the incident for the crew to become aware of it. As far as the crew was concerned, this was a routine flight among many, and they had also performed several flights since this particular one. This may have affected the crew's ability to remember the events in detail.

One of the consequences of that neither the crew nor the operator found out about the incident immediately was that the CVR could not be secured straight after the flight.

2.2.3 Clearance

The operating procedure on the Boeing 737 is that the crew is assumed to programme the runway and departure route before starting the engines. In practice this takes place while the aircraft is parked at the gate. This is the normal procedure for most flights, i.e. clearance is received at the gate. In this case clearance was given during taxiing. Nor did the crew request departure clearance while they were still at the gate.

The company's rules allow the pilots to programme in and prepare themselves for an expected departure route before they receive the actual departure clearance. However it is a requirement that the pilots must check that the programmed route agrees with the departure clearance that they have actually received. It must be said that this obviously did not take place in this particular case.

2.2.4 Performance calculations

A number of TODC calculations were carried out for the take-off, some of which were intended for runway 14, one during de-icing and one during taxiing. In interviews the co-pilot could not remember any specific reason why they were made.

For the calculations at the time of de-icing, however, SHK believe that is a reasonable procedure because no clearance for runway or departure at that time were actually obtained. It is both operationally correct as understandable that in this situation to perform calculations for the alternative take-off options available.

When taxiing on taxiway A towards runway 32, however, the co-pilot carried out an additional calculation that intended runway 14. Considering that runway 14 was entered since the previous calculation, there is a possibility that the co-pilot only focused on the new brake values and thus overlooked the fact that the calculation did not correspond with taxiing towards runway 32. It is generally not logical to conduct such a calculation if you are aware of that you are taxiing towards the opposite runway end.

2.2.5 Stress factors

The slot time for this particular take-off was set at 06:05, i.e. only five minutes after the departure from the gate according to the timetable. This could have meant a stress factor for the crew. Put against this is the fact that the commander related during his interview that he and the co-pilot had discussed this and he said that they should stay calm and not become stressed, taking whatever time was needed to do everything properly. The commander did not want any extra workload that would put pressure on them and make them miss anything.

Both the ATCO and the crew were exposed to a certain amount of further stress because the slot time was very tight and in practice more or less impossible to keep, due to de-icing. In addition, the crew did not know whether the slot time would be extended. At 06:11:53 they were also asked how much longer they would spend in de-icing, whereupon the ATCO pointed out that “time will run out in three minutes”. In these three minutes de-icing would have to be completed and the aircraft taxied in fog and on a propably slippery taxiway all the way to the end of the runway, prepare for take-off and take off. When SK001 received taxi clearance from the de-icing ramp the co-pilot asked, in direct connection to the read-back of the taxiing clearance, whether they could have an extension to the slot time. This indicates that the slot time was taking up much of the crew’s thoughts. When they were told that an extension to the slot time had been granted, no limit was defined, the only message was that they had been granted an extension.

Another fact that indicates there was a certain amount of stress was the speed of taxiing from the de-icing ramp to the take-off point. On the straight part of taxiway A the average speed was 17.5 knots. On a non-slippery surface this would be a normal speed, but in the prevailing conditions that were present, this speed could be considered rather high. During the initial part of the 180 degrees turn towards the runway the speed was still relatively high, decreasing while in the turn to 7.5 knots. This speed must also be regarded as high for a turn in slippery conditions. Taxiing was not halted when the aircraft entered the runway, but continued to a rolling start. In addition to this procedure, suggesting a degree of urgency, it also reduced the possibilities to perform the procedures that according to the company should be made before take-off.

2.3 The air traffic control officer

2.3.1 Clearances

The ATCO did not give SK001 the departure clearance to Stockholm/ Arlanda while the aircraft was parked at the gate. It has not been possible to discover why this was not done.

At the same time as SK001 requested taxi to the de-icing ramp and received the question about runway 14 by the ATCO, the ATCO was engaged in a conversation with Nordic Aero Ground Services about a slot time for another aircraft. This telephone call may well have distracted the ATCO and contributed to the failure to follow up on the offer of runway 14 to SK001. On the other hand the ATCO later gave taxi instructions and take-off clearance to SK001 with both messages containing the words “runway 14”. Therefore it is clear that the ATCO had no doubt that SK001 had understood and accepted runway 14 for take-off. Also the route clearance “VERAG 3 B” applied to runway 14, even though the words “runway 14” were not spoken in direct association with the route clearance.

2.3.2 The slot time

Management of the slot time necessarily took up part of the ATCO’s attention. There were several telephone conversations with Stockholm and a couple of communications with SK001 about this. The ATCO also spoke to another operator about their slot time. Initiative was also taken to contact FMP in Stockholm to request a new slot time, or an extension of the current slot time. The ATCO received permission for an undefined extension of the slot time. When later SK001 requested an extension of the slot time they learned that it had been granted. In all there were 10 telephone and radio exchanges dealing with the slot time for SK001. The aggregate time spent on these communications was 3 minutes and 40 seconds. The greater part of this time was taken up by two telephone conversations with FMP at Stockholm/ Arlanda and one call to the SAS station.

2.3.3 Reporting

It has not been possible to discover why SK001 or the operator were not informed straight away that SK001 took off from the wrong runway.

2.4 Languages

Most of the communication between SK001 and the ATCO took place in English, which is correct according to SAS OM-A. However Swedish was used in the conversations concerning de-icing, runway conditions and the invitation from the ATCO that SK001 could use runway 14 for take-off. Using a mixture of Swedish and English could possibly have affected the crew in such a way that they did not apprehend that the offer to use runway 14 was as significant as if it had been made in English.

2.5 The naming of Standard Instrument Departures (SID)

The SID that the commander had programmed was “VERAG 3 C” which was associated with runway 32. The clearance given to the crew was “VERAG 3 B” which was associated with runway 14. There was therefore only one letter

which distinguished between the two SIDs. The runway designation itself was not included in the clearance.

According to the investigation mentioned in Section 1.18.5 it is clearly unsuitable to have several SIDs with similar names at an airport. This is one of the main contributory reasons for the pilots to have used the wrong SID as reported in this investigation.

2.6 Weather and visibility conditions

The fact that at the time of the incident it was dark and visibility was limited meant that the ATCO had difficulty in seeing the taxi route taken by SK001. Nor were there any other aids available to the ATCO to check where SK001 actually was.

The weather and lighting conditions could also have contributed to the limited awareness of the crew as to their position on the airfield, and their directional sense was weakened.

2.7 CVR recording time

The recording time on this particular aircraft was 2 hours, which is currently the highest requirement stated in ICAO Annex 6. During several investigations into incidents SHK has found that information was missing from CVRs due to the short recording time. A contributory reason for the loss of information could for example have been that the incident was not so serious that the commander decided it was not necessary to secure the CVR, alternatively that in this event the crew was not aware that an incident had taken place at all. One can also imagine a case where the flight lasts longer than 2 hours, in which case, even if the commander was aware of an incident, the CVR information will be overwritten since it is not permitted to stop the CVR and FDR during flight.

The consequences of having a short recording time for sounds from the cockpit mainly arise in the case of an incident. As far as this incident is concerned, certain aspects of the events could have been clarified much better if such a recording from the CVR or other equipment had been available. The aspect of too short a recording time therefore applies from an investigation perspective with the aim of improving flight safety.

Remark
In ICAO's amendments to the Chicago Convention Annex 6 which has been referred to SHK for consideration, SHK has suggested that the recording time for the CVR equipment is extended to 24 hours from 1 January 2016. The response has been coordinated with the Swedish Transport Agency.

2.8 Relevant barriers

When an accident or incident occurs, there are barriers that can stop the event from evolving. A barrier can be physical e.g. a protective fence or administrative, such as established procedures. The barriers that for some reason failed the intended task are considered broken. To prevent a recurrence, one seeks also to identify possible barriers which, had they existed, could have stopped the accident or incident. They are called possible barriers.

Broken barriers:

The following barriers can be ascribed to CRM, i.e. cooperation among the crew:

1. Check of clearance. The barrier was broken as the clearance did not correspond with the planned route. A contributing factor to that was probably the difference between the names of the two SID's only consisted of single letter.
2. Communication between the crew. The barrier was broken as the communication repeatedly deviated from the communication pattern that should be used to ensure that the crew always have the same perception of what is happening at the moment and what will happen in the future.
3. Communication between the crew and ATCO. The barrier was broken as the communication repeatedly deviated from the communication patterns that should be used to ensure that both always have the same perception of what is happening now and what will happen in the future. At this current occurrence it was broken when the ATCO offered a change of runway to the crew. The response from the crew, which is not identifiable, was not followed up by ATCO.
4. Mutual supervision of taxiway. The barrier was broken because the crew did not check which runway they taxied towards. The fact that there was no clear signage to the taxiway may have contributed to it.

The following barriers can be ascribed to checks of various kinds:

5. Check of taxiing permission. The barrier was broken since the crew did not check which runway they taxied towards.
6. Check of clearance. The barrier was broken as the "runway 14, cleared for takeoff" was inconsistent with where they were at the airport.
7. Departure briefing. The barrier was broken as a second departure briefing probably was not performed.
8. Check of compasses, FMS, etc. The barrier was broken as the current control probably was not executed correctly when the aircraft taxied to the runway.
9. Visual check of the taxiway. The barrier was broken as the visual conditions meant that it was not possible for ATCO to visually observe the aircraft's taxiway.

Possible barriers:

1. Stop Bars, activated by ATCO, at runway entrances.
2. Ground radar so that the ATCO could see aircraft movements on the ground.
3. Proper signage indicating the direction to the starting positions.
4. Route clearance is given at the gate.
5. Electronic transfer of clearances.
6. Standard Instrument Departure (SID) with less risk of confusion

2.9 Conclusions

2.9.1 General

After analysis of the facts available in connection with this incident, SHK notes that all options are based on events - or a sequence of events - all of which can be categorized as illogical and improbable. The conclusion that can be made based on that of the three possible options, there is one that is more probable explanation than the other models in an otherwise unlikely turn of events.

Commander
It is likely that the commander during the whole procedure was set to take-off from runway 32 and therefore acted accordingly. During de-icing the focus was on the then-current time slot, where any discussion of taxiways and/or runway acquired was of secondary meaning. During taxiing to runway 32, concentration was entirely focused on external conditions with probable slippery taxiways and reduced vision. Under these circumstances it is not unlikely that the commander mentally handed over radio communications to the co-pilot and only took in the expected elements of communication: "Taxi to the holding," "cleared for take off", and not noticed the adjacent runway number 14. The speed of taxiing and rolling start indicate the existence of remaining stress factors affecting the situation.

The co-pilot
The co-pilot could under the stress-affected time period during de-icing been improperly left with the impression that the commander would consider taking runway 14 and therefore acted accordingly. During the taxiing permission, the co-pilot acknowledge runway 14 correctly. During the decisive moment, when the commander turned to the "wrong direction", the co-pilot was busy with radio communication for route clearance. The SID that was programmed for runway 32 could, due to its nearly identical name, have been mistaken - and thus accepted - and not changed to the given clearance. During the remainder of taxiing, it is entirely possible the co-pilot did not note the "180 °-error" on the compasses, which were prevailing. The TODC-calculation was performed for runway 14, and the acknowledgements for runway 14 which was conducted by the co-pilot, also points to the perception that take-off would be at runway 14.

Jointly
The take-off was carried out rolling indicating that the check according to company procedures normally carried out at the take-off was unlikely performed completely. The remaining part of the take-off and the departure has then proceeded normally, as all instruments and settings pointed "correct", i.e. for departure from runway 32 according to VERAG 3C.

2.9.2 The crew

SHK may, despite the above, note that it has not exactly been determined where it went wrong in the chain of events and what the reasons for this was. However it has been established - no matter which option caused the crew's conduct - is that the part of CRM relating to communication and cooperation among the crew has not worked. The fact that we humans can say one thing and do another, according to SHK should serve as a strong incentive for all those involved in complex systems that always weave CRM in all aspects of a business.

2.9.3 The air traffic controller

There are several points in this report, where the ATCO's bases for decisions and reasons have not been established. It can however be concluded that the workload for a single controller can quickly reach capacity limits in which "that was the last straw", and the risk of failings or lack of actions increases. The incident occurred in a situation where a lone air traffic controller - with limited night sleep – was burden with a number of other problems.

SHK considers that the training of CRM factors for air traffic controllers, especially in terms of working alone, can be enhanced for both education and further education.

3 CONCLUSIONS

3.1 Findings

a) The pilots were qualified to perform the flight.
b) The aircraft had a valid Certificate of Airworthiness.
c) The limited visibility affected the sequence of events.
d) The Standard Instrument Departures (SIDs) had six out of seven identical characters despite being associated with take-off from different runways.
e) The signage at the airport did not agree with the information in the AIP.
f) While at the gate the commander received information that runway 32 was in use.
g) SK001 did not receive, nor ask for, its route clearance to Stockholm/ Arlanda before starting engines at the gate.
h) The received slot time could not be kept, but was extended by the ATCO.
i) The ATCO offered SK001 to use runway 14 for take-off. However this offer was never followed up by either the ATCO or the crew.
j) The crew did not perform a complete check that the clearance they actually received was in agreement with the one that they (or at least the commander) had planned for.
k) The crew correctly acknowledged the instructions from the control tower regarding taking off from runway 14, but took off from runway 32.
l) Regardless of whether the pilots had the same or differing opinions on which runway they would take off from, communications broke down between the commander and the co-pilot on several occasions.
m) The crew was informed of what had happened one day after the incident.

3.2 Causes of the incident

The cause of the incident was deviations from the CRM concept, mainly in respect of internal and external communication.

4 RECOMMENDATIONS

It is recommended that the Swedish Transport Agency should:

- Nationally and internationally work for to develop the system of naming SIDs with the aim of minimising the risk of them being confused, (RL 2009:18 *R1)*

- Consider present existing recommendations relating to route clearance at the gate are upgraded to specifications. (RL 2009:18 R2).

- Investigate the feasibility of the introduction of stop bars at the relevant Swedish airports, (RL 2009:18 R3).

- Investigate the feasibility for implementation of systems – at relevant Swedish airports - that will allow ATCO to determine where an aircraft is situated at the airport. (RL 2009:18 R4)

- Ensure that signage for starting positions at Swedish airports to be reviewed in order to minimize the risk of taxiing incorrectly, (RL 2009:18 R5).

Appendix A. Transcript of

SK 001 ATC recording.

The transcript does not contain all communication that were made during the actual period. Messages that are of private nature, or are irrelevant for the event, has been deleted from the transcript.

Time: Local time

From:	**Source of message.**
TWR	- Tower Kallax
192	- Air Sweden 192
001	- Scandinavian 001
401	- Northflight 401
003	- Scandinavian 003
502	- Nordic 502
MET	- Meteorologist Kallax
OBS	- Weather observer Kallax
SGS	- Scandinavian Ground Services Luleå
NA	- Nordic Aero ground services Luleå
RMP	- Ramp Kallax
PER1	- Unknown person 1
PER2	- Unknown person 2
FP	- Snowclearance leader Kallax
STO	- Slot Center Stockholm
ACC	- Area Control Center Stockholm
TODC	- In the table can also be found times and content regarding the TODC calculations that were made. (TODC = Takeoff Data Calculation)

Rem:	**Remark**
VHF	- VHF radio.
TEL	- Telephone tower.
&	- Interphone tower.
RAD	- Local radio.

Information: Message as interpreted.

[Brackets]	- surrounds transcriber's comments or additional information.
(Brackets)	- surrounds information that is highly uncertain.
??	- Denotes information that has not been interpreted due to disturbances or for other reasons.
? -	- Either means a question is asked or that the transcript is uncertain
(x)	- Person's name deleted

Time	From	Not	Information

05:33:10	192	VHF	Kallax, Air Sweden 192, approaching ten miles final.
05:33:15	TWR	VHF	Air Sweden 192 continue on heading.
05:35:03	TWR	VHF	Air Sweden 192, wind 060 degrees at two knots. High intensity lights on including flash. Runway 32 cleared to land.
05:35:12	192	VHF	(Runway) 32, cleared to land, Air Sweden 192.
05:38:57	TWR	VHF	Air Sweden 192 on ground 38. Taxi to apron via A3.
05:44:28	001	VHF	Kallax Scandinavian 001, request departure information.
05:44:33	TWR	VHF	Scandinavian 001, runway 32, wind 050 degrees at two knots. QNH 1005. Temp minus 3, dewpoint minus 4. Braking action 39, 31, 41, rime and on taxiway and apron down to 20.
05:44:52	001	VHF	Weather copied thank you, Scandinavian 001.
05:44:56	TWR	VHF	Have you received your slottime?
05:44:58	001	VHF	Affirmative.
05:46:06	TODC		Beräkning gjordes för bana 32 och torr bana.
05:47:51	TWR	TEL	Har det ropat en?
05:47:53	MET	TEL	Jo, det ropade en. 192 Swede nånting.
05:47:57	TWR	TEL	Ja men det är postkärran det. Det var han som landade.
05:48:09	MET	TEL	Jo, första fick dom på flygnivå 100. Så var det lite... till och från lite skikt då och så blev det tätt på fyratusen fot. Ja, jag frågade hade du någon is då? Näe, näe, nä inte så mycket.
05:51:37	TWR	TEL	Jag tänkte höra när du börjar obsa.
05:51:39	OBS	TEL	Ja jag börjar... jag tar det tjugo över givetvis.
05:51:44	TWR	TEL	Ja det... tjugo över tar du?
05:51:45	OBS	TEL	Ja. Jag kan ju skicka in nu tio i också om du ...
05:51:49	TWR	TEL	Nog kan jag skick... jag har skickat redan för...
05:51:51	OBS	TEL	Du har gjort det ja. Ja men då kö... då kör jag tjugo över.
05:52:55	SGS	TEL	SGS Luleå.
05:52:57	TWR	TEL	Hej det här är (x) i tornet.
05:52:59	SGS	TEL	Hej (x).
	TWR	TEL	Har du skickat något delay-message, tänkte jag, på SAS 001 med tanke på hans CTOT?
05:53:05	SGS	TEL	Nja... det... har vi nog inte gjort. Är dom inte färdiga?
05:53:10	TWR	TEL	Mm, nej han har inte ens pushat och skall via de-icing så han hå... kommer aldrig och hålla sin CTOT fem över.
05:53:15	SGS	TEL	Så han skall avisa också. För det vet ju egentligen int vi.
05:53:19	TWR	TEL	Nä just det. Men... Jaja. Men... Han

			kommer inte att hålla CTOTen, det är ganska säk... ah, måste han ju avisa. Det har ju snöat hela natten.
05:53:26	SGS	TEL	Jaja. Hm. Ja vi får... vi får höra vad vi säger om det och så får vi skicka en... en... delay då. Eller ja, ja... Det är ju det vi, vi vet ju int hur lång tid den kommer att ta heller.
05:53:37	TWR	TEL	Nä... Nej men till dom... Pratar du någonting mer med han eller?
05:53:42	TWR	TEL	Är det han som står på fyran eller? Jag ser inte, vi har så dåligt väder.
05:53:44	SGS	TEL	Jag måste titta själv var han står. Nej, femman skall han stå på.
05:53:47	TWR	TEL	Femman står han på.
05:53:48	SGS	TEL	Alltså dom plane... Dom har börjat jättetidigt och planera för att va iväg i tid för att komma... [Other voice in the background] Ja dom är färdiga där uppe. Det vet jag.
05:53:55	TWR	TEL	Ja men vad bra. Då kanske dom håller tiden.
05:55:49	401	VHF	Kallax, gomorron Northflight 401 descending flight level 100. Any change 14 for landing?
05:55:55	TWR	VHF	Northflight 401 proceed direct ten miles final runway 14. Intention is ILS approach.
05:56:01	401	VHF	Direct ten miles final 14, Northflight 401.
05:56:04	TWR	VHF	Northflight 401 descend to altitude 3000 feet, transition level 55, QNH 1004.
05:56:13	401	VHF	Descend to 3000 feet, 1004, T-level 55, Northflight 401.
05:56:18	TWR	VHF	Northflight 401, met report wind 040 degrees at 2 knots, visibility 1500 meters in snow and snowgrain. Clouds broken 300 feet, temp minus 4, dew point minus 4. Braking action 41, 31, 39, rime and dry snow, on taxiway and apron down to 20.
05:56:46	401	VHF	401.
05:57:20	TWR	VHF	Scandinavian 001 from tower.
05:57:43	001	VHF	Kallax Scandinavian 001 godmorron. Request start and push and also taxi for deicing.
05:57:51	TWR	VHF	Scandinavian 001 start and push approved for deicing. And how many minutes in deicing?
05:58:01	001	VHF	Approximately five minutes, Scandinavian 001.
05:58:04	TWR	VHF	001.
05:58:59		TEL	[Ringing twice]
05:59:06	STO	TEL	Stockholm (x).
05:59:07	TWR	TEL	Hej, (x) på Kallax. Jag kan meddela att SAS 001... dom skickade ju ingen delay på han, min operatör. Men han kommer inte att vara i luften fem över, som han har fått en slottid för han skall via

			avisningen.
05:59:22	STO	TEL	Vad bedömer du att han klarar da?
05:59:23	TWR	TEL	Jag bedömer att han, jag fråga, fem minuter deicing för att det var lätt avisning. Så att han kan nog vara i luften, kanske tolv över, tretton över någonting.
05:59:32	STO	TEL	Han klarar fönstret i alla fall.
06:00:34	TWR	VHF	Northflight 401 descend to altitude 2000 feet.
06:00:37	401	VHF	Descend to altitude 2000 feet, Northflight 401.
06:01:23	NA	TEL	Nordic Aero, (x).
06:01:24	TWR	TEL	Hej, det här är (x) i tornet.
06:01:26	NA	TEL	Hej.
06:01:27	TWR	TEL	Har du fått Nordicens slottid på Arlanda?
06:01:31	NA	TEL	Nä.
06:01:32	TWR	TEL	Då kan jag meddela dig. Han skall ju starta kvart i.
06:01:35	NA	TEL	Ja. Mm.
06:01:36	TWR	TEL	Den är 0718 svensk tid. Så det var ju... över en halvtimme. Så vet du om den och kan meddela besättningen. 0618 alltså UTC har dom slottid.
06:01:49	NA	TEL	Okey. Nu sitter jag nere i incheckningen så jag har ingen möjlighet och meddela besättningen, tyvärr. Så om du skulle kunde ringa igen så får kanske (x) som står uppe i gaten svara.
06:01:54	TWR	TEL	Nähä, men ni har... Men du då ringer jag en gång till så svarar inte du. Okey. Hej.
06:02:01	NA	TEL	Jajamän. Ja. Hej.
06:02:18	NA	TEL	Nordic Aero, (x).
06:02:19	TWR	TEL	Hej, här är (x) i tornet.
	001	VHF	Scandinavian 001 request taxi to deice.
06:02:22	NA	TEL	Hejhej.
06:02:23	TWR	TEL	Vänta skall jag bara ge SAS taxi.
06:02:24	TWR	VHF	Taxi approved.
06:02:25	TWR	RAD	Filip Petter (01), du kan lämna i söder.
06:02:26	001	VHF	Taxi approved Scandinavian 001. Vad har du för bankonditioner just nu?
06:02:29	TWR	VHF	Ähm... Bromsverkan... Det är rimfrost och det är torr snö. 41, 31, 39 bromsverkan.
06:02:38	FP	RAD	Strax får du ett nytt bromsvärde.
06:02:40	TWR	RAD	Ja.
06:02:41	TWR	VHF	41, 31, 39 bromsverkan.
06:02:44	001	VHF	41, 31, 39?
06:02:47	TWR	VHF	Det stämmer och... Ni kan få bana 14 för start.
06:02:50	TWR	TEL	Du, jag har en slottid på Nordic 502. Har du fått den?
	001	VHF	?? 001. [Partly masked by telephone conversation]
06:02:56	NA	TEL	Äh, har ni fått nått slottid? Nä, ingenting. Nej.
06:02:59	TWR	TEL	Nej. Noll. Deras. Deras. Jag har en slottid

			om du vill ha den.
06:03:04	NA	TEL	Jodå.
06:03:05	TWR	TEL	0618. Är slottiden.
06:03:07	NA	TEL	0618. Ja.
06:03:09	TWR	TEL	Den skilde lite grann från starttiden så... Jojo, då vet du. Tack. Hej.
06:03:12	NA	TEL	Ja tack. Hej.
06:03:18	001	VHF	Och, tornet 001, vad hade du för djup på snön?
06:03:22	TWR	VHF	Ja, den driver bara lite grann över banan. Dom har under nån millimeter bara.
06:03:27	001	VHF	Okey. Tack du.
06:04:23	TWR	VHF	Northflight 401 turn left heading 160, cleared ILS approach.
06:04:28	401	VHF	160. Cleared ILS, Northflight 401.
06:04:34	TODC		Beräkning gjordes för bana 32 med 2 mm snö och friktionskoefficient 0,31.
06:04:59	TODC		Beräkning gjordes för bana 14 med 2 mm snö och friktionskoefficient 0,31.
06:05:09		TEL	[Ringing once]
06:05:10	ACC	TEL	Stockholm.
06:05:11	TWR	TEL	Kallax, SAS 001 femton över.
06:05:14	ACC	TEL	Hmm, femton över. Precis han hinner med ja. 400 mot...
06:05:18	TWR	TEL	Jag pratade med (x) och han sa att det var okey.
06:05:20	ACC	TEL	Ja det var det, ja.
06:05:21	401	VHF	Kallax Northflight 401 established.
06:05:23	TWR	VHF	401 continue approach.
06:05:25	401	VHF	Continue approach.
	TWR	TEL	400 och...
06:05:26	ACC	TEL	Hammar 1004.
06:05:28	TWR	TEL	1004 transponder.
06:05:29	ACC	TEL	Jupp. Hej.
06:05:30	TWR	TEL	Tack.
06:05:57	TWR	VHF	Northflight 401 wind 030 degrees 3 knots. Highintensity lights on including flash. Runway 14 cleared to land.
06:06:05	401	VHF	14 cleared to land 401.
06:06:31	TWR	TEL	Hej, (x) i tornet.
06:06:33	RMP	TEL	Hej.
	TWR	TEL	Är du på deicingen?
06:06:34	RMP	TEL	Jo.
06:06:35	TWR	TEL	Du, för jag kan bara (erkänna) har jag glömt ringa Northflight. Han landar om ungefär fyra, fem minuter till plats 21.
06:06:41	RMP	TEL	Vad säger du allt för nåt?
06:06:42	TWR	TEL	Nordflight från Pajala. Om fem minuter ungefär till plats 21.
06:06:45	RMP	TEL	Ja. Okey, då skall jag se till att nån är där.
06:06:50	TWR	TEL	Okey, vad bra. Tack.
06:09:17	TWR	VHF	Northflight 401 on ground 09. Backtrack A3 to apron, stand 21.
06:09:22	401	VHF	Backtrack A3 to apron Northflight 401.
06:10:26	TWR	VHF	Northflight 401 report on apron.
06:10:30	401	VHF	Wilco 401.

06:10:38		TEL	[Ringing once]
06:10:42	MET	TEL	Metrologen ??.
06:10:43	TWR	TEL	Hej, (x) i tornet.
06:10:44	MET	TEL	Hej.
06:10:45	TWR	TEL	Du, kommer det, det vara så här dålig sikt mot banan tror du? Länge.
06:10:51	MET	TEL	Ja, det kommer det och vara.
06:10:52	TWR	TEL	Det lätt... Ja. Måste nästan ha LVP för jag ser ju ingenting.
06:10:58	MET	TEL	Nä, vad kan det vara? Det kommer nog att variera mellan 800 meter och 3 kilometer som mest.
06:11:03	TWR	TEL	Ja det blir ännu sämre alltså. Jaja. Ja men då vet jag. Okey. Hej.
06:11:07	MET	TEL	Ja. Hej.
06:11:46	TWR	VHF	Scandinavian 001 from Kallax tower.
06:11:51	001	VHF	Go ahead.
06:11:53	TWR	VHF	How many more minutes in deicing?
06:11:56	001	VHF	Jaa, dom håller på med, längst bak nu så jag...
06:12:00	TWR	VHF	Ja, okey för tiden går ut om tre minuter.
06:12:03	001	VHF	Ja.
06:12:04	401	VHF	Northflight 401 on apron.
06:12:06	TWR	VHF	Thank you.
06:14:40	TWR	TEL	Du, SAS 001, han höll ju inte tiden. Så nu får du säga om han skall taxa in och stänga av sina motorer igen eller om han skall starta.
06:14:50	STO	TEL	Äh... Så här, så här är det ju. Han har missat sitt fönster. Då måste han skicka en delay.
06:14:57	TWR	TEL	Ja, och det blir ju jag som får skicka den så att...
06:14:59	STO	TEL	Äh, men du alltså ja. Om jag visste hur det blev på Arlanda alltså för att, jag har lite grann satt en chansrestriktion. Och jag vet ta mig sjutton inte.
06:15:07	TWR	TEL	Ja. Nä det förstår jag å, alltså jag förstår.
06:15:10	STO	TEL	Kö, kör med han. Kör med han.
06:15:12	TWR	TEL	Okey.
06:15:31	STO	TEL	Ja, ??. Det är bra. Tack.
06:15:32	001	VHF	(Taxi) Scandinavian 001.
06:15:33	TWR	TEL	Hej. Hej.
06:15:35	TWR	VHF	Scandinavian 001 taxi to holding point runway 14.
06:15:37	001	VHF	Taxi to holding point 14 Scandinavian 001. May we have an extension?
06:15:47	TWR	VHF	Du menar slottime?
06:15:49	001	VHF	Affirm.
06:15:50	TWR	VHF	Affirm, you have that.
06:15:52	001	VHF	Thank you.
06:15:54	TWR	VHF	And wind is 030 degrees at 3 knots. QNH 1004. Temp minus 4, dew point minus 4. And braking action four, five minutes ago was 35, 26, 32.
06:16:09	001	VHF	Copied. QNH 1004, Scandinavian 001.
06:16:14	TWR	VHF	Scandinavian 001 advise when ready

			copy clearance.
06:16:17	001	VHF	We are ready to copy, Scandinavian 001.
06:16:20	TWR	VHF	Clearance Stockholm Arlanda, Verag 3B departure, UT31, flight level 400. Squawk 1004.
06:16:29	001	VHF	Cleared Stockholm Arlanda, Verag 3B, UT31, flight level 400 and squawk 1004, Scandinavian 001.
06:16:42	TWR	VHF	001.
06:16:46	TWR	VHF	Scandinavian 001 report ready. All intersections are available.
06:16:52	001	VHF	001 wilco.
06:16:59	TWR	RAD	(FP) står ni på driftsvägen norr antar jag?
06:17:02	FP	RAD	Vi står på driftsvägen norr.
06:17:07	RMP	TEL	Kallax rampen.
06:17:09	TWR	TEL	Hej, (x) i tornet.
06:17:10	RMP	TEL	Hej.
06:17:11	TWR	TEL	Du, jag skall lägga ännu mer arbete på dig. Jag ser ingenting så vi måste tyvärr ha LVP. Så att. Så det inte händer nånting.
06:17:17	RMP	TEL	Okey. Ja. Ja, då skall vi.
06:17:23	TWR	TEL	Då får du aktivera det. Tack. Hej.
06:17:24	RMP	TEL	Okey. Ja.
06:17:35	TODC		Beräkning gjordes för bana 14 med 2 mm snö och friktionskoefficient 0,26.
06:19:45	001	VHF	Tower, Scandinavian 001 we are ready at full runway.
06:19:49	TWR	VHF	Scandinavian 001, runway 14, cleared for takeoff.
06:19:52	001	VHF	14, cleared for takeoff, Scandinavian 001.
06:20:28		TEL	[Sound of dialling tone and dialling of an external number. Four signals but no answer. Lasting until 06:21:02]
06:20:41	TWR	RAD	Filip Ludvig.
06:20:42	FP	RAD	Filip Petter ?? i norr. [Partly masked by telephone ringing]
06:20:47	TWR	RAD	Jaa.
06:20:50	FP	RAD	??
06:20:57	TWR	RAD	Starta han från söder då?!
06:20:59	FP	RAD	Jag vet inte hur ??. [Partly masked by telephone ringing]
06:21:04	PER1	TEL	(x).
	TWR	TEL	Hej, det är (x), vänta.
06:21:06	TWR	RAD TEL	Du, han startade på fel bana, men det gjorde ju inte nånting egentligen, men. Ja, han startade bana 32. Va.
06:21:09	PER1	TEL	Nä. Jaha.
06:21:12	FP	RAD	?? FP.
06:21:13	TWR	TEL	Allvarligt. SAS han starta fel bana. Int för att det gjorde nåt för banan var ju fri, men...
06:21:17	PER1	TEL	Jaha. Jaja. Jamen det är sånt som händer. Lätt hänt.
06:23:31	TWR	TEL	Kallaxtornet (x).

06:23:32	SGS	TEL	Hej (x). (x) på SAS.
06:23:33	TWR	TEL	Hej.
06:23:34	SGS	TEL	001 kommer den iväg eller?
06:23:37	TWR	TEL	Jo, han kom iväg.
06:23:38	SGS	TEL	Vad bra.
06:23:39	TWR	TEL	Men du.
	SGS	TEL	Ja.
06:23:40	TWR	TEL	Det funkar inte så bra det där med delayer och så där.
06:23:43	SGS	TEL	Nä, och det var ju... Alltså dom gick ju fem i.
06:23:47	TWR	TEL	Joo, men ja. Det blir så himla fullt och så står ni i deicingen och så skall jag skicka delayer och ha... Alltså nu var dom jättesnälla på Arlanda. Han hade lika gärna kunnat få taxa in igen. (Jag vet int hur vi skull...).
06:24:34	TWR	TEL	Nä.
06:24:36	SGS	TEL	Ski, skickar jag en försening då blir det ju så även om han är då klar fem över.
06:24:41	TWR	TEL	Jå, det är himla svårt det där. För jag mena... Nu va han
06:24:43	SGS	TEL	Jaa. Det är som bara mellan tummen och pekfingret, nåt sånt.
06:24:47	TWR	TEL	Nu startade han ju utanför sitt fönster. Och det är int okey det heller. Men han sa på Arlanda: skickar vi en delay så kan vi lika gärna få en två timmar.
06:24:54	SGS	TEL	Javisst.
06:24:55	TWR	TEL	Men och, de int heller och hålla på och tumma systemet. För om... Ja. Ja det är så där. Men nu är han i luften i alla fall.
06:25:19	TWR	VHF	Scandinavian 001 airborne 20. Contact Sweden Control 125.6.
06:25:25	001	VHF	125.6 Scandinavian 001 one. Tack så mycket för hjälpen. Hej då.
	PER2	TEL	Va han ute på fel bana eller
06:26:30	TWR	TEL	Ja men absolut. Och vet du, jag sitter här och funderar vet du. Och så blir man så här... Men va sa jag till han.
06:26:35	PER2	TEL	Nä, du sa, du sa... 14
06:26:38	TWR	TEL	Sa jag 14 till han?
06:26:40	PER2	TEL	Och klart och starta 14
06:26:41	TWR	TEL	Ja visst sa jag det?! Runway 14 cleared for takeoff.
06:26:42	PER2	TEL	Jajamän. Ja.
06:26:45	TWR	TEL	Men vad läste dom tillbak? Missade jag att dom sa 32 när dom läste tillbak?
06:26:52	PER2	TEL	Eh. Den, de kom inte jag ihåg..
06:26:55	TWR	TEL	Nä. Alltså eller om dom bara sa cleared for takeoff. För att du vet att jag, jag kan skönja avisningen vet du.
			Jag kan sköja avisningen vet du och jag tyckte att SASen svängde fel. Och så tänkte jag bara naa men... Ibland knixar dom som till du vet innan dom vänder.
	TWR	TEL	Och sen hör jag bara dig. Ja men vi ser inget flyplan.

06:27:16	TWR	TEL	Jaa, jaa. Nu. Och så det här vädret. Det är väl typiskt.
06:27:19	PER2	TEL	I det här vädret. Men då, då är det inte utan orsak vi sätter ut LVP då.
06:27:24	TWR	TEL	Nä, vet du, det är ju inte det. Ja nu har vi verkligen svart på vitt att det kan va bra med LVP.
06:28:47	TWR	TEL	[Laughing] Du, lyssnade du på flygradion?
06:28:52	??	TEL	Ja, till och från.
06:28:53	TWR	TEL	Ja. Hörde du när SAS starta?
06:28:55	??	TEL	Näe.
06:28:56	TWR	TEL	Nä, nä. Jag tänkte bara om du hörde vad dom läste tillbaks.
06:28:59	??	TEL	Näe.
06:29:00	TWR	TEL	Dom starta fel bana nämligen. Jag ser, jag ser ju ingenting.
06:29:02	??	TEL	Håhå. Jamen just det.
06:29:05	TWR	TEL	Hå och stop. Det gjorde ju ingenting. Banan var ju fri, men du vet jag såg ju ingenting.