Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2006:20e

Aircraft accident to OO-DJN at Gothenburg/Landvetter airport, O county, on 10 March 2006

Case L-05/06

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.

The report is also available on our web site: www.havkom.se

Translated by Peter Langsdale from the original Swedish at the request of the Swedish Accident Investigation Board.

In case of discrepancies between the English and the Swedish texts, the Swedish text is to be considered the authoritative version.

Statens haverikommission (SHK) Swedish Accident Investigation Board

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Statens haverikommission
Swedish Accident Investigation Board

2006-10-20 L-05/06

The Swedish Civil Aviation Authority

601 73 NORRKÖPING, Sweden

Report RL 2006:20e

The Swedish Accident Investigation Board (Statens haverikommission, SHK) has investigated an aircraft accident that occurred on 10 March 2006 at Gothenburg/Landvetter airport, O county, involving an aircraft with registration OO-DJN.

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

The Board will be grateful to receive, by 23 April 2006 at the latest, particulars of how the recommendations included in this report are being followed up.

Göran Rosvall Henrik Elinder

Identical letter to EASA

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2 SHK document concerning item A-41/06
3 Extract from Register of Licences regarding the pilot (to the Swedish Civil Aviation Authority only)

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L-05/06
Report finalised 20-10-2006

Aircraft; reg. and type	OO-DJN, BAe Avro RJ85
Class/airworthiness	Normal, valid Certificate of Airworthiness
Owner/Operator	SN Brussels Airlines
Time of occurrence	2006-03-10, 21:50 hours, in darkness *Note.:* All times are given in Swedish standard time (UTC + 1 hour)
Place	Gothenburg/Landvetter Airport, O county, (pos. 5739N 01217E; 154 m above sea level)
Type of flight	Commercial passenger transport
Weather	According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis: Wind 040°/8 knots, visibility > 10 km, cloud none, temperature/dew point −11/−14 °C, QNH 1013 hPa
Persons on board:	
crew members	4
passengers	28
Injuries to persons	None
Damage to aircraft	Substantially damaged
Other damage	None
Commander:	
Sex, age, licence	Male, 52 years, valid ATPL.
Total flying time	10200 hours, of which 3500 hours on type
Flying hours previous 90 days	124 hours, of which 83 hours on type
Number of landings previous 90 days	113, of which 22 on type
Co-pilot:	
Sex, age, licence	Male, 25 years, valid ATPL.
Total flying time	2381 hours, of which 2104 hours on type
Flying hours previous 90 days	83 hours, of which 62 hours on type
Number of landings previous 90 days	91, of which 67 on type
Cabin crew members	Two females, C/A 1 and C/A 2

The Swedish Accident Investigation Board (SHK) was notified on 10 March 2006 that an aircraft with registration OO-DJN had an accident at 21:50 hours on that day at Gothenburg/Landvetter Airport, O county.

The accident has been investigated by SHK represented by Göran Rosvall, Chairperson, Henrik Elinder, I IC/technical investigator, and Stefan Christensen, operational investigator.

The investigation was followed by Max Danielsson and Ulrika Svensson, Swedish Civil Aviation Authority.

Summary

After takeoff from Gothenborg/Landvetter airport the red lamp on the instrument panel, indicating that the nose wheel gear was not retracted and locked, did not extinguish. When the pilots, after several tries, did not managed to get normal function of the landing gear they requested to go back

and land at the departure airport. During the return flight the pilots requested to make a low fly-by over the airport to try to get the position of the landing gear checked from the ground by airport personnel.

This was accepted and the aircraft made an ILS approach[1] to runway 03 and levelled out at 200–300 above ground level. The low pass was made parallel to runway 03 and approximately halfway between the runway and the control tower. After the fly-by, during which the pilots heard that staff on the ground thought that all the landing gear was lowered, they decided to land on runway 03.

A smooth landing was achieved on the main gear at about 100 knots IAS[2]. and with the nose wheel in the air. The nose wheel remained extended for about 2.5 seconds after its first contact with the ground, and then the nose wheel gear folded forwards towards its retracted state. The nose of the aircraft hit the runway and the aircraft slid further, supported by its nose and the main landing gear for about 300 meters before it stopped.

No one onboard was injured and the evacuation was made via slides. During the evacuation one of the cabin crew, a female, had difficulties to lock the rear left door in full open position which made the evacuation difficult.

The technical investigation has showed that a grease-nipple on the nose wheel locking mechanism was blocked resulting in insufficient lubrication causing the mechanism to jam.

Furthermore the Board has noted that the certification requirements for emergency evacuation from an inclined aircraft do not contain a requirement for the door to be capable of being secured in the open position.

The accident was caused by seizure of the nose wheel locking mechanism as a result of a blocked grease nipple, which prevented correct lubrication.

Recommendations

The Swedish Civil Aviation Authority is recommended to:

- Investigate whether there is a need for special regulations concerning low fly-by passes and if such a need is identified, to issue such regulations *(RL 2006:20e R1)*.
  (Compare with the SHK document in item A-41/06 in Appendix 2 of this report.)

EASA is recommended to:

- On certification of new types of aircraft to ensure that physical strength is not a decisive factor for opening and locking emergency exits on aircraft in the open position, even in the case of abnormal tilting angles *(RL 2006:20e R2)*.

[1] ILS = Instrument Landing System
[2] IAS = Indicated Air Speed

1 FACTUAL INFORMATION

1.1 History of the flight

1.1.1 The flight

The aircraft, an Avro RJ85 belonging to SN Brussels Airlines, operated on the route Brussels–Gothenburg–Brussels as SN 2275/2276.

The flight to Gothenburg proceeded without problems and landing on runway 03 took place in good meteorological conditions. Due to a late arrival to Gothenburg, the crew agreed to try to keep the time on ground to a minimum before the return flight to Brussels as SN 2276. After about half an hour on the ground, with nothing out of the ordinary noted, the aircraft taxied out to take off from runway 03. The same good weather conditions as for the landing applied.

1.1.2 Fault indications

Take-off was at 21:02 with normal procedures and the aircraft commander as the pilot flying. When the landing gear was retracted the red lamp on the instrument panel did not extinguish, indicating that the nosewheel gear was not retracted and locked. When the pilots lowered the landing gear to try another retraction, they saw that the green lamp to indicate that the nosewheel landing gear was lowered and locked did not light.

The commander notified air traffic control that they had problems with the landing gear and needed time to investigate the fault. Air traffic control then gave permission for SN 2276 to enter the Nolvik[3] holding pattern at 4000 feet. The commander transferred control to the co-pilot and as a first step tried to check the position of the landing gear via the alternative indication system. This system has lamps that indicate green when they are pressed down, providing that the respective landing gear is down and locked.

During this check the lamps for the left and right main gears lit, but that for the nosewheel gear remained unlit. The commander then went through the procedures according to the emergency check list. Not even after activating the landing gear emergency system did the indications show that the gear was down and locked – neither on the ordinary nor the emergency indication system. On activating the emergency lowering system, oil pressure in parts of the system fell, meaning among other things that the nosewheel steering could not be used.

Since the weather conditions at Brussels were difficult, the pilots decided to return to Gothenburg/Landvetter Airport and land there. They informed the cabin crew of the situation and the commander also gave brief information to the passengers via the PA system. SN 2276 declared an emergency to air traffic control and requested a low fly-by over the airport to try to get the position of the landing gear checked from the ground by airport personnel, if possible. This procedure is permitted by the aircraft operator and is included as an item on the emergency check list. This request was approved by air traffic control after co-ordination with the control tower, and the aircraft commander then took over the controls. The aircraft made an ILS approach[4] to runway 03 and levelled out at 200–300 above ground level. The low pass was made parallel to runway 03 and approximately halfway between the runway and the control tower.

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[3] Nolvik = Radio beacon west of Landvetter
[4] ILS = Instrument Landing System

1.1.3 Preparations

After the fly-by, during which the pilots heard that staff on the ground thought that all the landing gear was lowered, they decided to land on runway 03. On being asked by air traffic control, the pilots agreed to keep the aircraft in the holding for about 10 minutes until the rescue services would be in position. (Reinforcement vehicles were requisitioned from the Gothenburg municipal rescue services). While in the holding, the pilots carried out the prescribed procedures in the emergency check list and instructed the cabin crew to prepare the cabin for a so called "Level two" landing. This means that the cabin is checked extra carefully and that the passengers are instructed to remain seated with their seat belts properly tightened.

The commander also informed the cabin crew that there was a risk of the nosewheel collapsing, and therefore asked the crew to be "mentally prepared" for an upgrade to "Level three" which would involve emergency evacuation. The passengers were not informed about the risk of a nosewheel collapse on landing. During the initial approach the pilots received the message that the rescue vehicles from the municipal rescue services had not yet arrived at the airport, and were asked to carry out some additional 360° turns. At this time a third attempt was made to lower the nosewheel gear to the locked position but this was unsuccessful. The pilots did think, however, that the sound of "locking" was on this occasion normal, and therefore believed that the nosewheel gear, despite the absence of a green light, was in the down and locked position.

During the additional waiting time, higher vertical g manoeuvres than normal were carried out, with the aim of using the vertical forces to achieve nosewheel gear locking. These manoeuvres were in accordance with the instructions in the emergency check list, and were announced to the passengers before they were begun. These measures did not however make any change to the nosewheel gear status. Air traffic control was also notified that the aircraft would remain on the runway after landing, since the nosewheel steering was unusable due to the attempt of emergency lowering of the gear.

1.1.4 Emergency landing

A normal ILS approach to the runway commenced at 21:44. The flaps were gradually lowered to 33°, which is normal. At a late stage an audible warning was activated, indicating that the landing was not down and locked, so the co-pilot switched off the two circuit breakers that provided the system with power.

A smooth landing was achieved on the main gear at about 100 knots IAS[5]. and with the nosewheel in the air. After about 17 seconds of ground roll the nose lowered, and the nosewheel contacted the runway. The nosewheel remained extended for about 2.5 seconds after its first contact with the ground, and then the nosewheel gear folded forwards towards its retracted state. The nose of the aircraft hit the runway and the aircraft slid further, supported by its nose and the main landing gear. According to an interview with the pilots there was a tremendously loud noise in the cockpit, while a burning smell and smoke came up through the floor. The airport staff could witness that there was a large shower of sparks emerging from the underside of the aircraft nose.

The slide continued for about 24 seconds, and the aircraft finally came to a stop at 21:52 with its nose just to the left of the runway centre line. The brakes were activated by the commander during the slide to increase the retardation of the aircraft. The distance from the first point of contact of the nose to where the aircraft came to rest was about 300 m. As soon as the

[5] IAS = Indicated Air Speed

aircraft stopped the pilots started the “Emergency Evacuation Checklist” and the commander ordered evacuation of the aircraft as soon as all four engines had been stopped.

1.1.5 The evacuation

On receiving the evacuation order C/A 1, who was the senior cabin crew, first opened the left forward door and checked the operation of the emergency slide, and then opened the right forward door. When she had checked the operation of the slide she began the evacuation by calling out: “Get up, get out, go, go, go”. Evacuation of the forward part of the cabin took place with no problems and 18 of the 28 passengers left the aircraft through the forward emergency exits. As the evacuation began, the first rescue vehicles arrived at the accident site.

The rear doors are hinged at their rear edges and thus swing back when opened. C/A 2 opened the left rear door to commence evacuation. The door opened normally and the slide inflated. However the door would not lock in the open position, but swung back towards its closed position. C/A 2 then called to the passengers to use the other side, while she tried twice more but unsuccessfully to get the door to stay in its open position. A male passenger had in the meantime opened the rear right door. While C/A 2 checked that the slide had inflated normally, she blocked the left exit and directed the passengers to escape through the right exit, through which ten passengers evacuated.

The passengers were directed away from the aircraft and the cabin crew checked that there was no-one remaining in the cabin. The commander and the senior cabin crew verified that the aircraft had been evacuated and handed over to the rescue personnel who boarded the aircraft. The passengers were gathered together with some difficulty (many were in the process of taking photographs of the aircraft with their mobile telephones), and with the aid of ground staff could get them into the terminal building. The commander then briefly explained the event to the passengers.

None of those on board were injured.

Location: 5739N 01217E; 154 m above sea level.

1.2 Injuries to persons

	Crew members	*Passengers*	*Others*	*Total*
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	4	28	–	32
Total	4	28	–	32

1.3 Damage to aircraft

Substantially damaged.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 Commander

The commander, male, was 52 years old at the time and had a valid Airline Transport Pilot Licence.

Flying hours			
latest	*24 hours*	*90 days*	*Total*
All types	3	124	10200
This type	3	83	3500

Number of landings this type previous 90 days: 22.
Flight training on type concluded in 1999.
Latest PC (Proficiency Check) carried out in 2005 on 16 October.

1.5.2 Co-pilot

Co-pilot, male, was 25 years old at the time and had a valid Airline Transport Pilot Licence.

Flying hours			
Latest	*24 hours*	*90 days*	*Total*
All types	3	83	2381
This type	3	62	2104

Number of landings this type previous 90 days: 67.
Flight training on type concluded in 2003.
Latest PC (Proficiency Check) carried out in 2005 on 29 November.

1.5.3 Cabin crew members

2 females (C/A 1) and (C/A 2)

1.5.4 The crew members' duty schedule

The commander was on the last day of an eight day duty roster.
The co-pilot was on the last day of a ten day duty roster.

1.6 Aircraft information

1.6.1 General

Aircraft information	
Manufacturer	BAE Systems
Type	Avro RJ 85
Serial number	E2275
Year of manufacture	1995
Gross mass	Max. authorised start/landing mass 43200/38500 kg, actual 34000/32600 kg
Centre of mass	Within permitted limits
Total flying time	23705 hours
Number of cycles	19375
Flying time since latest inspection	C-check/836 hours
Fuel loaded before event	Jet A1, 2860 kg left tank, 2800 kg right tank

ENGINE	
Manufacture	Honeywell

Model	LF507			
Number of engines	4			
Engine	*No. 1*	*No. 2*	*No. 3*	*No. 4*
S/N	Lf-07400	Lf-07446	Lf-07492	Lf-07562
Total operating time, hrs	20182	13367	19598	10574
Operating time since overhaul	8760	9242	2979	10574
Cycles after overhaul	6553	7628	2149	8832

The aircraft type is a four-engined jet with room for 82 passengers, 10 C class and 72 Y class. The aircraft had a valid Certificate of Airworthiness.

1.6.2 *Landing gear*

The three sets of landing gear on this aircraft type are extended and retracted hydraulically. The landing gear is operated by a control on the instrument panel in the cockpit. Immediately to the left of the control are indication lamps which show the status of the landing gear. When all three sets of wheels are extended and locked, three green lamps are lit – one for each set of wheels. While the landing gear is in motion three red lamps are lit, and when all three landing gears are retracted and locked, none of the six lamps are lit. There is also an alternative indication system, where check lamps are lit when they are depressed, on condition that the gears are in their locked position.

The landing gear has an emergency system which enables the landing gear to be extended even without access to hydraulic pressure. In this case the landing gear is extended with the aid of gravity and dynamic air forces. Operation of the emergency landing gear extension system takes place by means of a handle located under a cover between the pilots' seats. When after emergency operation the landing gear is in position permitting landing, three green indication lamps immediately above the handle are lit.

Each landing gear is equipped with electrical sensors which register when they are under load (when the aircraft is on the ground).

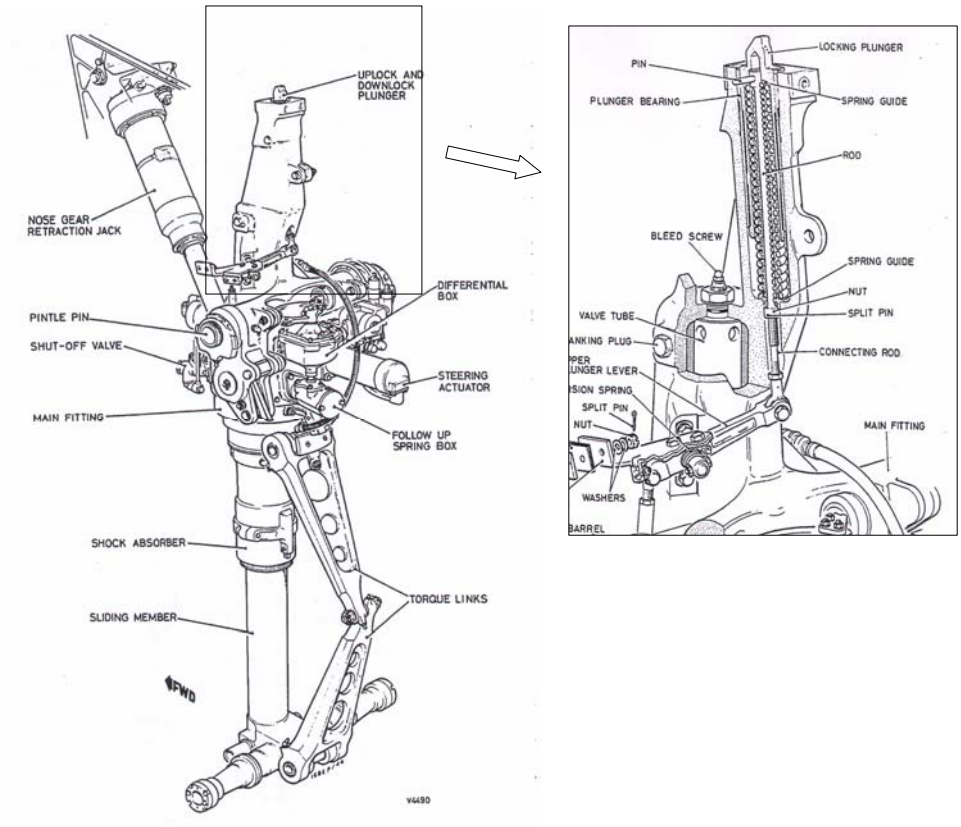
1.6.3 *Nosewheel locking function*

The nosewheel gear consists in principle of a sprung landing gear leg with its upper end on a bearing in the aircraft structure. Inside the landing gear

leg, above the bearing point, is a built-in locking function consisting of a locking plunger that moves inside a cylinder. The plunger locks the landing gear, both downwards and upwards, by hooking onto latches in the nosewheel gear aperture. The plunger and cylinder are lubricated by grease via a grease nipple on the landing gear leg.

The plunger is spring-loaded to its locked (pressed out) position by means of a compression spring. At the end of the landing gear extension and retraction movements the plunger moves a small distance on a cam in front of each respective latch before, with the aid of spring pressure, it is pushed out to its locked position. Unlocking takes place by means of the locking plunger, with the aid of a linkage system connected to the landing gear hydraulic cylinder, being pulled into the landing gear leg so that it is released from the locking latch before the extension or retraction movement begins. (See the illustration below.)

For aircraft maintenance purposes the nosewheel gear can be manually locked in the extended position by inserting a locking pin into the landing gear. Insertion of the locking pin is mechanically prevented unless the locking plunger is in its locked position.



1.6.4 *Maintenance status*

The aircraft had been maintained in accordance with the applicable regulations. The maintenance interval for the nosewheel gear is 15000 landings (cycles) or 12 years. The inspection interval is 500 landings. During inspection the gear locking mechanism must be greased.

At the time of the accident the landing gear had accumulated 558 landings since maintenance. Inspection including greasing of the locking mechanism had been carried out 367 landings before the accident in connection to periodical inspection of the aircraft.

1.7 Meteorological information

1.7.1 At the time of the accident

According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis:

Wind 040°/8 knots, visibility > 10 km, cloud none, temperature/dew point –11/–14 °C, QNH 1013 hPa. Estimated runway temperature –10/–15 °C.

At 20:26 the temperature/dew point was measured as –9/–12 °C.

1.7.2 Air temperatures

According to measurements in the aircraft (FDR):

During the flight to Gothenburg the aircraft spent over 50 minutes at an altitude of above 30000 feet where the air temperature (SAT – Static Air Temperature) was below –50 °C.

The air temperature while on the ground at Gothenburg was approximately –8 °C.

When the aircraft departed from Gothenburg the air temperature was –7.5 °C and during the abbreviated flight was at its lowest –12.5 °C.

The temperature in the environment where the aircraft was for the last two and a half hours before the accident never rose above –6.0 °C.

1.8 Aids to navigation

The aircraft carried out a normal ILS approach with the aid of ordinary ground and airborne navigational equipment.

1.9 Communications

There were radio communications between the aircraft and air traffic control. The relevant parts of this communication have been transcribed and are shown in Appendix 2.

1.10 Aerodrome information

Gothenburg/Landvetter airport status was in accordance with AIP[6]-Sverige/Sweden.

1.11 Flight recorders

1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with a Flight Data Recorder (FDR) of type P/N 980-4700-003 S/N 1653 which registered the relevant parameters from the landing in question. This information has been analysed and shows that the approach to the airport and landing on the runway took place normally. The nosewheel met the runway and came under load approximately 17 seconds after the main gear touched down. Just under 3 seconds later the load ceased, which indicates that at this point the gear began to retract.

[6] AIP – Aeronautical Information Publication

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with a Cockpit Voice Recorder (CVR) of type P/N 980-6020-001 S/N 1106 which had the capacity of recording noise in the aircraft for 30 minutes. Noise recorded during the course of the events has been analysed and selected parts transcribed, and attached as Appendix 2 of the report.

1.12 Accident site and aircraft damage

1.12.1 Accident site

After a normal landing on runway 03 the nosewheel gear collapsed and the aircraft slid on its nose approximately 300 metres before it stopped a few metres to the left of the centreline and about halfway along the runway.

1.12.2 Aircraft damage

Extensive damage was caused, including damage to the underside of the cabin nose and to the nose landing gear doors.

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

Immediately after the aircraft stopped on the runway the pilots could smell burning. However no signs that there was a fire have been found.

1.15 Survival aspects

1.15.1 General

The abnormal dynamic forces to which those on board were exposed in connection with the nosewheel gear collapsing and during the slide along the runway were minimal. The aircraft emergency transmitter was not activated.

The slide of the aircraft along the runway was uncontrolled and contained a risk of departing from the runway and collision with objects outside the runway, along with some fire risk.

1.15.2 Actions by the rescue services

Just over 20 minutes before the accident occurred, the rescue services were alerted that the aircraft had interrupted its flight and would fly back to the airport to land with a suspected fault in the landing gear. Because the flight crew accepted a delay in landing until the required rescue services had arrived, the rescue crew was well prepared. In all 17 vehicles and their crews were in position when the aircraft landed.

After the landing the rescue personnel were quickly on site and could secure the aircraft and assist passengers to evacuate the aircraft.

1.16 Tests and research

1.16.1 Measures taken on the aircraft at the accident site

When those on board the aircraft had left it, the nose was raised and the nosewheel gear was inspected. It was found that the nosewheel leg was hanging freely in an unlocked condition. It was not possible to insert the manual locking pin. When a technician pushed the landing gear leg to its fully extended position and at the same time knocked gently on it with a plastic hammer, a metallic sound was heard and the leg locked. It could be visually confirmed that the locking plunger had sprung out. After this it was possible to insert the manual locking pin.

1.16.2 Technical examination after towing

After towing, a visual inspection of the nosewheel gear aperture, the nosewheel gear and its locking mechanism was carried out, without finding anything abnormal. As far as it was practically possible the operation of the locking mechanism and its indication system were tested, and operation appeared to be normal. The checks were performed with the aircraft in an environment where the air temperature was above freezing. The nosewheel gear was then removed as a complete unit from the aircraft and sent for further inspection by a specialist workshop. After dismantling measurements were made of the nosewheel gear attachment points in the aircraft structure without finding any faults.

1.16.3 Technical examination of the nosewheel gear

Dismantling and inspection of the landing gear were carried out by the ordinary landing gear maintenance workshop in the presence of representatives of organisations including SHK (The Swedish Accident Investigation Board), the aircraft manufacturer, the landing gear manufacturer and the aircraft operating company. On dismantling the landing gear locking plunger water was found to be present on its sliding surfaces. There was very little lubricating grease on the plunger and its cylinder, and such grease as was present was discoloured and contaminated by water.

Plunger

On closer examination of the lubricating nipple, MS 15001-4, which is attached to the landing gear leg, and through which grease to the locking plunger must pass, it was discovered that it had been incorrectly manufactured and had no hole for grease at all. (See the illustration below.)

The actual grease nipple

The actual grease nipple and a correctly manufactured grease nipple

At overhaul of the landing gear normally all grease nipples are replaced. The actual grease nipple was manufactured by the Alemite company and distributed via the Wesco or Valtec companies. It has not been possible to obtain any explanation for the incorrect manufacture.

1.17 Organisational and management information

1.17.1 General

The aircraft operating company is based in Brussels and operates charter and scheduled traffic in Europe, Asia and the USA. There are about 2000 employed staff and the company operates about 35 aircraft of which more than 30 are of the BAe 146-200 and Avro RJ85ER/RJ100ER types.

1.18 Additional information

1.18.1 Measures taken by the aircraft operators

Because of this accident the aircraft operating company, among other things, informed staff concerned about the accident and carried out checks of all the aircraft concerned in respect of lubrication of the nosewheel gear locking system.

1.18.2 Measures taken by the aircraft manufacturer

The aircraft manufacturer has sent an All Operators Message (AOM) to all operators using this aircraft type: Ref 06/019V, which provides information about the accident and recommends specific checking action. In addition it is planned to complement the relevant section in the Aircraft Maintenance Manual (AMM).

1.18.3 Measures taken by the landing gear manufacturer

The landing gear manufacturer has initiated revision of the regulations for inspection and service of the affected type of landing gear.

1.18.4 Checks on the nipples in the stores

The appropriate organizations have checked the workmanship of lubrication nipples in their stores without finding any with the same type of fault.

1.18.5 Preliminary technical information

On 21 April 2006 the Swedish Accident Investigation Board (SHK) delivered to the Swedish Civil Aviation Authority a preliminary technical report concerning the fault that was found.

1.18.6 Fly-by to check the landing gear status

In a document, referenced A-41/06, the Swedish Accident Investigation Board (SHK) drew the attention of the Swedish Civil Aviation Authority to the fact that, in the cases of several accidents which had occurred during the previous year, there had taken place fly-bys at low altitude close to the air traffic control tower to check the status of landing gear, and that this can introduce certain elements of risk. In this document SHK pointed out that it should be investigated as to whether special routines and procedures are necessary for fly-bys.

1.18.7 Certification of emergency exits/emergency evacuation

When an aircraft is certified to carry passengers the evacuation in the case of an emergency situation is one of the criteria. The principal rule is that it shall be possible to evacuate all passengers in no more than 90 seconds, using only half the aircraft emergency exits.

The leaning angle of the aircraft, due to the collapse of one or more of the landing gears, is included as a factor when certifying emergency evacuation. The regulations governing certification of aircraft in this class are JAR[7]25. The Directive concerning the requirements for emergency evacuation are found in JAR25.809, where an extract of the text is as follows:
Each emergency exit must be capable of being opened, when there is no fuselage deformation, -
(1) With the aeroplane in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs of the landing gear.

[7] JAR = Joint Aviation Regulations

The Directive text does not include any definitions to state whether the expression “opened” means “opened, and locked in the open position”.

1.18.8 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. (See chapter 2.5)

1.18.9 Environmental aspects

No known environmental effects.

2 ANALYSIS

2.1 The flight

After take-off the pilots suspected that a serious technical failure had occurred in the nose gear. Their decision to abandon the flight and return to the departure airport was relevant. SHK has doubts however concerning the subsequent fly-by close to the air traffic control tower in order to get a visual check on the status of the landing gear.

SHK understands that in certain situations there may be good reason for a low speed fly-by, but questions whether these reasons take into account the risks that are associated with this kind of improvised flying at low speed and low height in the landing configuration and in addition with a defective aircraft. (Compare with section 1.18.6 above.)

2.2 The accident

When the aircraft landed the flight crew were aware of and well prepared for the probability that the nosewheel was subject to a serious fault. The landing was therefore performed gently and with the nose high, which together with other favourable landing conditions contributed to the consequences of the nosewheel collapsing being relatively minor. The appearance of a burning smell and the risk of fire after the landing motivated the decision to emergency evacuate the passengers.

2.3 The evacuation

SHK has nothing to add concerning the routines and procedures used during evacuation of the aircraft. In the opinion of SHK the co-ordination and handling of the situation by the crew worked well.

The rear left door could not be used for evacuation, because it could not be secured in the open position. This difficulty was due, as far as could be ascertained, to the fact that the aircraft, after the emergency landing, had adopted an abnormal position, where the forward inclination hindered the opening movement of the rear-hung doors. It should also be noted that the wind was blowing at about 8 knots from directly in front, which should have facilitated the opening and securing of the door.

With only 28 passengers and the front emergency exits available, the problem with the rear door should not have had any decisive effect on the execution of evacuation. In a fully loaded aircraft with fire or the risk of fire in the forward section, such problems with the door could have serious con-

sequences. SHK finds it remarkable that a door intended for emergency evacuation of an aircraft not could be secured using normal physical strength in its open position with such a small amount of inclination that results from a nosewheel collapse.

2.4 The nosewheel gear

After the accident the nosewheel could be locked in its extended position by gently knocking the leg with a plastic hammer. During the subsequent checks on the nosewheel attached to the aircraft no fault or abnormality could be found, neither in the locking mechanism nor in the indication system. During these checks the air temperature was above freezing.

The continued technical examination showed that a grease nipple in the nosewheel locking mechanism, which probably was installed at the last overhaul, was blocked due to a manufacturing fault. As a result the locking plunger, which was supposed to lock the landing gear in both the uplock and downlock positions, was never correct lubricated after the landing gear was last installed in the aircraft. Since that last installation the mechanism had therefore operated with only the small amount of grease that was applied during maintenance. The fact that the faulty nipple was not discovered in connection with maintenance can be explained by greasing often being carried out with the aid of compressed air, which reduces the possibility of a technician "feeling" the grease being pressed in.

After dismantling it was seen that water was present and water had contaminated the grease on the locking plunger and its cylinder. The insufficient amount of grease had probably allowed damp air to condense into water with the normal temperature changes that occur during flying. Water had then successively accumulated in the area.

According to the FDR the aircraft was, for two and a half hours before the accident, in an environment where the temperature never rose above –6.0 °C. Everything indicates therefore to the force of the compressive spring, which has the task of pressing the plunger into its locked position, being too low to overcome the friction resistance, so that the plunger remained in the compressed position. This also explains why the pilots could not get the nosewheel gear to lock in either the extended or retracted positions.

As can be seen from section 1.18 the affected organizations have taken several different measures to eliminate the risk of an incorrectly manufactured lubrication nipple being able to cause a similar fault. Further, it appears that the incorrectly manufactured grease nipple was a singular and unique fault. SHK therefore sees no reason to issue any technical recommendation as a result of this event.

2.5 Equal opportunities aspects

As stated in section 2.3 the rear left door could not be used for evacuation. This door should have been opened by a female member of the cabin crew. She did not however succeed in getting the door to lock in its open position. The equivalent door on the other side of the aircraft fuselage was opened by a male passenger, and this door did lock in its open position.

Examination of the door after the event has shown that it was not faulty. It must therefore be assumed that the difficulty in getting the door to lock in its open position was due to the forward inclination of the aircraft due to the nosewheel collapse, which meant that greater muscular force was required of the person who was to operate the door than is normally required when the aircraft fuselage is horizontal, and that the female crew member was not strong enough to apply the required force.

In the light of the fortunate circumstances, as SHK pointed out in section 2.3, the problem with the emergency escape door had no serious consequences. It is nevertheless unsatisfactory that a problem with the emergency exits arose with such a small angle of tilt that existed in this case. For both safety and equal opportunity reasons, escape doors, etc. should be designed so that physical strength is not of decisive consequence when it comes to opening and getting doors to lock open, even where large angles of inclination are concerned.

2.6 Certification Directive

The currently applicable Directive for emergency evacuation regulates the requirements for the opening of emergency exits at different angles of inclination caused by some form of landing gear collapse.

The expression “opened” is used in the Directive text, which the regulation compilers probably thought should also mean “open and locked”. In this specific case the difference between these expressions has however meant that an emergency exit could not be used in an emergency evacuation of a damaged aircraft.

SHK considers that the text of such an important Directive must not contain ambiguities, or alternative interpretations, where the regulation compiler has taken the view that it is implicitly understood that certain expressions also cover other expressions. It is obvious that an emergency exit shall be *open and locked* for it to be capable of use in the manner for which it is certified. It is therefore very important for the aircraft manufacturer to be given clear regulations as to the applicable requirements, and that future certification shall also show that opening and securing in the open position of emergency exit doors can take place without physical strength being a decisive factor.

3 CONCLUSIONS

3.1 Findings

a) The crew members were qualified to perform the flight.
b) The aircraft had a valid Certificate of Airworthiness.
c) The aircraft had been maintained in accordance with the applicable regulations.
d) The locking plunger in the nosewheel locking mechanism had jammed.
e) A grease nipple in the locking mechanism was blocked.
f) The faulty nipple was adjudged to be a singular and unique case.
g) There was a fly-by of the control tower at 200–300 feet at low speed and in darkness.
h) The female cabin attendant could not secure the left rear door in open position after the accident.
i) The certification requirements for emergency evacuation from an inclined aircraft do not contain a requirement for the door to be capable of being secured in the open position.

3.2 Causes

The accident was caused by seizure of the nosewheel locking mechanism as a result of a blocked grease nipple, which prevented correct lubrication.

4 RECOMMENDATIONS

The Swedish Civil Aviation Authority is recommended to:

- Investigate whether there is a need for special regulations concerning low fly-by passes and if such a need is identified, to issue such regulations *(RL 2006:20e R1)*.
  (Compare with the SHK document in item A-41/06 in Appendix 2 of this report.)

EASA is recommended to:

- On certification of new types of aircraft to ensure that physical strength is not a decisive factor for opening and locking emergency exits on aircraft in the open position, even in the case of abnormal tilting angles *(RL 2006:20e R2)*.

Appendix 1

CVR information from OO-DJN, 10 March 2005

NOTE! The fact that the CVR recording was supplied as a tape cassette means that timing errors of up to 10% may be present, depending on the accuracy of the tape player used.

Summary

On 3 April 2006, three tape cassettes with recorded material from the CVR concerning this incident were received.

All relevant voice traffic has been transcribed. In some cases the flight crew spoke in Flemish. The Flemish speech was translated into English and is written here in *italics*.

Headings

Time: The start time in minutes and seconds for each message is stated relative to the start time of the recording. There is no reference to local or UTC time. On each right-hand track are brief tones which are assumed to be timing markers!? 3.92–3.93 second intervals.

From: Source of message.
FO – First Officer on OO-DJN, (somewhat deeper voice)
CDR – Commander on OO-DJN (somewhat lighter voice)
xP - One of the pilots or both simultaneously
CA – Cabin attendant
APP – Landvetter approach control
TWR – Landvetter control tower
9017 – Novelair 9017
16E – Swedstar 16E

Note: Remarks
– Aircraft interphone

Information: Message written out in plain text.
?? means that it was not possible to interpret the information.
(Parentheses are used to indicate that the translation is uncertain).
[Square brackets are used to denote comments].

Time	*From*	**Note**	**Information**
00:00:22	TWR		And SL3U will you pass over the taxiways or more over the ramp area?
00:00:29	CDR	#	*Yes*, in between the ramp and the taxiway.
00:00:30	FO		In between the ramp and the taxiway, SN38U.
00:00:33	TWR		38U thank you.
00:00:36			[A beep lasting 0.9 seconds]
00:00:37	FO	#	?? altitude cancel
00:00:48	FO	#	?? flight director off
00:00:50	CDR	#	Yes.
00:00:59			[A beep lasting 0.6 seconds, similar to that at 00:00:36]
00:01:03			Five hundred. [Autocall from aircraft system]
00:01:04	CDR	#	We are maintaining 500 feet ??
00:01:08	FO	#	*Yes*.
00:01:19			[A beep lasting 0.8 seconds, similar to that at 00:00:36]
00:01:35			Too low, flaps. [Autocall from aircraft system]
00:01:38	FO	#	*Yes, 200 feet still*
	CDR	#	Yes
00:01:43	FO	#	The tower is there to the right of us
00:01:58	FO	#	??

00:02:16	TWR		SL38U, Yeah, it looks like the gear is down, but it is a little bit hard to see due to the darkness, but both the car on the taxiway and we in the tower seems to see that the wheel is out.
00:02:32	CDR	#	Okay.
00:02:32	FO		Okay thank you SL38U
00:02:35	CDR	#	Uh, request…
00:02:35	TWR		And 38U you can now contact Göteborg arrival 120.12 and to decide what to do.
00:02:43	FO		120.12 SL38U.
00:02:47	FO	#	flight vectors for uh?
00:02:52	CDR	#	Yes, Flaps 18
00:02:53	FO	#	Flaps 18.
00:02:54	CDR	#	Speed 190.
00:02:58	CDR	#	*Yes we are going uuh, yes we are going back here but uhh you have to tell them that we cannot taxi, so uhh they uhh have to provide a truck to pull us off the runway and hope the gear is down*
00:03:04	FO	#	O.K.
00:03:18	FO		Landvetter departure SL38U, we are levelling off now at 3000 feet and would request vectors for the ILS 03 again.
00:03:26	APP		SL38U Roger, and turn left to heading 250 for vectors.
00:03:31	FO		Left to heading 250 for vectors SL38U.
00:03:35	CDR	#	*And yes, VFTO,* flaps up.
00:03:36	FO	#	Speed checked.
00:03:37	FO	#	Flaps up.
00:03:39	FO	#	Heading 250 and *what altitude do you want?*
00:03:42	CDR	#	*yes, 3000 if possible for them, if it's o.k. with you, and them?*
00:03:46	FO		And SL32 … 38U is that okay for you that we keep 3000 feet?
00:03:51	APP		38U yeah, 3000 is fine and do you declare an emergency?
00:03:56	CDR	#	Affirmative.
00:03:57	DJN		Affirmative SL38U so we're gonna land and we will not be able to taxi, so if there could be a tow-truck ready to tow us from the runway?
00:04:06	APP		Okay Sir Roger that.
00:04:09	FO		So for your information we do not have the nose wheel confirmed down.
00:04:15	APP		Roger.
00:04:18	CDR	#	And set autopilot on, number 1.
00:04:21	FO	#	Autopilot number 1.
00:04:22	CDR	#	And autothrottle on, please.
00:04:24	FO	#	Autothrottle on.
00:04:26	CDR	#	And after takeoff checklist.
00:04:28	FO	#	Roger. So after takeoff checklist, the gear is down, flaps are up, engine air, *so I stay on* APU air Danny?
00:04:38	CDR	#	*Yes, yes, yes, leave it that way.*
00:04:40	FO	#	Engine air is off, APU air on and TRP is takeoff reduced, after takeoff checklist completed.
00:04:48	FO	#	And *then for the* climb checklist ? *The APU just keeps running? Is that O.K.?*
00:04:50	CDR	#	*Yes*.
00:04:52	APP		SL38U the problem is that a lot of traffic is coming in behind you and you will block the runway in that case, is it okay for you to hold a while?
00:04:59	CDR	#	Yes, affirmative.
00:05:00	FO		Affirmative SL38U.
00:05:02	APP		38U yeah, could you climb to 4000 feet?
00:05:05	CDR	#	Affirmative.
00:05:06	FO		Affirmative we climb to 4000 feet SL38U and do we hold at Nolvik again?

00:05:10	APP		38U climb to 4000 feet and proceed on the heading until advised please.
00:05:14	FO		We climb to 4000 feet and we proceed on the heading SL38U.
00:05:20	CDR	#	*Al right*, *fly a little, I will now brief our friends* okay*? [friends i.e. cabin crew]*, so we are climbing 4000 maintaining heading for the moment *O.K* ?, keep about speed 190, uh 200. You have control.
00:05:33	FO	#	My controls.
00:05:36	FO	#	My ATC
00:05:45	CA	#	*Yes, Hello*. [Female voice]
	CDR	#	*Can you come in for a minute please?*
	CA	#	*Yes*. [Female voice, same as at 00:05:45]
00:05:59	CDR	#	*Yes, so we have confirmed the gear problem so we are going back to Göteborg but we have to hold because everybody is* ?? *Everybody has been notified but we don't know when we will be landing but it will be a* normal landing*, because we passed in front of the tower and according to the tower, everything is out [means that the gear is down]. But it might not be solidly down, O.K.?*
	CA	#	*Yes*.
	CDR	#	*I will now ?? the passengers* [At this stage communication from App makes all further conversation between CDR and CA unintelligible]
00:06:24	APP		And SL38U we will have one landing before you and then I will vector you in for runway 03 so you can expect around 40 track miles.
00:06:32	FO		Roger thank you SL38U.
	CDR	#	*?? attached and ?? O.K.*
	CA	#	*Good luck*
	CDR	#	*O.K?*
	CA	#	*See you later.*
00:06:43	FO	#	*Yes* , *so that has been said*. *There will be one coming before us 40 mile* trackmiles *and then it will be our turn*
	CDR	#	*Yes*.
	16E		Göteborg go'kväll (Translator's note: "Good evening"), Swedstar 16E descending 5000 feet on radar heading 090.
	APP		Swedstar 16E, Hej (Translator's note: "Hello"), Radar contact. Descend till (Translator's note: "to") 3000 feet.
	16E		Descending 3000 feet Swedstar 16E
00:06:53	CDR	PA	[Public address announcement] Ladies and gentlemen from the cockpit, so we just passed in front of the tower for a crosscheck of the landing gear, and following the visual inspection of the tower the gear should be down, so we are holding a little bit just to leave some aircraft coming in, because if we do have a small problem with the nose wheel the aircraft can be stuck on the runway and so we are blocking all the traffic. So just for comfort of the other aircraft we are holding a little bit, all the situation is under control and flight safe, so that we gonna land back at Göteborg. I apologize once more for that and just follow the instruction of the cabin crew please, thank you. [end 00:07:36]
00:07:21	APP		SL38U request persons onboard.
00:07:26	FO		Say again for SL38U.
00:07:28	APP		Persons onboard please.
00:07:33	FO		Could you say again for SL38U?
00:07:35	APP		Persons aboard.
00:07:37	FO		Ah sorry, persons aboard, we have … stand by.
00:07:41	FO	#	*yes, of course I haven't written down how many passengers we have on board*,

	CDR	#	*I'll tell you right away* 28+4, 32.
00:07:49	FO		We have 32 persons onboard SL38U.
	CDR	#	No dangerous goods.
	APP		Thank you.
00:07:53	FO		And we have for your information no dangerous goods onboard.
00:07:57	APP		Say again please.
00:07:58	FO		For your information we have no dangerous good onboard.
	APP		Okay thank you.
	CDR	#	*O.K.*
00:08:05	FO	#	*It was written on that other little paper, 28. So you'll make a normal landing uh…*
00:08:16	CDR	#	*…and as long as possible keep* the nose wheel *from the ground, but I won't let it dip… fall because if the* nose gear *isn't completely locked…*
00:08:24	APP		SL38U request fuel.
	CDR	#	Fuel we got 4.2., 4.3
00:08:30	FO		We have 4.2 … 4.3, 4 ton 300 hundred onboard SL38U.
	APP		Thank you.
00:08:47	CDR		?? SL38U we don't have any need of priority, we can hold if you want just to leave some aircraft coming in.
00:08:58	APP		Yes, I'll let some aircraft come in but it's your turn now so turn left to heading 160 for vectors.
00:09:03	CDR		Roger 160, it should be no problem for the landing but most probably we will not be able to leave the runway.
	APP		Understood.
00:09:18	APP		*Swedstar 16 E left heading 070 cleared ILS 03*
00:09:19	CDR	#	*(?? we are landing so I'll take them back is that O.K.?) [Communication from App covers parts of what the CDR is saying]*
00:09:23	FO	#	*Yes, your controls*
	16E		*Left heading 070 cleared ILS 03 Swedstar 16E*
00:09:39	FO	#	*So we make a normal* landing, *uh, and you will then say something to the cabin when we are on the ground as well?*
	CDR	#	*Yes yes, yes yes but uh, if we…*
00:09:49			[sound of a chime]
	CDR	#	Hello.
	CA	#	Cabin is fully secured *and* no problem
	CDR	#	Yes thank you and for *your* information (name CA*) so it's a normal* landing.
	CA	#	Yes.
	CDR	#	B*ut* we never know, *it might end with an* evacuation *but that is* normal procedure *then,* okay ?
	CA	#	Okay, thank you.
	CDR	#	*But no fear or nothing. It will be a normal touch but after the touch something might happen.*
	CA	#	*O.K., Alright.*
	CDR	#	*And then it might be an evacuation or maybe even not, O.K.?*
	CA	#	*That's fine, thank you.*
	CDR	#	*Relax O.K.?*
	CA	#	*Oh yes, alright*
00:10:30	16E		Göteborg, Swedstar 16E established Localiser 03
	CDR	#	??
	APP		16E thank you, you're number 1. Contact Tower 118 6 Goodbye
	16E		Tower 118 6 Swedstar 16E Hej då (Translator's note: "Goodbye")
00:10:32	xP	#	?? *yes I had flown with it and there was always something with it. I was right wasn't I?*

00:10:59	FO	#	*Yes and those other guys are here so the technician wont be able to come any more*
00:11:38	FO	#	*Shall I go through the approach checklist?*
00:11:40	CDR	#	*Yes, or the* descend checklist *just so we know that everything is in order. D*escend checklist
	FO	#	descend checklist, pressurization
00:11:46	CDR	#	*Yes is zero, is good*
	FO	#	Briefing.
00:11:48	CDR	#	*Is*, yes, ILS with the problem, we know.
00:11:52	FO	#	Yes. Landing data. Ah, the speeds
	CDR	#	*Yes the speeds maybe again, yes for uh, yes take 33 ton, I can't read it so uh*
	FO	#	Yes, wait, I'll make some light
	CDR	#	triple one, 164, *yes, so maybe you can quickly take the checklist*
00:12:15	CDR	#	emergency checklist
00:12:16	APP		SL38U turn left heading 100 and approximately 22 track miles.
00:12:22	FO		Turn left 100 and 22 track miles 38U.
00:12:28	CDR	#	*Page uh, thirty six, uh thirty fi; thirty six A*
00:12:32	FO	#	Yes
00:12:41	FO	#	The landing gear not locked down after normal down selection . *Have you done a reset of the* circuit breaker?
00:12:48	CDR	#	*Ah no, maybe not, hmm*
00:12:50	FO	#	*It's B2*
00:12:54	APP		And SL38U when ready descend till (Translator's note "to") 3000 feet.
	FO		When ready we descend 3000 feet SL38U.
00:13:03	CDR	#	*Yes, it's in*
00:13:05	FO	#	Check and attempt one reset if appropriate.
00:13:09	FO	#	*Have you done a reset? And then you have* to recycle
00:13:15	FO	#	*Shall I* recycle *again?*
00:13:16	CDR	#	Uh, *yes, you may do it*
00:13:21	FO	#	Selecting gear up.
00:13:26	CDR	#	*Nothing, the wheels don't move.*
00:13:38	xP	#	*Ah yes, but no, it's that thing, set it down. Yes perfect. So it's too late to put him back… Yes it's a little late. Even though..well, you might try it, yes ? Yes. Do you know the systems? Well, hope that my hands are not caught in between. Yes. There is a little handle here isn't there? But you have to pull here a little upwards first. And then there is a handle to remove. Watch out, you can get your hands…[App partially covers conversation at this point]… Yes, leave it that way.*
00:14:09	APP		SL38U the fire brigade from the city will be here in approximately seven minutes. Would you like to make a 360 to wait for them or would you like to start your approach?
00:14:18	CDR	#	It's better to wait a little bit if possible.
00:14:21	CDR		It's better to wait a little bit if possible, Sir, we get plenty of fuel.
00:14:25	APP		38U Roger you can make a 360 to the right, let's make a 360 to the right.
00:14:30	CDR		Right hand 360 thank you.
00:14:41	xP	#	*Do you want me to take a look if? Yes yes. Yes it's a stupid [simple] system. It's just a little handle somewhere, wait, I'll turn the light on.*
00:15:13	FO	#	*But they have told me how you have to look out with that because you can get your hands caught in between.*
00:15:16	CDR	#	*Yes*, yes, gear up.
00:15:17	FO	#	Gear up.

00:15:31	CDR	#	??
00:15:36	CDR	#	*Yes set the gear back down.*
00:15:37	FO	#	Gear down.
			[Sound that could be landing gear going down]
00:15:44	CDR	#	*It locked, did you hear it, tak tak*
	FO	#	Yes.
	CDR	#	*Yes, it locked. It's the door which god dammit is fucking up. Did you hear it? Tak tak, that is the first lock of the* nose gear
00:15:54	FO	#	I pull him back out here?
00:15:56	xP	#	*Uh, yes yes. Just pull it o.k.? Yes. And now check it, ah, good.*
00:16:08	CDR	#	*On what heading were we, I don't remember anymore. Oh yes it was towards the, uh, It was 100 I think*
00:16:21	FO	#	?? 35B ?? landing ??
00:16:29	CDR	#	*So we have taken that* autospoiler *out, and otherwise* this is normal landing and we hold a little bit the nose gear and *, but no, I heard it, it's… it's locked*
00:16:49	FO	#	*Gear* with nose gear not locked down *please* accelerate to placard speed and make gentle application of G. *After landing it may not be possible to fit all gear locking pins.*
00:16:59	CDR	#	*Yes but I will, when I take it manually later, before the runway, I'll start a little, because* …[refers to putting G forces on the aircraft in order to try to get the gear to lock]]
00:17:10	FO	#	*O.K. and then* 36.
00:17:13	CDR	#	*And the runway is there yes.*
00:17:21	APP		38U make another 360 to the right please, another 360 to the right.
00:17:25	FO		We make another 360 to the right SL38U.
00:17:34	FO	#	Nose gear up, autospoiler off, *you have done that.*
	CDR	#	Yes. *There, and it's confirmed here.*
00:17:40	FO	#	Yes, flaps 33, deploy the spoilers manually with caution and only when nose gear is on the ground…
00:17:50	CDR	#	… on ground yeah *nose, that's standard and* manually why, *because I have set the autospoiler off. So what will happen to us; we will get a normal (amplitude) for landing, and just after landing, we will, as I lower the nosewheel, it will maybe, slowly come on the ground*. *It will maybe make some lights [sparks] ??*
00:18:16	APP		38U I've just been in contact with the tower and they said 10 minutes, 9 minutes from now the rescue team will be here, so would you like to wait another 360?
00:18:28	FO		Affirmative SL38U.
00:18:29	APP		38U yeah, make another 360 please and then we will start your approach.
00:18:34	FO		Make another 360 SL38U, confirm the heading that we roll out on.
00:18:40	APP		You can roll out on the heading 090, one 360 and then …yeah, 180.
00:18:47	FO		One 360 and then 180 we roll out on 090 SL38U.
	APP		Thank you.
00:18:54	FO	#	*O.K. so that* apply some G-force *and uh…*
00:18:58	CDR	#	*Yes I will do that If I now; if it works out for that approach, then I'll go manual, it's good weather, and then I can see if we don't get it down…Because the problem is that we can't get it up nor down so that means that that door stays open and…*
00:19:10	FO	#	*Yes. But that can't change much with, uh, that door can't change much with uh… the play or..?*
00:19:22	CDR	#	*Oh no, no because I am sure it is locked. We heard*

			it earlier; tak tak, that was the nose and then we have the main
00:19:32	FO	#	(one more) 360
	CDR	#	Yes, yes, yes
00:19:42	CDR	#	*I lost my situational awareness a li.. ah yes there*
00:19:48	FO	#	*There is the runway, to your left. Shall I do the approach checklist meanwhile?*
00:19:50	CDR	#	Yes, approach checklist.
	FO	#	Approach checklist, altimeters.
	CDR	#	1013 set and crosschecked.
	FO	#	QNH 1013 set and crosschecked. Flight instruments, *uhh*, Backa for the go-around *is on my side and you have uhh…*
	CDR	#	… anyway it's fully visual
	FO	#	Yes, flight instruments set and crosschecked fuel panel is set *. We still have 3 ton 8.* Fasten belts is on, the cabin *was* secured, *she said* and APU is still running. Approach checklist is complete. *And why do you think we would not be able to taxi then?*
00:20:23	CDR	#	*No, there is a chance, because with the problem with the* nosewheel, *then I can't have any* nose wheel steering. *And yes, well, when this crate is on the ground I will not risk of putting it on it's nose then just by taxiing.*
00:21:10	xP	#	*Oh no, of course not. And stopping and…try to get off the runway… we will see. Yes. The feeling we have on the ground, then I will deviate and stop. Then we'll ask for a little bus for the passengers and bla bla bla…Lucky that it's not an ?? guys, because, where are those firemen?[referring to that their emergency is not an urgent one] They were eating or what? Well in fact… Well, when you see a fire it's already…Yes, it should not be allowed. I was also thinking. That should really not be allowed.*
00:21:41	CDR	#	*Who wanted that* nightstop ??
00:21:44	FO	#	[laughing], *Yes, I did.*
00:21:49	xP	#	*Well maybe they will let us fly home with their aircraft. What? Maybe they will let us fly home with their aircraft. Yes, we will phone and they will dare to say " O.K. 14000, full fuel and fly home"*
00:21:58	APP		SL38U roll out on heading 070, heading 070 and approximately 18 track miles.
00:22:05	FO		We roll out on 070 SL38U okay.
00:22:10	CDR	#	*No, because there is still a problem. It did not go up and it did not go down. Because if it had not gone up, and you get three greens then you can fly gear down. But you are then limited to 14000, and with that weather, that would have been fun [ironic]. Oh well!*
00:22:31	CDR	#	*Where is that little runway? Yes, In sight.*
00:22:34	FO		And from SL38U could you confirm we intercept localizer 03?
00:22:37	APP		38U yeah and descend till (Translator's note "to") 3000 feet cleared straight in ILS runway 03.
00:22:42	FO		We descend 3000 feet cleared straight in ILS 03 SL38U.
00:22:56	CDR	PA	Now ladies and gentlemen for information we are now coming in for the landing and during the final I will manoeuvre with the aircraft just to pull some g-force to see if we got the safe gear indication, thank you.
00:23:18	CDR	#	Voilá I take it manually, so we have gear down, flaps … ja.
00:23:23			[3 brief audible signals]
00:23:30	CDR	#	?? loc is alive
	FO	#	Checked.

00:23:40	FO	#	heading and the QFU, glide is alive
00:24:06	CDR	#	*Yes I'll stop because those guys will get sick in the back. It must be panic and I don't want that*
00:24:12	FO	#	*Yes, it's obvious that it's not much use.*
00:24:14	CDR	#	*No, no, no.*
00:24:20	FO	#	And the glideslope is alive.
	CDR	#	Thank you, so the approach checklist was completed?
00:24:23	FO	#	Roger.
00:24:24	CDR	#	Approach checklist is complete?
00:24:25	FO	#	Yes, approach checklist is complete.
	CDR	#	Ah, O.K.
00:24:29	CDR	#	Flaps 18.
00:24:30	FO	#	Speed checked flaps 18.
00:24:31	CDR	#	Speed 160.
00:24:32	FO	#	Speed 160.
00:24:38	APP		SL38U are you established now?
00:24:40	CDR	#	Ja. (Translator's note: "Yes")
00:24:40	FO		We are established localizer 03, SL38U.
00:24:43	APP		38U thank you, 9 miles to touch down contact tower 118 6 goodbye.
00:24:47	FO		118 6 bye SL38U.
00:24:51	FO		Göteborg tower hello again, SL38U we are becoming established 03.
00:24:57	TWR		Good evening again SL38U, tower continue approach runway 03, wind 030 degrees and 8 knots.
00:24:03	FO		We continue approach 03 SL38U.
00:25:07	CDR	#	Set 3000, set okay.
	FO	#	3000 set.
00:25:29	TWR		Novelair 9017 line up runway 03 and be ready for a quick departure.
00:25:34	9017		Line up 03 we are ready for departure.
00:25:43	TWR		Novelair 9017 wind 030 degrees 10 knots cleared for takeoff.
00:25:49	9017		Cleared takeoff 03 Novelair.
00:25:53	FO	#	Radio altimeter alive.
	CDR	#	Ja okay okay. We're gonna make altimeters check at 2000 feet.
	FO	#	Yes
00:26:33	CDR	#	*They haven't understood anything. There is someone on the rolling point. If we get problems, so be it. We have warned those guys..; oh, it could be the fire brigade.*
	FO	#	*Yes it could be the fire brigade. One just left but the fire brigade is ready.*
00:26:44	CDR	#	*2000, mark [passing through 2000 feet]*
	FO	#	correct
00:26:47	CDR	#	Gear is down flaps 24.
	FO	#	Speed checked flaps 24.
00:26:52	FO	#	140.
00:26:55	CDR	#	*Following the Emergency nose gear extension, ah we have no nose gear*
	FO	#	*No… No, that's just it.*
00:27:04			[warning signal sound lasting 2.1 seconds]
00:27:04	TWR		SL38U wind 040 degrees and 8 knots cleared to land runway 03.
00:27:10	FO		Cleared to land 0,3 SL38U.
00:27:13	FO	#	Landing checklist?
00:27:15	CDR	#	Landing checklist.
00:27:16	FO	#	Landing checklist, gear.
	CDR	#	Nose gear is not safe.
	FO	#	Yes. Brakes.
00:27:21	CDR	#	?? checked.
00:27:23	FO	#	APU is not, on … eh off. The flaps to go, and nose wheel steering is centred. One open item.

00:27:33	CDR	#	Yes. Set flaps (33).
00:27:35	FO	#	Speed checked flaps 33.
00:27:36			[warning signal sound lasting 17 seconds]
00:27:44	xP	#	?? Now I can't cancel it. Hmm, that is strange, can't we shut down that aural? I have to pull right? Yes. [H, discussion at the same time as the warning sound]
00:27:55	FO	#	Ca van, ?? an aural warning ?? *We are rather high.*
00:28:07	CDR	#	Yes.
00:28:10	FO	#	Further flaps?
00:28:11	CDR	#	33 set for nose wheel uhh … set for landing.
00:28:14	FO	#	33 set for landing. Landing checklist completed, and we are cleared to land.
00:28:35	CDR	#	Slightly high on glide, no problem.
00:28:37	FO	#	Checked.
00:28:41			[Middle Marker signal]
00:29:21	FO	#	Ground idle.
00:29:32	CDR	#	??
00:29:33			[crackling noise continuing until 00:29:46, total of 13 seconds]
00:29:48	FO	#	*Four engines are off.*
00:29:49	CDR	#	*Yes*.
00:29:55	?	?	?? (evacuation) ?? [unintelligible]
00:29:59			[a clicking sound, then quiet, probably main power switch or equivalent]

Statens haverikommission
Swedish Accident Investigation Board

Appendix 2

2006-04-05 A-41/06
Dossier 3.1

The Swedish Civil Aviation Authority
SE-601 73 NORRKÖPING, Sweden

Low fly by passes in association with technical problems

The Swedish Accident Investigation Board (Statens Haverikommission – SHK) has noted in a number of investigations that are in progress where low fly-bys have been performed or been considered during various operational and weather conditions, following suspected landing gear malfunctions.

The applicable incidents are:

- L-50/04, Cessna Citation in December 2004 at Arlanda airport. Nosewheel collapse on landing on runway 26. Air traffic control asked if the aircraft commander wanted to perform a low fly-by. The aircraft commander declined due to the prevailing weather conditions.
- L-33/05, PA 31 in September 2005 at Umeå airport. Nosewheel collapse on landing on runway 32. A low fly-by was performed at a very low height above the runway.
- L-05/06, Avro RJ 85 in March 2006 at Landvetter airport. Nosewheel collapse on landing on runway 03. Low fly-by at low height in darkness.
- L-06/06, PA 31 in March 2006 at Umeå airport. Emergency landing on the airport after belly landing on snow parallel to the runway. Repeated fly-bys at low height.

The low fly-bys had the intention of trying to obtain visual confirmation of a suspected aircraft malfunction, usually concerning some part of the landing gear. Manoeuvres of this kind, as far as SHK knows, have become some sort of general practice where problems are experienced with the landing gear before landing.

SHK understands the need felt by an aircraft commander to obtain confirmation of faults and malfunctions in the case of aircraft types where the position of the landing gear cannot be seen from the cockpit. In many cases the landing gear may be assumed to be locked down even though the cockpit indications show this is not the case. However, no information to confirm whether the landing gear is locked down or not, can be obtained in this way. Nevertheless, there is a possibility of, for example, identifying a failure on one side, so that a judgement can be made concerning which is the most likely direction of a possible devation from the runway.

SHK considers that a serious problem is raised by the fact that these low passes are performed in uncontrolled ways without restrictions. Such low passes are naturally carried out at low speed in landing configuration, i.e. with landing gear and flaps extended. It should also be borne in mind that these low passes take place with an aircraft that is to some extent defective, by a crew at increased stress level preceding an expected emergency landing.

In one of the cases, that on 10 March at Landvetter, this manoeuvre was performed with a four-engined jet aircraft at approximately 300 feet in darkness along the area between the runway and the control tower. The aircraft was in commercial transport service with paying passengers on board. The level of risk associated with such a manoeuvre is naturally hard to assess, but seen from a broader flight safety perspective the subsequent emergency landing could be said to be less of a risk.

The investigations into the above-mentioned incidents are not yet complete. However, SHK wishes to draw the attention of the Swedish Civil Aviation Authority to this matter so that possible rules for low fly-bys can be considered and – if such rules are drawn up – issued without delay.

Stockholm as dated above

Göran Rosvall
Chairperson
The Swedish Accident Investigation Board