Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2009:14e

Incident involving aircraft OE-LRW at Åre/Östersund airport, Z län (Jämtland county), Sweden on 9 September 2007

Case L-27/07

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

2009-09-18 L-27/07

The Swedish Transport Agency

SE-601 73 NORRKÖPING, Sweden

Report RL 2009:14e

The Swedish Accident Investigation Board has investigated an incident that occurred on 9 September 2006 at Åre/Östersund airport, Z-län (Jämtland county), to an aircraft registered OE-LRW.

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 March 2010 at the latest, particulars of how the recommendations included in this report are being followed up.

Göran Rosvall Stefan Christensen

APPENDICES

1. ***CD with animations (paper edition only)***
2. ***Transcript of radio communication***
3. ***Report from the ATC***
4. ***Report from the handling agent***
5. ***Crew calculated load sheet***
6. ***Crew calculated balance sheet***
7. ***GWC table runway 30***
8. ***Expert opinion from SKL***

Press here for link to animation (internet edition only)

Report RL 2009:14e

L-27/07
Report finalised 18 September 2009

Aircraft; registration and type	OE-LRW, McDonnell Douglas DC 9/MD83
Class, airworthiness	Normal, valid Certificate of Airworthiness
Registered owner/Operator	Sanayi Enterprises Inc./M.A.P. Management and Planning GmbH, Vienna, Austria
Time of occurrence	9 September 2007, at 21:06 hours, in darkness. Unless stated otherwise, all times are given in Swedish daylight saving time (UTC + 2 hours)
Location	Åre/Östersund airport, Z län (Jämtland county), (Posn. 63°11'40"N, 014°30'00"E; 375 m above sea level)
Type of flight	Commercial air transport
Weather	According to the METAR at 20:50: Wind 130°/8 knots, no cloud below 5000 feet, temperature/dew point +08/+04°C, QNH 1004 hPa
Persons on board:	
crew members	6
passengers	169
Injuries	None
Damage to aircraft	None
Other damage	Damage to approach lights and reflective snow poles
Commander:	Male, 38 years old, ICAO ATPL Turkish no. 3643/Austrian Validation no. 9226
Total flying time	9,260 hours, of which 8,160 hours on type
Flying hours previous 90 days	158 hours, all on type
Number of landings previous 90 days	62
Co-pilot:	Male, 32 years old, CPL/IR Turkish no. 4555/Austrian Validation no. 9227
Total flying time	2,060 hours, of which 1,820 hours on type
Flying hours previous 90 days	218 hours, all on type
Number of landings previous 90 days	91
Cabin crew members	4 females

The Swedish Accident Investigation Board (SHK) was notified on 10 September 2007 that a McDonnell Douglas MD83 aircraft with registration OE-LRW had an incident 9 September 2007, 21.06 hours, at Åre/Östersund airport, Z län (Jämtland County).

The accident was investigated by SHK represented by Göran Rosvall, Chairperson, Stefan Christensen, Investigator in Charge and Lars AlveståI, operations investigator aviation. SHK was assisted by Roland Karlsson as an operations expert.

The investigation was followed by Britt-Marie Kärlin, Swedish Civil Aviation Authority.

Summary

An MD 83 aircraft was scheduled to perform a charter flight for a Swedish travel agency from Åre/Östersund Airport to Antalya, Turkey. There were 169 passengers and six crew members on board. At take off, which was made from

runway 30, the aircraft became airborne at the end of the runway. Afterwards it was established that the aircraft had collided with the approach lights for the opposite runway. Damage had been made to lights and reflective poles up to a distance of 85 meters from the runway end.

The cockpit crew had requested take off from runway 30, due to a more favourable climb out profile from a performance point of view, as there were no obstacles in the climb out direction. The surface wind, which also had been prevailing when the aircraft landed one hour earlier, was though in favour for take off runway 12.

When analyzing the crew calculations for take off it was revealed that the present weather- and wind conditions was not included in the calculations that was the base for the maximum allowed mass for the particular take off. A number of baggage pieces in the forward cargo compartment were not included in the calculations. Standard weights were used for calculations of passenger- and baggage weight. In order to investigate if there were any deviations from the standard weight, SHK carried out a weight survey among the passengers. The result was that the real passenger mass was 568 kilos more than the calculated. The investigation showed that the aircraft was 3.148 kilos heavier than the maximum allowed mass during prevailing conditions. The analyses of the take off also showed that the rotation of the aircraft was initiated late and with too low rotation rate.

The pilots were employed in the company as a part of a business deal when the actual aircraft was leased, and had not passed the normal selection and employment routines. Company training was accomplished, but the Commander had in connection with the take off applied some own procedures that was not in compliance with company rules and policies. SHK points out in the report that it is probable that the crew prioritized production, and thereby neglecting some flight safety issues, in order to execute the flight.

The incident was caused by deficiencies in the company's handling of the balance between flight safety and production. These deficiencies lead among other things, to that take off performance calculations was carried out without some limiting factors, implying that the aircraft mass exceeded the maximum allowed under the prevailing conditions.

Recommendations

- The Swedish Transport Agency is recommended to increase the number of SAFA inspections (Safety Assessment of Foreign Aircraft), and in the international flight safety community work for that these inspections are completed with control of the statements regarding operational documentation of the actual flight. *(RL 2009:14e R1)*

- The Swedish Transport Agency is recommended to work for that the Austrian Civil Aviation Authority (Austro Control) follows up the work of improvement within the company in question regarding Safety Management System, employment routines and training of cockpit crew. *(RL 2009:14e R2)*

1 FACTUAL INFORMATION

1.1 History of the accident

1.1.1 Conditions

Flight number KK7634 was a charter flight carrying passengers from Åre/Östersund airport to Antalya airport in Turkey. The aircraft, of type MD-83, had departed from Antalya earlier that day and arrived at Åre/Östersund approximately one hour before the incident. The landing was on runway 30[1]. The tour operator Detur had engaged Atlasjet Airlines in Turkey as the airline to perform the flight. Atlasjet had in turn a leasing agreement with the airline M.A.P. Management and Planning GmbH, which is registered in Vienna, Austria.

1.1.2 Preparations for the flight

Passenger and baggage check-in, loading and refuelling were carried out by Scandinavian Ground Services, SGS, in Östersund, which had been contracted to provide these services. The loading instructions, preparation of the load & trim sheet and performance calculations for the flight were prepared by the pilots. Standard weights for the passengers and baggage were used. The loading instructions and ordering of fuel were given verbally.
The total number of passengers was 169, including one infant.
163 bags were checked in as baggage, although the crew had only noted 134 pieces of baggage on the load & trim sheet.
According to the load & trim sheet for the flight the aircraft take off mass was [2] 154,557 lb[3] (70,169 kg), while the maximum permitted, uncorrected, take off mass for runway 30 at Åre/Östersund was 155,620 lb (70,651 kg). The crew calculated the maximum permitted take off mass taking into account the conditions pertaining to performance. These calculations omitted certain influential factors such as a tail wind and the current atmospheric air pressure.

1.1.3 The take off

At request of the crew the take off was performed on runway 30 with tail wind. The reason for this was that this runway provided a higher base value for calculating the maximum permitted take off mass, due among other things to the runway slope and the absence of obstacles in the direction of departure. The aircraft positioned for take off at the beginning of the runway and performed a static take off, i.e. take off power was set before the brakes were released.

The aircraft lifted off at the end of the runway. It was later discovered that the aircraft had struck the approach lights at the far end of the runway. Damage was caused to the transverse approach lighting bars and to the reflective snow poles located close to the lighting fixtures. The transverse approach lighting bars are located 27, 56, and 85 meters respectively from the runway threshold and are approximately 50 cm high.

Neither the crew nor air traffic control reported anything abnormal during the take off and the flight continued as planned to Antalya in Turkey.

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[1] The runway number is an abbreviation of the approximate compass bearing, i.e. runway 30 runs in the direction of approximately 300°.
[2] Within aviation terminology the term mass is used to express weight.
[3] 1 lb = 0.454 kg

The incident occurred in darkness at position 63° 11' 55.1"N, 014° 28' 46"E, 364 metres above sea level.

1.1.4 *Interviews with the crew*

Interviews with the crew took place at the Austrian Civil Aviation Authority premises in Vienna 8 days after the incident. The interviews were carried out by SHK with the crew members individually, in the presence of an accredited representative of the Austrian AIB[4] and a representative of the Austrian Civil Aviation Authority.

<u>The landing</u>
According to the interviews with the crew, the landing at Åre/Östersund took place approximately 1 hour before the take off. They had planned toland on runway 30, taking into account the weather information that was available to the crew, which was that the forecast wind was 280° at 9 knots, (see Section 1:7). When the actual weather was obtained from the control tower, however, the earlier plan was changed, to land on runway 12 instead. According to the commander this decision was based on both the actual wind (which he remembered as 130°, 6 or 8 knots), and also that runway 12 had an ILS facility. The landing took place without any problem.

<u>The time spent on the ground</u>
In accordance with company procedures the commander performed a walk around check while the aircraft was on the ground, which also included supervision of, and instructions for, refuelling the aircraft. The co-pilot prepared for the departure by, among other things, calculating and checking the performance figures. According to the interviews it was routine procedure for the co-pilot to perform these calculations and for these then to be checked by the commander. The co-pilot also stated that he felt confident and competent in the execution of this task. Both pilots were of the opinion that runway 30 was more favourable from the performance point of view, due to the absence of obstacles in the direction of departure.

As far as the commander could remember the performance calculations were based – either completely or partially – on the wind information that was in the available forecasts. No weather information was provided to the crew by the handling agent at the airport. The commander could not remember the wind direction in the actual weather report from the control tower that was obtained before engine starting. The co-pilot stated that he – without remembering why – had used zero wind as a base value when he was calculating the various take off alternatives.

The loading instructions to the ramp personnel in respect of the baggage were verbal and consisted only of “load from the rear forwards” (see Section 1.17.2). According to the commander, after loading had been completed, he received notice from the ground staff regarding the number of bags in the rear hold compartments - 3 and 4 – and that there were “a few” bags in hold compartment 1. These could, according to the commander, who on his own admission was not informed of the actual number, be regarded as a minor change and therefore did not need to be added into the calculation. He also stated that the company policy (with reference to Section 8 in the OM-A), was not to change the load & trim sheet if the alteration was less than 500 kg or 5 passengers.

<u>The take off</u>

[4] Austrian AIB: The Austrian Accident Investigation Branch

The commander could not remember the actual weather at take off but could recall that they had made the calculations for take off from runway 30 because this made a higher take off mass possible. The take off was performed statically and with the air conditioning systems of both engines switched off. According to the commander this provided higher take off power even though formally one could not make use of this by means of a higher permitted mass in accordance with the performance tables. The commander however claimed that in his personal experience this meant that the permitted take off mass could be increased by 2,000 lb (908 kg).

The acceleration during take off was perceived as normal by both pilots. The commander felt that the rotation was “heavier” than normal. He also said that he performed a slow rotation, taking into account the risk of a tail strike. After the rotation the aircraft had to be trimmed more to the rear than normal, according to the commander. Both the co-pilot and the commander admitted that the aircraft was low at the end of the runway, but not so low that they could have struck the approach lights. The climb out and the remainder of the flight passed without any further problems.

1.1.5 Interview with eyewitness 1

A witness who was located about 60 meters north of the extended runway centreline and about 800 meters from the threshold of runway 12 stated that the take off and climb away of KK7434 were characterised by unusually loud engine noise, the aircraft was low and the flight path was shallow. The witness, at that time a pilot in the Swedish Air Force, had many years of experience from operations at Åre/Östersund airport. He related that he thought at first it was a pair of military combat aircraft taking off. When it turned out to be a civilian commercial aircraft he was convinced that it had suffered an engine failure during take off, since it was flying so low at the location where he was observing it. See Figure 6.

1.1.6 Interview with eyewitness 2

A former air traffic controller at Åre/Östersund airport was on board as a passenger and provided a statement giving his impressions of the take off of KK7434. The former air traffic controller also had experience as a pilot in the Swedish Air Force. He stated that the aircraft was held on the brakes while the engines spooled up to take off power, i.e. a static take off. The passenger also told how both the control tower and the "snow hangar" went past while the aircraft was still on the ground. The snow hangar is located south of the runway and about 100 m from the end of runway 30. Immediately after passing the threshold of runway 12 the landing gear was retracted. None of the information supplied by the crew indicated that anything abnormal took place during take off. See Figure 6.

1.2 Injuries to persons

	Crew members	Passengers	Others	Total
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	6	169	–	175
Total	6	169	–	175

1.3 Damage to the aircraft

After the incident had been brought to the attention of SHK contact was made with the airline's base in Antalya, where both that particular aircraft and crew were based. An inspection of the aircraft was carried out by the base commander on site. The inspection did not reveal anything, no damage or other observations could be found on any part of the aircraft.

After contact with MAP, however, another inspection was carried out by a company representative. This did not reveal any damage to the parts of the aircraft that were lowest while passing the damaged approach lights. During this inspection, nevertheless, a foreign object was found in the aircraft's right landing gear.

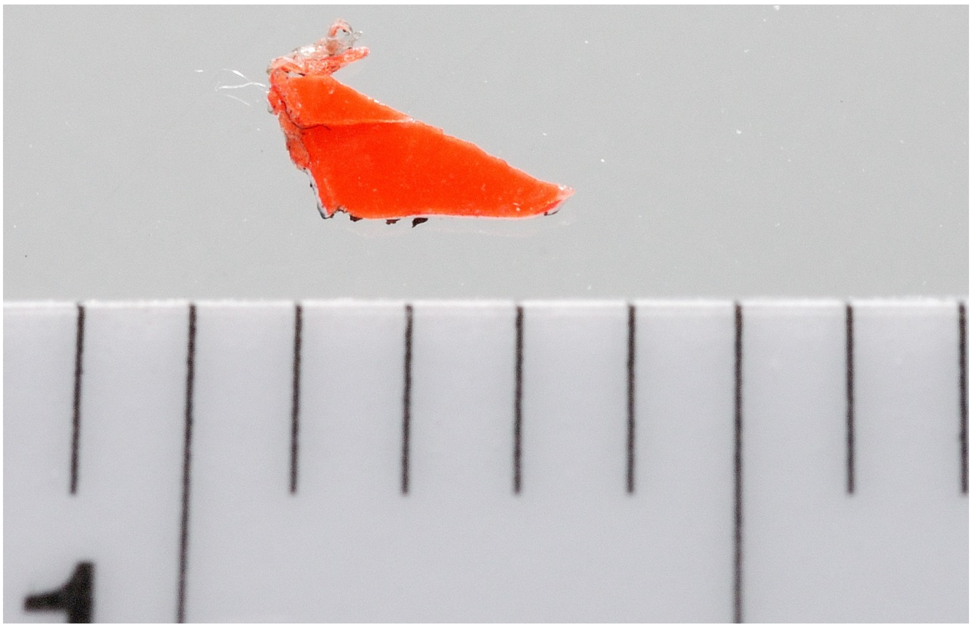

Fig.1. Particle found at the landing gear.

This foreign object consisted of an unknown piece of plastic material coloured orange, measuring about 2.8 x 1.5 mm. The particle was retrieved and sent, together with one of the damaged reflective poles from the airport to SKL[5] for examination and analysis (see Section 1.16.1)

1.4 Other damage

1.4.1 General

During inspection of the runway on 10 September damage was discovered to the approach lights for runway 12. This lighting was of the Barrette CL Cat I international standard type, and consisted of a 720 m long centreline with the approach lights located at right angles to the runway. There was also a long horizontal transverse light bar located further from the runway end. Damage had occurred to the three approach light bars nearest to the runway, C1, C2 and C3.

[5] SKL: Statens Kriminaltekniska Laboratorium (The Swedish National Laboratory of Forensic Science).

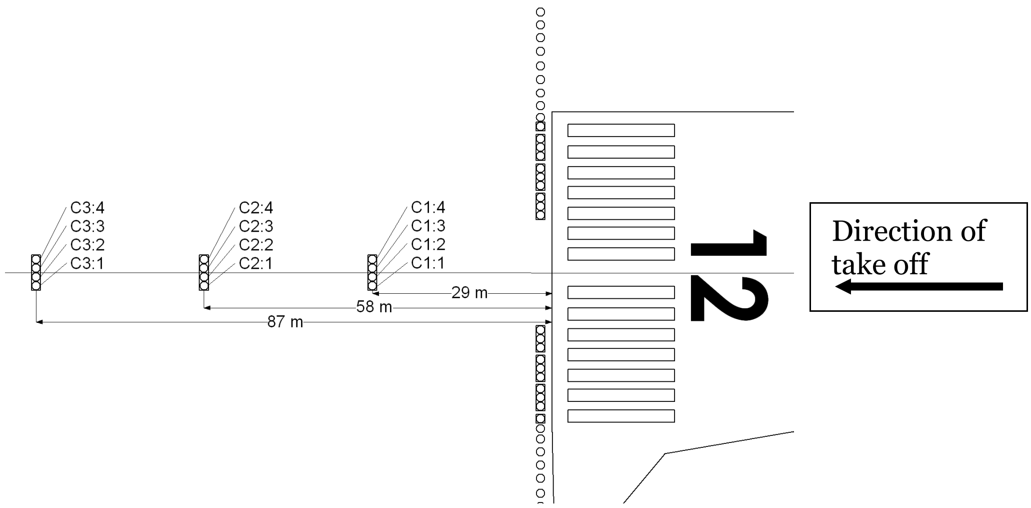

Fig.2. Part of the approach lighting to runway 12 at Åre/Östersund airport

During the inspection that was carried out after the incident had been discovered, the following damage could be established to the approach lights:

- C1:1: glass housing for low intensity lighting broken, and high in tensity light fitting twisted,
- C1:4: lamp housing for high intensity lighting deformed, with two longitudinal scores, broken lens in the high intensity light fitting, reflective snow pole broken off, glass housing for low intensity lighting broken and light fitting direction twisted,
- C2:1: High and low intensity light fittings detached from the upright, lamp housing for high intensity lighting deformed with longitudinal scoring and broken lens, glass housing for low intensity lighting broken,
- C2:4: glass housing for low intensity lighting broken, light fitting twisted, reflective snow pole broken off and connection box cracked,
- C3:1: reflective snow pole bent, low intensity lighting broken, reflective snow pole detached from upright.

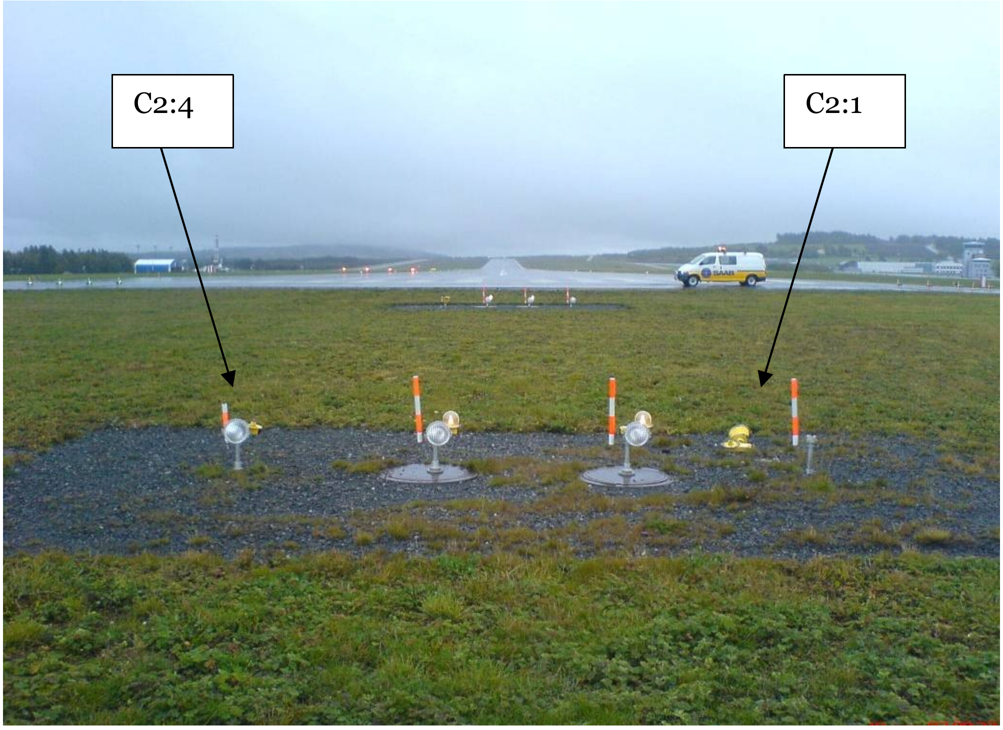

Fig.3. Second row of approach lights.

During the runway inspection it was also discovered that there was about 20 kg of gravel at the end of runway 30, extending on to the runway. The gravel was removed and the runway cleaned before the airport could be opened for air traffic.

1.5 Personnel information

1.5.1 General

The cockpit crew, i.e. the commander and co-pilot, had previously been employed by Atlas Jet in Turkey. In connection with leasing of this particular aircraft, the aircraft owners proposed that these pilots should be included in the business agreement and thereby provide piloting services for the inleasing company M.A.P.

1.5.2 The commander

The commander, male, was 38 years old at the time and had a valid Airline Transport Pilot Licence.

Flying hours			
Previous	24 hours	90 days	Total
All types	4.7	158.5	9260
This type	4.7	158.5	8160

Number of landings this type previous 90 days: 62.
Flight training on type carried out on 6 June 1997.
The most recent Proficiency Check, PC was performed on 26 May 2007 in a flight simulator for that type of aircraft.
All the prescribed proficiency checks performed in the most recent three years had approved results, according to the commander's PC/OPC reports.

1.5.3 Co-pilot

The co-pilot, male, was 32 years old at the time and had a valid CPL/IR Licence.

Flying hours			
Previous	24 hours	90 days	Total
All types	9.1	218.8	2060
This type	9.1	218.8	1820

Number of landings this type previous 90 days: 91.
Flight training on class/type carried out on 21 May 2006.
Most recent PC performed on 24 May 2007 in a flight simulator for that type of aircraft.
All the prescribed proficiency checks performed in the most recent three years had approved results, according to the co-pilot's PC/OPC reports.

1.5.4 Cabin crew members

4 females

1.5.5 The crew members' duty schedule

The pilots had checked in at 14:10 at Antalya airport to prepare for the flight to Åre/Östersund and the return flight, with planned check out at Antalya airport at 01:15 the next day. It was the pilots' third successive working day and had been preceded by 11.3 hours of rest. The accumulated duty time for the pilots during the previous 7 days was 25.3 hours. In respect of both the planned period of duty and the actual period, they were within the permitted limits. The requirements for rest periods and breaks from duty were also met in accordance with the applicable regulations.

1.6 The aircraft

1.6.1 General

The MD-83 is a type of aircraft manufactured by McDonnell Douglas in the USA. McDonnell Douglas is now owned by the Boeing Company. The MD-83 is a variant of the MD-80, with a longer range and an extra fuel tank. The MD-80 went into service in 1980 and this type of aircraft is still in use in various parts of the world as a domestic, medium distance and charter aircraft. The type is certified under the name of DC-9-80 and about 1,200 were built, of which about 1,000 are still operating.

The aircraft	
Manufacturer	Boeing
Type	DC-9/MD83
Serial number	49629
Year of manufacture	1989-05-15
Flight mass	Max. authorised take-off/landing mass 72,640/63,333 kg, actual 70,169/57,137 kg
Centre of mass	Within permitted limits
Total flying time	48,295 hours
Number of cycles	26 274
Flying time since latest inspection	411 hours
Fuel loaded before event	15,517 l Jet A1

Engine		
Manufacture	Pratt and Whitney	
Engine model	JT8D-219	
Number of engines	2	
Engine	*No. 1*	*No. 2*
Total operating time, hrs	43212	45884
Operating time since overhaul	4273	7833
Cycles since overhaul	3109	5910

The aircraft had a valid Certificate of Airworthiness. According to the technical log book for the aircraft no technical remarks relevant to the incident had been entered, nor were there any in the Hold Item List. After the flight five remarks in the log book were noted, in respect of equipment in the cabin, which were not relevant to the incident.

1.6.2 Elevator control system

The elevator control system on the MD-83 (see Figure 4) consists of two elevators and an elevator control tab located on the horizontal stabilizer (tail plane). On each elevator is an elevator control tab that is operated by the respective control column via a cable system. An elevator movement command from the control column causes the elevator control tab to move, and the aerodynamic force thus generated means that the elevator itself then moves. As the elevator position changes, this affects another geared tab, which moves according to the elevator movement through gearing. There is also a third pair of elevator controls, the anti-float tabs, one on each elevator, that via gearing improves longitudinal stability (pitch) in the case of an extremely nose-heavy trim condition in the landing configuration.

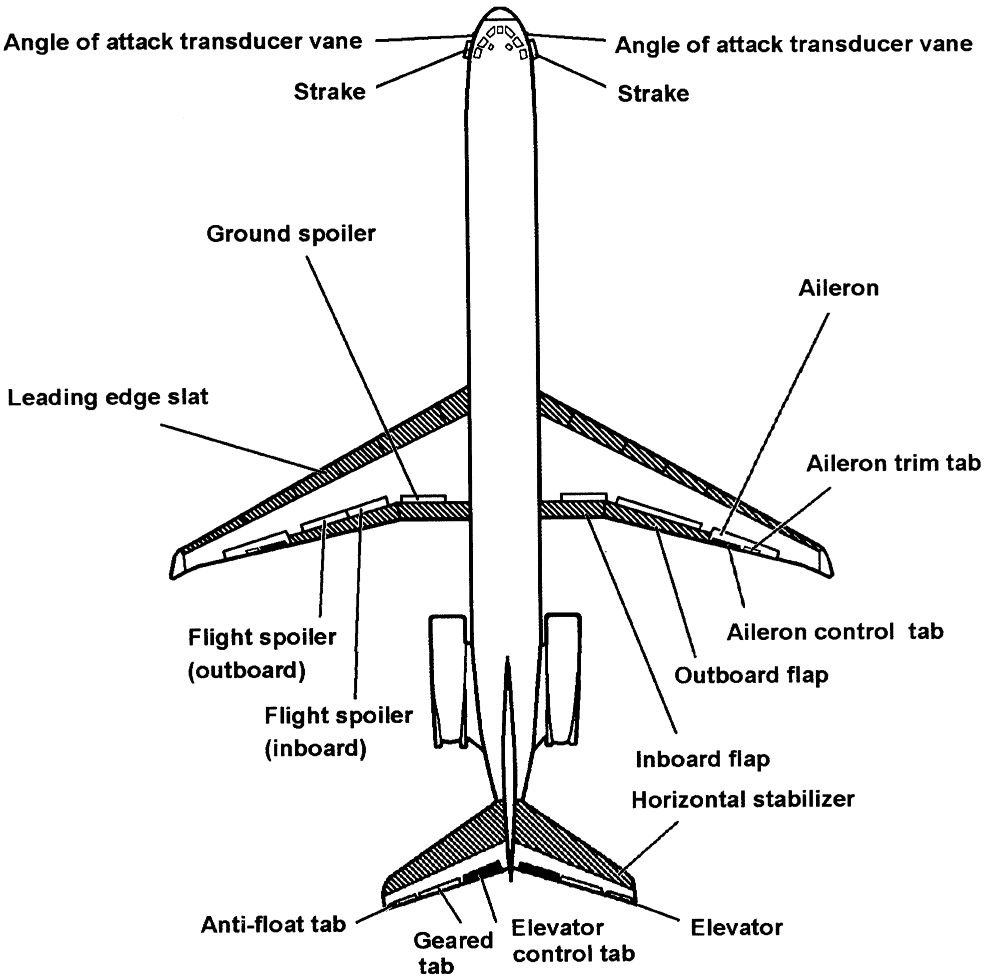

Fig.4. Sketch of MD-83 showing the elevator surfaces and trim tabs.

1.6.3 Trimming system for the horizontal stabilizer (tail plane)

Longitudinal trim (pitch) is effected by movement of the stabilizer (tail plane) angle relative to the longitudinal axis of the aircraft. This operation is electrically controlled, either by switches on the control column or by controls on the pedestal between the pilots.

Before take off, among other things the aircraft centre of gravity and flap setting must be determined. The aircraft centre of gravity, "Mean Aerodynamical Chord" MAC, for take off and MAC for "Zero Fuel Weight"[6] are calculated with the aid of the load and trim sheet for the flight. The MAC for Zero Fuel Weight is the centre of gravity of the aircraft without any fuel load, and is used to determine the most unfavourable centre of gravity location when landing. The MAC is stated as a percentage of the mean chord of the wing.

Special performance tables, called Gross Weight Charts, GWC, are used to calculate the maximum permitted take off mass for taking off from a particular airport in the actual conditions that are present. The performance tables provide information concerning the speeds that are to be used on take off and climb out, including the highest speed (V_1) at which the decision to abort the

[6] "Zero Fuel Weight": The dry weight of the aircraft, i.e. the total mass without any fuel on board.

take off can be taken. The values input to the calculations are the physical data of the aircraft, height above sea level, actual take off mass according to the load and trim sheet, the actual wind, temperature, air pressure and runway condition, such as a wet runway, increased rolling resistance or reduced runway friction, and the selection by the pilot of the wing flap setting for take off. Only values that are shown in the tables are allowed to be used, although interpolation between the defined values is permitted.

One alternative for selection of the wing flap position is called the optimum, FLAP OPT. The FLAP OPT tables show the most optimal wing flap setting for take off with the current input values.

1. Pitch (longitudinal trim) control
2. Indicator for calculated pitch (longitudinal trim) position
3. Mechanical indicator for pitch (longitudinal trim) position
4. Indicator for calculated pitch (longitudinal trim) position
5. Thumbwheel to select flap position
6. Thumbwheel to select centre of gravity position, MAC

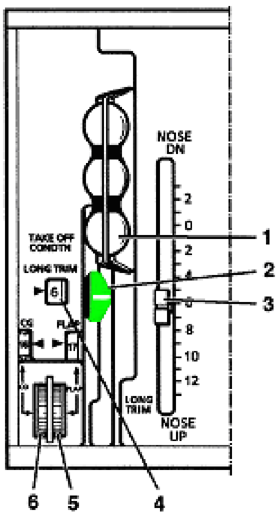

Fig.5. Longitudinal trim (pitch trim) panel on the MD-83

The calculated MAC value for take off and the selected wing flap position are set on the aircraft's longitudinal trim (pitch trim) panel, see Figure 5. The two wheels (5) and (6) are adjusted so that the MAC (CG – centre of gravity) and FLAP values are shown in the windows in front of the wheels (5) and (6). Then the LONG TRIM window (4) shows the aircraft trim index for take off. The position of the horizontal stabilizer (tail plane) must be set so that the index slider (3) next to the numbered markings on the longitudinal trim position indicator agrees with the value in the LONG TRIM window (4). The horizontal stabilizer (tail plane) setting is set by the pilots with the aid of switches on one of the control columns. After this the indicator (2) position must be compared with the position of the mechanical indicator index (3). The positions of both indicators must agree within a range that is set by the longitudinal length of the indicator (2). The permitted range of the indicators is marked by a green segment that is about 4 index units long. Before take off the pilots must check that the indications (2), (3) and (4) agree.

1.6.4 The aircraft weight status

A weight report from 9 March 2006 for aircraft serial number 49 629 and registered at the time of the incident OE-LRW was obtained from M.A.P. The aircraft "Standard Empty Weight" was determined as being 83,526.49 lb (37,921 kg). The weighing was carried out within the prescribed time interval.

"Dry Operating Weight" is used for performance planning. This mass must include the mass of the crew with baggage, catering equipment and removable equipment for passenger services, along with the stores of drinking water and chemicals for the toilets. The operator stated the Dry Operating Weight of the aircraft as 85,880 lb, (38,990 kg)

1.7 Meteorological information

1.7.1 Forecasts

For an open commercial airport a Terminal Aerodrome Forecast, TAF, is issued, which consists of a brief description in coded format of the expected meteorological conditions during a defined period of time. A TAF is normally valid for 9 hours and the length of the forecast is adapted to suit the airport opening times. If the observed wind, visibility or cloud conditions deviate by more than established limits during the forecast period, an amended airport forecast, TAF AMD is issued.

The following meteorological information was available before take off. The times are adjusted to Swedish daylight saving time, which is UTC + 2 hours.

TAF ESNZ (issued at 1630 applicable to 17-21)
091630 091721 28009KT 9999 BKN040=

In plain text the forecast was: Airport forecast for Åre Östersund airport issued on the 9th at time 16:30, applicable to the 9th between 17:00 hours and 21:00 hours, wind direction 280 degrees, wind speed 9 knots, visibility more than 10 km, broken cloud with a cloud base of 4000 feet.

1.7.2 Current weather

A METAR is a coded meteorological report issued at regular intervals for aviation and for distribution beyond the originating airport. These reports state the current meteorological conditions at the airport at the particular time of issuance. METARs are normally issued only while the airport is open and are then transmitted twice an hour, at 20 and 50 minutes past the hour. For local distribution in connection with aircraft take off and landing a MET REPORT is issued.

<u>METARs that were issued before and after landing respectively:</u>

METAR 1950 13006 CAVOK 09/04 QNH 1005 hPa

METAR 2020 13008 CAVOK 09/05 QNH 1004 hPa

Plain text:

At 19:50 hours: Wind direction 130 degrees, velocity 6 knots, temperature 9 degrees, dew point 4 degrees, QNH 1005 hPa.
At 20:20 hours: Wind direction 130 degrees, velocity 8 knots, temperature 9 degrees, dew point 4 degrees, QNH 1004 hPa.

METARs that were issued before and after take off respectively:

METAR 2050 13008 CAVOK 08/04 QNH 1004 hPa.
METAR 2120 13010 CAVOK 08/04 QNH 1004 hPa

Plain text:

At 20:50 hours: Wind direction 130 degrees, velocity 8 knots, temperature 8 degrees, dew point 4 degrees, QNH 1004 hPa.
At 21:20 hours: Wind direction 130 degrees, velocity 10 knots, temperature 8 degrees, dew point 4 degrees, QNH 1004 hPa.

It may be noted that the METAR information showed that the wind direction changed by 150° from the TAF forecast wind direction of 280°. In practical flight terms this meant that the conditions for operating on runway 30 changed from headwind to tailwind.

As a result of the METARs that had been issued earlier, it can be determined that the wind direction forecast by TAF applied up to about 15:20 in the afternoon, with broken cloud at 4500 feet. For a short period wind was calm, after which the wind successively veered to south-westerly with a moderate increase. At the same time, all the clouds below 5000 feet disappeared.

1.7.3 Reports to the aircraft

Arrival
In connection the start of the approach the following information was supplied to the aircraft:

MET REPORT: wind direction 130 degrees, 6 knots, temperature 9 degrees and QNH 1005.

Departure
On request from the aircraft before engine start, air traffic control supplied the following information:

MET REPORT: wind direction 120 degrees, 8 knots, temperature 9 degrees and QNH 1004.

The above weather information in connection with take off was transmitted to the aircraft at 20:40:59, which was about 23 minutes before the aircraft took off.

Remark.

METAR is named MET REPORT in radio communication with an aircraft.

1.8 Aids to navigation

Not applicable.

1.9 Communication

The communications between the air traffic controller in the Åre Östersund control tower and KK7434 were recorded, and the printout is shown in Appendix 2. The relevant parts of the communications between the control tower, the aircraft and the ramp personnel, before and after take off, are given below. A certain amount of editing has been carried out by SHK.

VHF is radio communication and TEL is telephone communication. 7434 is communication from the aircraft, TWR from the control tower and APT from the ramp personnel.

Before take off:

20:40:40	*7434*	*VHF*	*Tower good evening again, this is Atlas Jet 7434, request.*
20:40:47	*TWR*	*VHF*	*7434.*
20:40:49	*7434*	*VHF*	*Sir, ehm, we are requesting the latest wind and also requesting runway 30 for departure if possible, due to performance.*
20:40:59	*TWR*	*VHF*	*Yeah, latest wind 120 degrees 8 knots, the temperature is 9 and QNH 1004.*
20:41:09	*7434*	*VHF*	*In this case we will use the runway 30 Sir. 1004 QNH copied, Atlas Jet 7434.*
21:03:55	*7434*	*VHF*	*Tower Atlas Jet 7434 ready for lineup and departure.*
21:03:59	*TWR*	*VHF*	*Atlas jet 7434, runway 30, cleared for takeoff.*
21:04:03	*7434*	*VHF*	*Cleared for takeoff runway 30, Atlas Jet 7434.*

After take off:

21:07:37		*TEL*	*[A ring tone]*
21:07:40	*APT*	*TEL*	*Was that the last row of lamps, eh?*
21:07:42	*TWR*	*TEL*	*Yes, you'll have to darn well go out and check whether the lights are still there, you know.*
21:07:46	*APT*	*TEL*	*Yes. Yes, but you know, I'm, I'm standing here with my stomach churning.*
21:07:50	*TWR*	*TEL*	*Yes, this, it's terrible to see that, take off, like.*
21:07:53	*APT*	*TEL*	*Yes (swearing)! Yes.*
21:07:54	*TWR*	*TEL*	*And that I thought that he – it's hard to see in the dark now, isn't it - but it felt as if he, took off after the end of the runway.*
21:08:01	*APT*	*TEL*	*Yes, I'll look to see if I can see anything up*

			there when I get up there.

1.10 Aerodrome information

The airport has the status of an approved instrument airport in accordance with AIP[7]-Sweden.
The runway is 2,500 m long, 45 m wide and equipped with low and high intensity runway edge lighting, threshold lighting and approach lighting in both runway directions. The runway surface consists of asphalt, whilst the ground surface beyond the end of the runway is covered by gravel, sand and grass. The approach lighting installations are surrounded by gravel and sand. The approach lights for runway 12 are 720 m long and of Barrette CL type meeting international standards. They consist of a central line of lights and a transverse row of lights, along with reflective snow poles located at the side of each lighting fixture.

1.11 Flight recorders and voice recorders

1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with a Flight Data Recorder of Honeywell type, which recorded parameters concerning the actual flight. That specific flight recorder was sent to M.A.P.'s "Flight Data Monitoring Support Company", which is "Swiss 49 AG" in Switzerland, where the data was read out from the FDR. SHK received the data as raw data and in Excel format. The data from the FDR contained a total of 9 take offs going back in time, of which the most recently recorded was the actual take off at Östersund. The equipment recorded a total of 60 parameters in analogue format, unlike more modern equipment which is digital. Relevant data from the FDR was used by SHK in the investigation, including forming the basis for computer animation of the take off.

In respect of the recorded parameters it can be mentioned that the elevator angle was recorded, although control column movements were not. The parameters that indicated that the aircraft was either on the ground or in the air were derived from sensors in the nose landing gear, however there was no recorded parameter that indicated when the nose landing gear left the ground.

For the construction of the data animations and the interpretation of the FDR data SHK engaged the company Flightscape Inc. of Canada.

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with a CVR. No recording was however available, since it was automatically overwritten when the incident became known to SHK.

In ICAO Annex 6, Operation of aircraft chapter 6.3, are the international regulations found, regarding recording equipment on aircraft. In chapter 6.3.9.1 is regulated that the basic requirement for a CVR is that it continiously records the latest 30 minutes of a flight. Requirement regarding 2 hours recording time is valid for aircraft obtaining its individual certificate of airworthiness after January 1 2003 (according to chapter 6.3.9.3).

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[7] AIP – Aeronautical Information Publication

Chapter 6.3.11 states that flight recorders (CVR included) not shall be turned off during flight.

An operators responsibility to ensure that recorded information is preserved is described in chapter 11.6. From this it may be concluded that:

An operator shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or incident, the preservation of all related flight recorder records and, if necessary, the associated flight recorders, and their retention in safe custody pending their disposition as determinated in accordance with Annex 13.

1.12 Incident site

1.12.1 *Incident site*

The incident occurred at Åre/Östersund airport, ESNZ, in connection with a take off to the north-west on runway 30. The incident, during which the aircraft landing gear struck the opposite runway's approach lighting, took place at the gravel surface beyond the end of the asphalted runway.

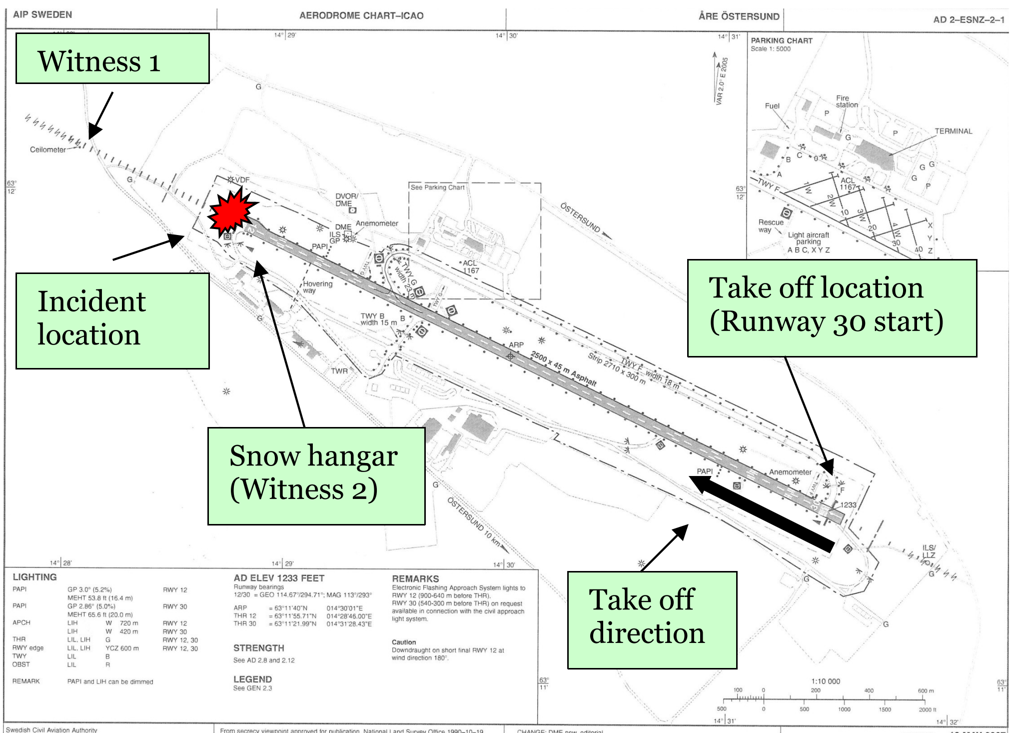


Fig. 6. Map extracted from AIP-Sweden showing Åre/Östersund airport with annotations for the incident sequence.

1.12.2 *The aircraft*

No damage was found to the aircraft. The only evidence that could be found was the paint particle discovered in the landing gear and that could be identified as part of the reflective tape from the snow poles next to the approach lights.

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

1.15.1 Actions by the rescue services

Not applicable.

1.16 Tests and research

1.16.1 Landing gear inspection and damage to the lighting fixture

Figure 7 shows the damage to lighting fixture C 1:4. The lamp housing has two longitudinal parallel dents and tears. The sheet metal material at the front edge of the lamp housing has been torn out in the direction of the runway where the aircraft took off.
Figure 8 shows a detail view of part of the MD-83 landing gear. The distance between the inner pair of rows of the projecting bolts matches the damage to the lamp housing very well.

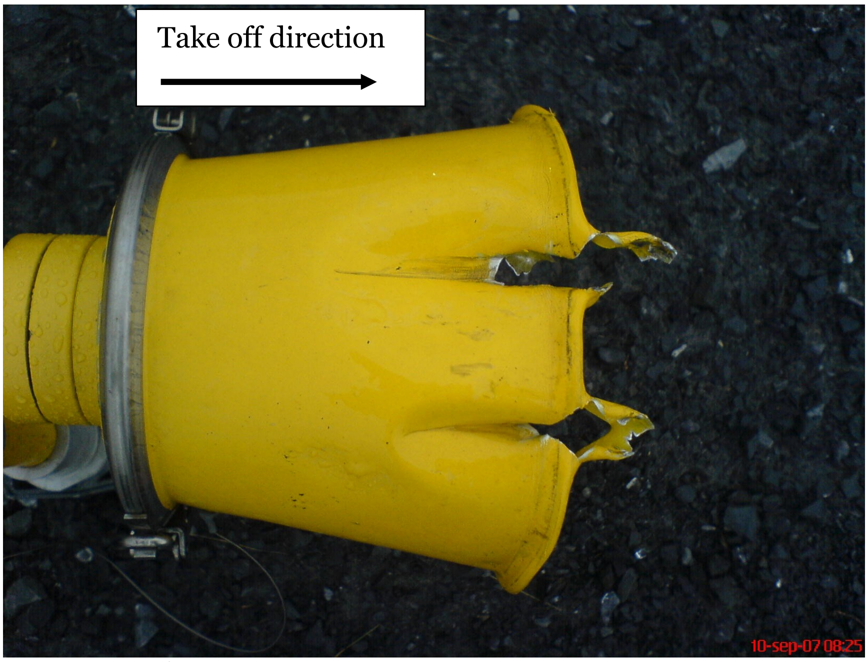


Fig.7. Lamp housing C1:4.

Fig.7. Detail view of part of the MD-83 landing gear and lamp housing C1:4.

1.16.2 Examination of the particle

The foreign object particle that was retrieved from the aircraft right main landing gear was sent, together with one of the damaged reflective snow poles from the airport to SKL (The Swedish National Laboratory of Forensic Science) for examination and analysis.

The result of the examination, in the form of a report giving an expert opinion confirmed that the material of the retrieved particle (a paint chip) agreed in all respects to the material analysis of the accompanying reflective snow pole. The conclusions of SKL in respect of the examination are as follows:

"The clear varnish layer, the orange and white paint and the adhesive-like layer in paint chip A agree in the investigated respects with the equivalent layers on reflective snow pole B."

The complete expert opinion is appended as the report in Appendix 8.

1.16.3 Passengers and baggage in accordance with OM-A

The company's approved Operations Manual Part A, OM-A, was obtained from M.A.P. It is apparent from OM-A, 8 – 37, that the company used the prescribed standard weights for passengers and baggage for Holiday Charters within the European Region in accordance with JAR-OPS 1.620. In the case of adult passengers the mass, including hand baggage, is considered to be 76 kg, for children 35 kg and for infants 0 kg. The standard mass for checked baggage is 13 kg.

Section 8 describes how changes after the load and trim sheet has been prepared, Last Minute Change – LMC must be dealt with. For the MD-83 aircraft type changes are accepted up to 500 kg without a new load and trim sheet needing to be prepared. The changes must however be entered into the load result LMC column, and the resulting changes affecting the aircraft mass and balance must be calculated and noted. There are no instructions in the OM-A stating that known changes do not need to be entered into the load sheet.

1.16.4 Passenger and baggage mass in accordance with JAR-OPS

JAR-OPS 1.620 also prescribes, apart from standard weights for passengers, that corrections shall be made to the standard masses for passengers and baggage when deviations from the standard values can be expected. This is stated in JAR-OPS 1.620 (h) & (i) and IEM OPS 1.620 (h) & (i). The M.A.P.'s approved OM-A however does not include this text.

According to JAR-OPS 1.625 the person who supervises the loading of the aircraft must also confirm that the loading of the aircraft agrees with the information on the load & trim sheet and sign it.

1.16.5 Passenger and baggage mass in accordance with a passenger survey

SHK wrote to all the passengers on the flight concerned asking for the personal mass and mass of their own hand baggage that accompanied the flight from Åre/Östersund on KK7434 that particular day. 166 passengers replied to the questionnaire. The prescribed average mass was assumed in the cases where there was no reply. The survey showed that there were ten children, and the total mass of the passengers amounted according to the survey to 12,911 kg (28,438 lb). The mass of the passengers including their hand baggage was greater than the calculated mass using the standard values. The difference amounted to 1,251 lb (568 kg), i.e. about 4.6%.

1.16.6 The acceleration of the aircraft along the runway

Before take off on the runway both the aircraft air conditioning systems had been switched off, which increases the available thrust of the engines. The performance tables did not contain information concerning corrections for take off with the air conditioning systems disconnected. The take off sequence commenced when the brakes were released, and the aircraft centre of gravity was located about 30 m from the beginning of runway 30.

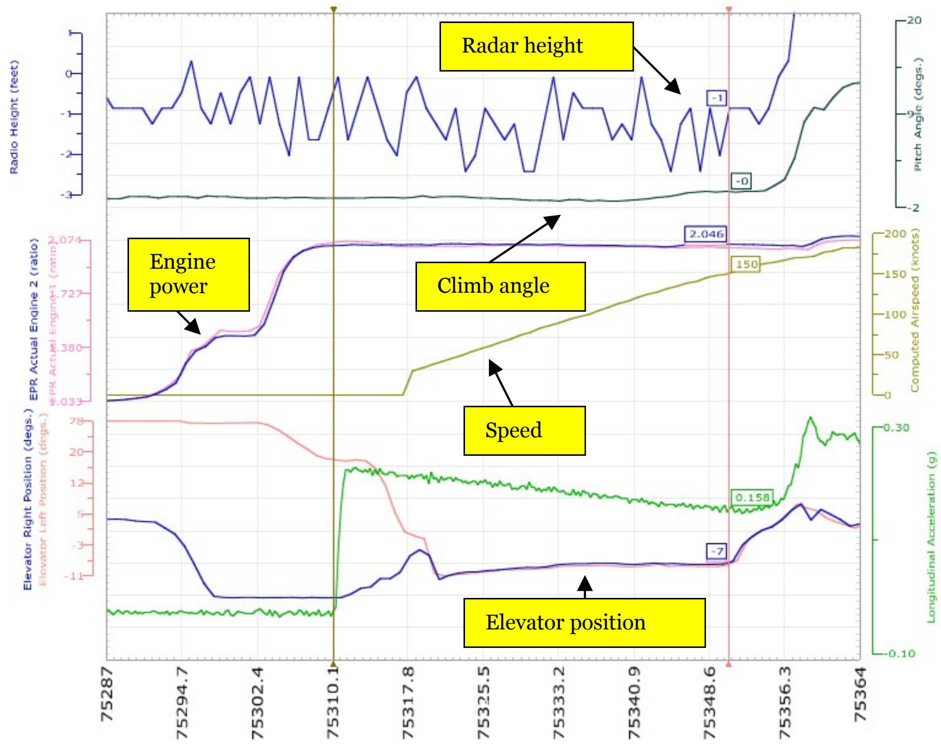


Fig.8. Extract from the flight data recorder during the take off sequence. The horizontal axis shows the time in seconds.

Figure 8 shows certain parameters taken from the flight data recorder during the take off sequence. The horizontal axis shows the time in seconds. The beginning of the take off sequence is indicated by a vertical line at 75 310.1, and the moment when rotation began is at 75350.6, i.e. when the elevators were moved to lift off the runway, with the speed at that time being 151 knots Computed Airspeed, CA. The difference between CA and the speed that the pilots could see on the instruments, the indicated air speed (IAS) is negligible. According to the flight data recorder rotation took place at about 2° per second, up to about +14° pitch angle.

Figure 9 shows the relevant parameters during the time the aircraft lifted off the ground. The instant the nose wheel lifted off the runway is indicated by a vertical line at 75 354.1 at a speed according to the diagram of 164 knots, while the aircraft main wheels lifted off the runway at 172 knots at time 75 357.6. The different lift off instants, for the nose wheel and the main landing gear, were calculated from the flight data recorder values from the "weight on wheels" [8] switch at the nose wheel, and the radar height indications respectively.

SHK has compared the data from the aircraft flight data recorder during this particular take off with other comparable take offs for this aircraft. The comparison showed that engine and other relevant parameters for the aircraft during this event did not in principle show any difference from earlier flights with the same aircraft.

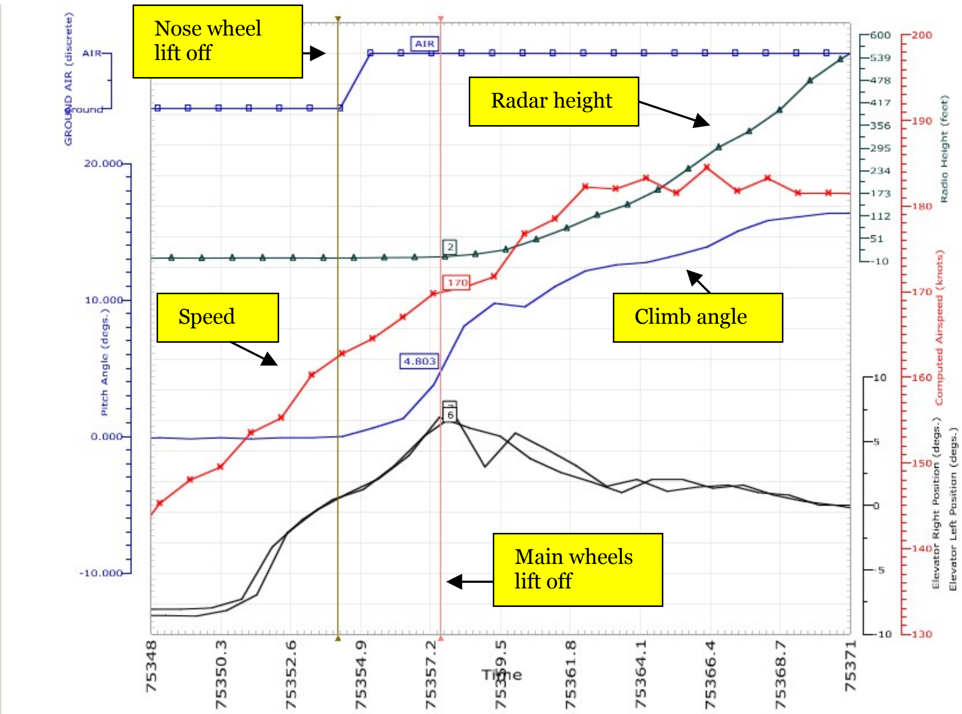


Fig. 9. Extract from the flight data recorder during the later part of the take off sequence. The horizontal axis shows the time in seconds.

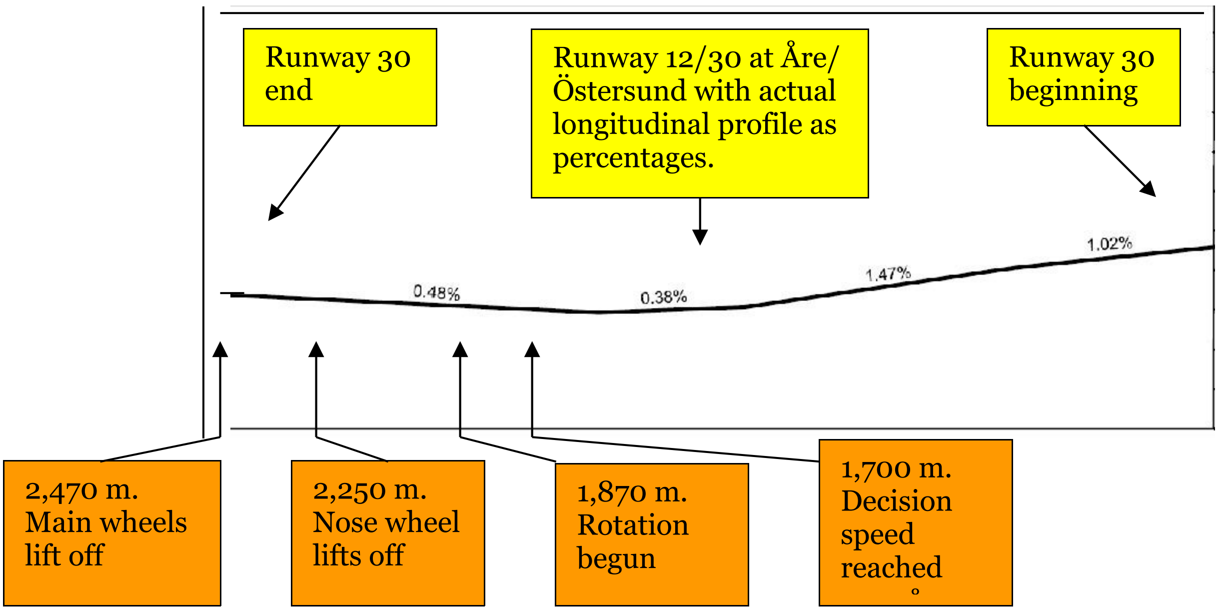
1.16.7 The aircraft rolling distance

The aircraft rolled for about 47 seconds along the runway before the nose wheel lifted off. This took place at about 164 kt (CA), and after a further 3.5

[8] "Weight on wheels": A switch on the landing gear leg that is activated when the aircraft wheels leave the runway or when they come down on to the runway respectively.

seconds, approximately, the main wheels left the runway. During the subsequent second the aircraft collided with the two transverse light bars closest to the runway 12 threshold, at a height of about 45 cm above ground.

The rolling distance was calculated from the CA recording, time and most recent known wind information (120/8). Runway 30 has a length of 2 500 m. The calculations show that the aircraft reached decision speed V_1 at about 1 700 m from the start of the runway, rotation began at about 1 870 m, the nose wheel lifted at about 2 250 m and the main wheels left the runway about 30 m from the end of the runway.



1.16.8 Tests in simulator

SHK performed a number of simulations of the actual take off in various conditions. The tests were carried out in the MD 80 simulator at the Oxford Aviation Academy (formerly known as the SAS Flight Academy). In all the tests the weather conditions at the time were entered. The actual weights and power outputs were programmed in accordance with the data from the FDR.

- The first tests were carried out using the normal rotation technique in accordance with the MD-83 flight manual. During these take offs the lift off was late but did not conflict with the runway length or result in a collision with the approach lights.

- After this, slow rotation was tried, in order to emulate the technique that as used during the incident. During these take offs it was found that under the conditions that applied it was very easy to come into conflict with the available runway length and there was thus an obvious risk of collision with the approach lights.
- SHK also simulated situations with loss of engine power at the critical decision speed, V_1. In the cases of half the take offs – which were all interrupted so as to stay on the runway – the aircraft only came to a full stop when it had gone beyond the end of the runway. Attempts to continue the take off with only one engine operating were not considered as meaningful and were therefore not performed on this occasion.

1.17 Organisational and management information

1.17.1 General

The airline, M.A.P - Management and Planning GmbH, is based in Vienna and was founded in 2002. The main business of the airline is “business aviation” with the whole of Europe as its service area. At the time of the incident the fleet consisted of 15 small business jet aircraft and three MD-83s. In respect of the business jet part of the fleet, these were mainly used for tasks of taxi type character. In the MD-83 case the main focus was on longer term tasks of the type ACMI (Aircraft – Crew – Maintenance - Insurance), i.e. what is usually called wet leasing. This type of production involves task operation on behalf of other customers, where the company in principle provides a ready to fly aircraft with crew. This includes the operational and technical responsibility resting on the operator, according to the AOC[9] that was issued. The responsibility for other parts of the production, such as ticketing, marketing, passenger handling, etc. lies with the client company.

Contracts of this type can involve operations for both charter and scheduled airlines. In the case of M.A.P. the actual division has been about 90% charter flights and 10% scheduled flights. The contract is normally arranged so that the operator is payed per flying hour (block hours). It is also standard in such contracts that the operator bears all the costs that fall into the area of responsibility that it can influence, while the client company covers other peripheral costs. In the case of an unplanned intermediate landing, caused for example by a weather problem, the operator is not liable for any costs and/or reduction of the contracted compensation.

In this particular case a Swedish charter arranger, Detur, had contracted a Turkish company, Atlas Jet, for charter flights between Sweden and Turkey in the first instance. Due to under-capacity in the Turkish charter company it was decided to wet lease capacity from M.A.P. in order to fulfil the obligation to Detur. According to the contract between Detur and Atlas Jet the flights would be operated using Airbus 320 aircraft with a capacity of 168 passengers.

1.17.2 Operational procedures

For charter contracts, normally the contract covers only estimated block time volumes within an agreed operations area. Flights can then vary depending on the client’s travel destinations. The procedures within the particular company are that the sales department receive the actual flight task for a certain period

[9] AOC: Air Operators Certificate

of time and then hand over to the flight operations department for detailed planning.

In connection with the tasked traffic for Atlas Jet, M.A.P. wrote a contract to operate the flights with an MD-83 with 170 seats available for sale.
In the planning of the operating conditions, i.e. which parameters determine the possibility to take off with a full payload from a specific airport, initially a general rough calculation is made by the flight operations department, based on the static conditions, such as runway length, height above sea level, etc.

Detailed planning of the performance conditions, where such variable parameters as wind, pressure and temperature are included, is carried out by the crew before each take off. For departures from airports where the static conditions may be marginal, the actual size of the payload can only be determined once the variable parameters are known.

In the case of charter flights with this particular company the crew receives an estimated tasking in respect of the payload size from the operations department in the company. Taking into account the amount of fuel required, a preliminary calculation of the payload can then be made before the flight is performed. The weather reports on which operational planning is based are normally sent in advance from the company operations department to the handling agent at the relevant departure airport.

If a situation arises – for example due to conditions at the departure airport and/or conditions at the arrival airport – it may sometimes happen that the payload or the amount of fuel must be reduced. In such a case there are various alternatives:

- Reducing the number of passengers
- Reducing baggage weight
- Reducing the amount of fuel by planning for an intermediate landing.

In such cases the particular company's regulations are to contact the operations department before deciding on alternatives. The company then normally also contacts the specific tour operator. It came out in interviews with the crew that these procedures worked well and the pilots did not experience any pressure to always perform the flights in accordance with the contracted conditions.

1.17.3 Handling procedures

In the case of ACMI operations, handling can be performed in different ways. Ramp handling, i.e. loading and unloading, provision of steps, ground electrics, fuel, etc. is ordered and paid for by the client company. Passenger handling, i.e. check-in, baggage handling, gate checks, etc. also lie within the area of responsibility of the client. In respect of load checks the procedures differ between individual operators. When flying for a scheduled company, the procedures that are standard for the client are used. As an example computer-based mass and balance results calculated by the scheduled airline's ramp agents are used. On the other hand, for charter flights these mass and balance calculations are performed manually by the crew.
For this particular flight the loading and load calculations were performed as follows:

The handling company - passengers

SGS handled the check-in of passengers and baggage. During this process the number of each category, adults, children and infants was noted. The number of bags that were checked in was noted, but they were not weighed during check-in.

The result, the numbers of checked-in passengers and bags, was then reported to the crew verbally in order to form the basis of the manual calculation of the load & trim sheet. A copy of the load & trim sheet was then given to the handling company staff.

The handling company – baggage handling
No written loading instructions were provided from the aircraft crew to the loading personnel in respect of how the baggage should be distributed between the various load compartments. The verbal instructions from the commander were to "load from the rear forwards".

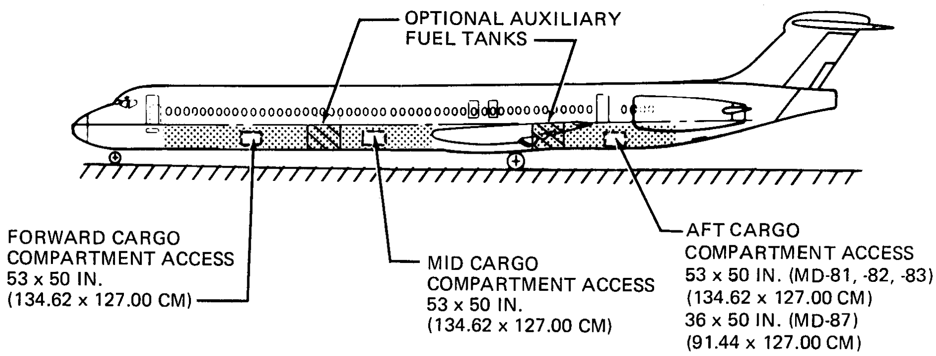


Fig. 10. Cargo compartment divisions in the MD-83.

When loading of the baggage was completed, according to the handling agent a verbal report was given to the commander as follows:

- Forward cargo compartment 1: 29 bags
- Mid cargo compartment 2: 54 bags
- Aft cargo compartment 4: 80 bags

The number of bags in the forward cargo compartment was verified by the loader who participated in the baggage loading for that actual departure. According to the handling agent it was also pointed out to the commander that 29 bags in forward cargo compartment 1 had not been included when the copy of the load & trim sheet prepared by the crew had been handed over.

During the interview the commander disagreed and said that he had only been informed of "a few" bags being in forward cargo compartment 1.

The mass and balance calculations made by the crew

According to the load & trim sheet, 168 passengers and one infant had boarded. The passenger mass was stated as 27,187 lb (12,343 kg). It was also stated that 690 lb (313 kg) of baggage had been loaded into the mid cargo compartment 2, and that 2,800 lb (1,271 kg) of baggage had been loaded into aft cargo compartment 4. The total mass of passengers and baggage (payload) was stated on the load & trim sheet to be 30,677 lb (13,927 kg).

The aircraft was fuelled with 15,517 litres (12,530 kg) of jet fuel, of type JET A-1[10], and the total mass of fuel at take off was stated in the load & trim sheet at take off to be 38,000 lb (17,252 kg). The difference between the mass of the fuel on board and refuelling was 4,952 kg, which was the mass of fuel remaining on arrival at Åre/Östersund.

1.17.4 Reporting and quality system

According to its own account, the company had a functioning quality system and a good safety culture in its organisation. Both the principal owners of the company were themselves pilots employed by another company outside Austria. The company used a reporting system divided into the following main divisions for pilot reporting:

Pilots Voyage Report:	The most common reporting method. Used for minor events and/or deviations from regulations and procedures.
Incident Report:	Used in the case of serious events or deviations.

After preparation of a report in the department concerned, feedback is given to the reporting pilot or crew. If there is reason for it, an Operational Notice is issued, which is to be regarded as short term information before the possible introduction into the OM-A or another manual.

At the time of the incident the company had no FSO - Flight Safety Officer – but was engaged in the recruiting process to fill this position. In respect of other aspects of safety the company considered it had a good standard and culture, resulting in a reasonable number of reports concerning deviations within the operational area. At the time of the interviews, there was also a discussion about the documentation that was available for flight safety work, including the ICAO Safety Management Manual.

1.17.5 Recruitment and training of pilots

The company's needs for MD-83 operational crews vary throughout the year. The group of pilots is therefore composed of both permanently employed and short term employed pilots of various nationalities and origins. In most cases, for reasons of cost, it tries to recruit pilots with the required typerating. Recruitment into the company of pilots normally proceeds as follows:

- Selection on the basis of submitted CVs
- Interviews by operational personnel from the company
- Simulator test

For applicants accepted for employment as pilots, the next step is a company-oriented phase of training consisting both practice and theory. The practical part, in the form of simulator training, is carried out using the company's own instructors at the Oxford Aviation Academy, and the theoretical part – the company course – is handled internally in the company using its own instructors. Other training and education – e.g. CRM, PGT, EMG, MED, etc., is also performed under the aegis of the company.

[10] JET A-1 – 0.8075 kg per litre at 15°C

In this particular case neither pilot had been recruited in accordance with the normal company procedures. When that particular aircraft was to be leased, the aircraft owners proposed that the pilots would form part of the agreement and thereafter perform flight duties for M.A.P. for the period of the contract. Both pilots had Turkish nationality and had previously been employed by Atlas Jet.

This proposal was accepted by M.A.P. and the pilots were employed on a short term contract. At the time of the interview, however, the employment conditions of the pilots were not clear, according to the chief pilot of M.A.P. According to the information given to SHK, both pilots had thereafter completed a normal company course. The chief pilot had completed a Line Check with the co-pilot.
He had never flown with the commander.

1.17.6 Earlier incidents

The company had been involved in an incident during a take off from Lanzarote in Spain 2006. That incident took place with the same type of aircraft as in the current incident, an MD-83. On take off from Lanzarote the aircraft flaps were not extended and the warning that should advise the pilots of this condition was inactivated, as its circuit breaker had been pulled. The aircraft got into the air but was very close to stall.

1.18 Other

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.

1.18.2 Environmental aspects

Not applicable.

1.18.3 Calculation of take off performance

<u>Regulations for the take off performance calculation</u>
The basic principle is that a two-engined commercial transport aircraft must either be able to abort take off at the decision speed V_1 and stop on the runway, or complete the take off, climb and maintain a predetermined margin from obstacles beneath with either one or two functioning engines.

According to the design requirement regulations in FAR-25/JAR-25 for two-engined commercial transport aircraft and their application in JAR-OPS 1, the length of runway required for take off must be calculated as the longest of:

a) the distance for acceleration to , and climb to 35 ft with two engines + 15%,
b) the distance for acceleration to V_{EF}, acceleration to V_R with one engine and climb to 35 feet above the end of the runway,
c) the distance for acceleration to V_{EF}, acceleration to V_1 with one engine, and reaction time at constant speed + braking distance.

V_1 is the highest speed at which the actions to reject the take off must begin. V_{EF} is the speed at which loss of an engine is assumed to take place in the performance calculations. V_R is the speed at which elevator movement for take off must take place, and V_2 is the speed that must be maintained at the first stage of the climb out.

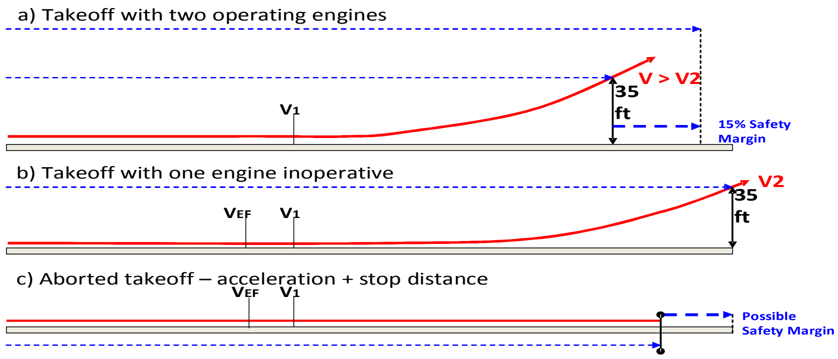


Fig. 11 Criteria in accordance with FAR-25/JAR-25 for calculating the runway length for take off.

In order to fulfil the requirements the mass of the aircraft must be adapted so that the longest distance out of a, b and c are accommodated within the available runway length at the airport, see Figure 12. The runway length in accordance with a, b and c must for every take off be calculated, taking into account the meteorological conditions and the actual condition of the runway. In the case of a "balanced take off" the safety margin if the take off is abandoned can be zero. Account must also be taken of the fact that the greatest structural take off mass of the aircraft must not be exceeded.

1.18.4 Basis for calculation of take off performance

The operator of KK7434, the airline M.A.P, used the performance basis for the MD-83 that had been produced by the European Aeronautical Group, EAG. The aircraft manufacturer's information along with any special requirements set by the operator are the basis for the construction of the performance tables. After a request from SHK, EAG has checked both the calculations and the revision status of the performance material that was supplied to the operator. No errors were found in the material and the flight crew had access to performance tables with the latest revision status.

In order to calculate the maximum permitted take off mass and the speeds for rejected take off and departure from a certain runway at an airport, the pilots used the performance tables that were carried on board the aircraft. There are tables for different flap selections for take off and for FLAP OPT, along with tables for different runway conditions. The FLAP OPT tables include tables for the optimal flap settings for take off. The tables show the values for the maximum permitted take off mass in the case of different wind and temperature conditions, and the corrections that must be made for air pressure deviating from the standard air pressure of 1013.2 hPa. Interpolation is necessary for the intermediate values in the table.

The tables are in paper format and consist of a large number of pages for each airport. A number of input parameters then provide values to be read off the table grid system. See Appendix 7.

By application of the operator's take off performance tables, and using the latest weather reports received by the aircraft, SHK has calculated the maximum permitted take off mass for the aircraft for runways 12 and 30 respectively.

Meteorological conditions:	Wind direction/wind speed 120°/8 kt, temperature 9°C, air pressure (QNH) 1004 hPa,
Maximum permitted take off mass for runway 12:	69,674 kg, FLAP OPT 11.2, V_1[11], V_R, V_2: 147, 150, 158 kt
Maximum permitted take off mass for runway 30:	67,956 kg, FLAP OPT 16, V_1,V_R,V_2: 139, 145, 152 kt.

The crew's values according to the load & trim sheet:

Defined take off mass for runway 30:	70,169 kg, FLAP OPT 11.2

1.18.5 *The performance planning for the flight*

M.A.P. provided to SHK the load & trim sheet and the balance sheet for the actual flight, appendices 5 and 6.

SGS at Åre/Östersund provided a copy of the refuelling sheet. The refuelling sheet shows that the aircraft was refuelled with 15,517 litres (12,530 kg) of fuel, Jet A-1, before its take off from Åre Östersund airport.

According to the load & trim sheet for this particular flight the "Dry Operating Weight" was stated as 85,880 lb (38,990 kg), "Total Traffic Load" as 30,677 lb (13,927 kg) and the mass of fuel on board as 38,000 lb (17,252 kg). The take off mass was defined as being 154,557 lb (70,169 kg), the mass of fuel consumed to the destination as 28,705 lb (13,032 kg) and the mass on landing as 125,852 lb (57,137 kg). The margin to the maximum permitted structural take off weight (underload) was defined as being 1,063 lb (483 kg). The alternative landing airport was stated as LTBS, Dalaman Airport.

The number of passengers was stated as 168 + 1 and their mass as 27,187 lb (12,343 kg). The distribution between the numbers of adults and children respectively was not entered on the load & trim sheet.

Under the heading SI, Special Information, on the flight crew load sheet there was a note: RWY 30, FLAP OPT: 11.2, TEMP 10°C. These values may refer to the performance tables for Åre/Östersund airport runway 30 at the maximum permitted uncorrected take off mass of 155,620 lb (70,651 kg). The same value

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for the maximum permitted take off mass is also present in the flight crew calculation on the load & trim sheet.

According to the balance sheet for the flight the aircraft balance index before take off, Loaded Index TOW = 49 and the Mean Aerodynamic Chord, MAC = 7.5% and 10.6% for the landing and take off masses respectively.

After correction for the existing load in cargo compartment 1, the load index at take off = 41 and the MAC at take off was 8.9%.

1.18.6 *Procedure deviations*

Within aviation, and perhaps particularly in the charter sector, most procedure deviations result from unrealistic targets or production conditions. As a result of this people may create short cuts and/or devise their own solutions in order to fulfil the task. Most of these solutions are often based on the desire and motivation to do a good job. Less often, such action results in carelessness or negligence. These violations are usually divided into two main areas:

<u>Deviations that are brought about by circumstances</u>
Deviations that arise spontaneously, possibly reinforced by lack of time or a high workload, wherein people who should know better deviate from regulations and standards. Strong goal orientation and motivation can lead to such deviations occurring, where an individual is often convinced that the deviation from procedure will not lead to any problems or consequences.

<u>Deviations from routine procedures</u>
Deviations that have arisen among individuals or groups, where the deviation has become *"the normal way to do business"*. These deviations arise when there are recurrent difficulties in carrying out tasks while at the same time following the procedures that have been established. This type of behaviour can lead to people accepting and normalising deviations that in time themselves become routine. Deviations of this type are often not categorised as such, but are regarded more as necessary parts of the job in order to get the work done and meet the production goals.

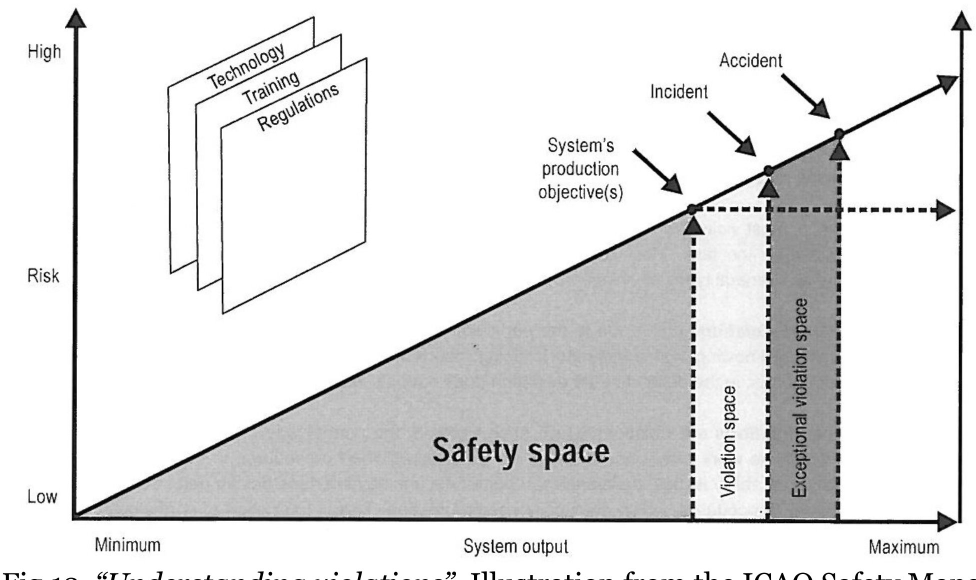

Fig.12. *"Understanding violations"*. Illustration from the ICAO Safety Management Manual.

Organisationally provoked deviations
A third form of deviation, that is often neglected, is the company's role in maintaining the balance between production and safety. As illustrated in Figure 12, the risks to safety increase as the production objectives are raised. In a charter company, where marginal operations tend to be standard, the borderline to violations provoked in the area of operations is often very small.

The work on safety within an airline is not, to a decisive extent, a question of trying to create an environment in which no errors or mistakes are made, but rather, in an efficient and conscientious way to identify and trap deviations from the established standards within the business. When the production targets for the business are determined, it is also necessary to define how the staff, operational and technical resources shall be utilised in order to achieve the equivalent levels of safety.

1.18.7 ANS Operational deviations report, ANS-DA

An Operational deviations report, ANS-DA, has been issued by air traffic control at Åre/Östersund showing that lamps forming part of the approach lighting for runway 12 were damaged in connection with the take off of KK7434, Appendix 3.

1.18.8 SGS Safety Report

According to the SGS Safety Report, 29 bags were loaded into cargo compartment 1, 54 into cargo compartment 2 and 80 into cargo compartment 4. The bags in cargo compartment 1 were not entered into the load & trim sheet raised by the crew. An SGS representative pointed out to the commander that there were also 29 bags in cargo compartment 1. The commander replied that the information on the original load sheet, that was taken on board, would be corrected. Appendix 4.

1.18.9 Measures taken

- Checklists and speed booklets has been revised in order to secure correct actions in connection with take off calculations.

- New form for written load instructions has been developed and implemented, implying that load in all compartments will be documented and confirmed by the loading staff for each departure.

- Additional information concerning performance planning was given to the pilots in the company after this event. Information was also presented concerning the various alternatives for planning flights if the maximum permitted take off mass was at risk of being exceeded, i.e. intermediate landing for refuelling or the reduction of the load before take off.

- After this incident the operator's OPS Manual was supplemented by the prescribed text concerning the correction of standard masses in certain cases, and the presentation of mass in both pounds (lb) and kilograms (kg).

2 ANALYSIS

2.1 General assessment of the incident

SHK categorises the incident that occurred as very serious. The fact is that individual events resulting in the reduction of safety margins or safety factors do occur from time to time in most types of business. In this particular case, however, all the margins in respect of the determined safety factors during take off with this type of aircraft were completely used up. It has been seen that the aircraft was so low during take off that it collided with ground equipment at a considerable distance from the end of the runway, with a considerable risk of an accident.

The risks in connection with what occurred - apart from the obvious one that part of the aircraft would strike the ground – include the fact that damaged pieces and/or gravel could have struck the aircraft. As a result of the aircraft design, with the engines at the far rear of the fuselage, there is always the risk of ingestion of foreign objects into the engines during collisions while the aircraft is rolling along the ground or flying at a very low height. In this particular case there was in increased risk of the ingestion of metal parts and glass from the lights which had been broken by the aircraft main wheels while passing the rows of lamps. There was also a risk that the aircraft wheels could have been damaged during the incident, with puncturing and secondary damage to the hydraulic systems as a result.

2.2 The business

2.2.1 General

The operations with MD-83 aircraft in charter traffic by this particular company make up only a small part of its business, which is otherwise dominated by air taxi operations. There are also differences in the business management of the operations, where the charter part is usually based on contracts of varying scope.

The arrangements and contract descriptions obtained by SHK are of the normal type for the branch and do not show any deviations of a negative character. Seasonal variations regarding the demand for charter business also leads to variations regarding number of crew. This is reflected in pilot group that is not homogeneous, consisting of pilots from different backgrounds and with differing periods for their employment contracts, from permanently employed to pilots who have been accepted on a short term basis for the season.

This relationship does not in itself necessarily lead to negative consequences for the business, but does set high demands on the management and safety guidance within the organisation in order to maintain a high level of flight safety and to prevent an undesirable culture from being fostered.

2.2.2 Operations management

The recruiting method that preceded the employment of the pilots concerned in this incident is, according to SHK, an example of the shortcomings in the way the company deals with safety guidance questions.

In order that safety thinking will be able to be incorporated into and work at all levels of an organisation, the management of the business must conscientiously and purposefully lead from the front. The extent to which safety is prioritised as a goal in relation to other goals, such as production, is an important dimension of the culture in a business with high safety requirements. If the demand for production is too great, there may be a risk that the work is done with smaller safety margins and that both staff and material are exposed to greater strain. It could be said that the business in this particular company is run with production targets that are often based on marginal operational conditions.

In all flight safety work the procedures must be founded on the managements understanding of the priorities that are required to run a safe business. Without signals from the business management that flight safety has the highest priority, the risk arises for other prioritisation, with possibly reduced flight safety levels as a result.

So that the work of flight safety shall have the desired effect, it is obviously unsatisfactory if the company management bypasses prescribed procedures within the flight operations department and instead prioritises the implementation of a business agreement.

2.2.3 *Documentation and training*

The operational documentation provided to SHK shows no significant deficiencies. The standard values used for the calculation of the mass of passengers and baggage are in accordance with the applicable regulations.

The parts of the training that are performed under the aegis of the company cover the basic requirements in accordance with the regulations for these types of company courses. Considering the circumstances that surround the charter business of the company, the incident that has now occurred should motivate the company to reinforce its company training with the aim of achieving a high and consistent level of safety consciousness in respect of the implementation of its operations. Among these circumstances the following should specially be noted:

- seasonally employed pilots from varying backgrounds,
- a high proportion of performance-related marginal operations,
- the charter business only forming a minor part of the company.

It is also SHK's understanding that an increased effort to achieve a common view in respect of *production and safety* issues would provide a more robust platform for flight safety.

The commander's own understanding of certain questions – including LMC, the effect on performance of air conditioning and the rotation technique – shows that training can be reinforced and supplemented within these areas. Not least is this important considering that such training can serve as a barrier against unwanted deviations, whether situation or procedurally generated, arising within the business.

2.2.4 *Operational procedures*

Calculation of performance, mass and balance

The system used by the company for performance calculations is paper-based and set up in tabular form. Inspection shows that both the structure and the presentation of the tables are satisfactory. Nor have any errors been found in the particular parts of the tables that were used in the course of the incident.

In most charter flights the mass and balance calculations are performed manually by the crew before departure. The derivation of such a result comes from many calculations of different types, where such factors as the index value must first be extracted from the tables.

It can however be said that the table values are often the source of errors. The actual performance tables involved consist of a considerable number of pages for each airport, with the values shown in very small text, which increases the risk of confusion and/or errors. An alternative to the manual calculation presently used is a computer-based performance calculation system. This system can with advantage be combined with similarly computer-based systems for calculating the mass and balance of aircraft. A transfer to this type of system has normally the effect of increasing the overall level of flight safety.

Handling and loading procedures

In this particular incident all the loading instructions were given verbally from the flight crew to the ground staff. Confirmation from the ground staff after loading had been completed – which provides the basis for calculating part of the load result – was also provided verbally.

SHK can see that there were differing understandings of the wording of these statements, and considers that as a consequence of this there ensued an error in the results, in respect of both mass and balance. The incorrectly calculated balance result could have had an effect on the events during take off, since the aircraft trim system was set for a more rearward centre of mass than that which applied in reality. According to the currently applicable JAR-OPS 1.625, the person responsible for loading the aircraft should also with a written signature confirm that the actual load – and its distribution – agree with the information on the load sheet. This did not happen in the case of this particular flight, probably because different information concerning the load in cargo compartment 1 was given by the ground staff and the commander respectively.

From a flight safety aspect it is advisable for a written result always to be used in this kind of procedure, in respect of both the loading instructions from the flight crew and the confirmation of the completed task by the ground staff. Apart from the fact that a written instruction is less likely to be misunderstood, this also means that the procedure can be documented by means of saved copies.

2.3 Conditions

2.3.1 The aircraft

SHK finds no reason to question the aircraft weight status or the information concerning the mass and balance index. The investigation also showed – in the first place by analysing the data from the aircraft flight recorder – that the aircraft engines and other technical systems operated normally during the incident. No technical faults in respect of the aircraft technical or operational systems were identified before or after the incident.

It is therefore improbable that any technical fault or other abnormality affected the conditions in the case of the incident that occurred.

2.3.2 Personnel information

The cockpit crew at the time of the flight was not employed in accordance with the normal procedures of the company. The normal procedures for employment were in this case set aside by a request from the aircraft owners. A selection process means that a company, in accordance with established criteria, selects those candidates who best meet the profile that has been defined. For a company it is important to ensure that the candidates understand – and are able to accept – the safety culture and the operational quality thinking that have been implemented in the company and its employees.

In this particular case the crew were employed as a result of the terms in a business arrangement, which was on completely different grounds than the procedures that would otherwise apply. The flight operations management in the company had not been able to interview and/or test these specific pilots, which in the view of SHK showed a lack of understanding of the flight safety issue between the company management and its flight operations department.

Taking on pilots who had not been formally approved by the flight operations department means, apart from a risk factor that is difficult to assess in respect of a different flight safety attitude by the individual than that shown by the company, that the respect of the integrity of the flight operations department could become devalued among the other pilots in the company.

A factor that should also be taken into account is that charter operations are usually very marginally operative. The flights normally mean that the aircraft is fully booked so that take off is often performed at or close to the maximum permitted take off mass. This condition obviously sets high demands on the safety consciousness of both the operational management and the pilots. In the view of SHK it is therefore particularly important in the case of a charter operator for the selection method to employ pilots the be applied correctly in order to maintain flight safety.

2.3.3 The primary planning of the flight

The planning by the flight crew of the flight on that particular day can be categorised as a standard task for a company operating charters. The calculated load figures were part of the information supplied to the flight crew before the flight. In the weather forecast that was received before departuree from Turkey, the conditions were good for being able to take off from Åre/Östersund with a full load. The forecast stated a wind at 280° at a speed of 9 knots, which with the calculated use of runway 30 should have permitted a take off without problems with a full payload, i.e. passengers and baggage. Apart from the favourable wind, the use of runway 30 was preferable, due to the better basic performance conditions, since there were no obstacles in the climb out sector.

The weather enroute and at the destination was also satisfactory and no delays nor traffic disturbances had been advised. It is therefore not likely that the flight crew expected any problems, or expected any planning difficulties before the forthcoming return flight to Antalya.

According to the interviews with the crew, the approach to Åre/Östersund was planned according to the forecast, i.e. landing on runway 30. At the first contact with the air traffic control, however, a Met Report was received that showed a radical change in wind direction and that it was now more suitable for an approach to and landing on runway 12. SHK considers it probable that the crew, already at that stage, became aware that the original planning for their next flight could no longer be used, and that re-planning with the wind as it was would be marginal from the performance viewpoint.

2.3.4 *The secondary planning of the flight*

After the landing, the performance calculations for the forthcoming departure were carried out by the co-pilot. SHK's calculations show that the take off could not be performed within the prescribed safety margins, neither from runway 12 nor 30, with the take off mass stated on the load sheet in the airfield and weather conditions at the time. It is possible that the co-pilot - who was used to doing this task – had overlooked the fact that the mass of the aircraft would exceed that permitted when the conditions at the time were taken into account.

During their interviews, neither of the pilots could remember what the wind direction was. The co-pilot then used zero wind in his take off planning. SHK considers it improbable that both pilots had in such a short time forgotten the current wind direction when they had only just landed. It is therefore possible that the knowledge that some passengers and/or baggage would have to be left behind in order to perform the take off, the conditions for re-planning the take off were affected by this.

It can be said that if the prescribed corrections for wind, air temperature and air pressure, and the mass of the 29 bags were not taken into account, it once again became possible in theory to take off on runway 30 with a full load.

A possible explanation of the deviations in the calculations could have been that the crew were being pressured by the production target – the ambition to take all the passengers and baggage – in the belief that the deviations would not have any consequences in terms of the take off.

2.3.5 *Standard mass and balance values*

The operator had permission to use standard masses in accordance with JAR-OPS 1.620. However, in the company's approved OM-A, text concerning the correction of standard masses if deviations from them were expected was missing, such text being stated in JAR-OPS 1.620 and IEM OPS 1.620(g) and (h), Appendix 11.

The SHK survey showed that the true mass of the passengers and hand baggage was about 4.6% greater than the figure obtained by calculation based on standard masses. The difference is however adjudged to be within the margin of error allowed for performance standards and calculation methods. SHK thus considers that the criterion for correction of standard masses in accordance with JAR-OPS 1.620 was not met for this flight.

SHK notes that the operator's load sheet did not contain information concerning the division by passenger categories, adults, children and infants. On the basis of the survey, however, the division by passenger categories could in retrospect be determined, and the calculation by the crew of the passenger mass could be confirmed.

At the same time it can be said that the values stated on the load & trim sheet were correct in respect of the internal and external regulations. In actual fact the aircraft mass was however 568 kg greater than stated, which can further be added to the factors that had a negative effect on the take off conditions. There is however nothing to be gained by speculating on the possible consequences of this in respect of a longer runway and similar palliatives, since the aircraft during the take off in question was already outside the permitted range in respect of performance.

2.3.6 Review of the baggage situation

The investigation showed that the aircraft had taken off with an incorrect load & trim sheet in respect of the amount of baggage on board. According to the load details that were verbally given by the ground personnel to the commander, 29 bags had been loaded into cargo compartment 1. In respect of this the commander remembered differently and claimed that he was only informed about “a few” bags in cargo compartment 1, and that he would himself make the necessary correction.

It is the view of SHK that the lack of written documentation prevents a completely certain standpoint in respect of the number of bags. The loading of 29 bags in cargo compartment 1 has however been confirmed by the participating ramp personnel at the airport. It can also be established that the commander told the personnel that he would “correct it later”. In the interview, however, he stated that no correction had been made, since according to the company regulations such a correction would not be needed for values of less than 500 kg.

The information in the company manual did not however include such an exception. The only pertinent mention in the instructions was that a new load & trim sheet would not have to be drawn up if the change was less than 500 kg. The altered values should however always be added in as LMC on the original load & trim sheet. According to SHK the commander’s knowledge of this condition was not satisfactory.

2.4 The take off

2.4.1 Preparations for take off

The crew requested and obtained a Met Report that contained wind information showing that there was a tail wind on runway 30. The request also included the information that they wanted to take off on runway 30 for performance reasons. Excluding corrections for wind, temperature and air pressure, runway 30 generally allowed for a greater take off weight than runway 12 due to the slope and obstacle circumstances in the climb out direction from runway 12.

The current weather conditions were issued about 23 minutes before take off. If the pilots had not earlier received correct wind information (the performance calculations were based on zero wind), they now had the chance to correct the calculations, taking into account the actual wind. Such an alteration was however not made, so the original calculation remained as the basis for take off.

The 29 bags in cargo compartment 1 mainly affected the aircraft balance state and trim setting. The setting of the horizontal stabiliser (tail plane) had probably been adjusted in accordance with the information on the load & trim sheet, i.e. assuming that cargo compartment 1 was empty. This meant that the aircraft was felt as being nose heavy during rotation. The additional mass of the bags did not however affect the take off distance and climb out as much as the other factors which had not been corrected.

When KK 7634 taxied out for take off it was with a flight deck crew who were probably conscious of the aircraft being "heavy", i.e. that the maximum permitted take off mass, in respect of the prevailing conditions, was exceeded.

2.4.2 *Initiation of the take off sequence*

The take off was performed statically, which is the normal procedure for performance-limited take offs. The aircraft was positioned about 30 metres from the beginning of the runway, which is in accordance with the conditions for the performance calculations.

The air conditioning system was switched off before take off, according to information from the commander in order to increase the available thrust from the engines. This procedure is used for some types of aircraft and may, in certain cases, permit a greater take off mass according to the correction methods in the aircraft performance base. However, the performance base for this particular aircraft type does not contain information (N/A) for a performance correction with disconnected air conditioning systems. SHK assesses however that a certain performance advantage could have been obtained at take off due to this action. However, this action also indicates that the commander was aware that the take off would be marginal and that all available power would be needed.

The missing correction for tail wind and thereby the exceeding of the maximum permitted take off mass meant that neither the flap position nor the speeds for aborted take off, rotation or climb out could be obtained from the performance tables. The flap position and speeds for aborted and continued take off selected by the crew could therefore have affected the take off sequence and the obstacle margins.

Performance figures are not available outside the aircraft's normal operational area, i.e. there was no information concerning flap settings, runway length requirements and so on for mass in excess of the maximum. SHK can therefore not provide any other opinion than qualitatively concerning the safety margins associated with the flight.

The take off tests carried out by SHK in the simulator also showed that a rejected take off from the decision speed V1, would have involved a considerable risk that the crew not should be able to stop the aircraft before the end of the runway.

2.4.3 *Rotation and lift off*

Rotation was initiated at about 151 knots, which is the speed obtained from the performance tables with the stated conditions in accordance with the load & trim sheet, without any corrections for wind, temperature or air pressure. The nose wheel did not lift off until 163 kt, i.e. at 12 kt higher speed than V_R, which is a higher speed difference than during a normal rotation. During a take off at the maximum permitted take off mass, the difference in speed between initiating rotation and nose wheel lifting is normally about 3 kt. Data from the flight recorder showed that the aircraft rotated at about 2° per second, against the recommended rate of about 3° per second. The commander remarked that the aircraft felt nose heavy during take off. Contributing reasons for the slow rotation and the feeling that the aircraft was nose heavy were that the load in cargo compartment 1 had not been added in, and that the flap position and pitch trim setting were not set for the true take off mass and balance situation.

The tail wind and the slow rotation rate meant that the aircraft was further along the runway than had been predicted by the performance calculations when the decision speed for an aborted take off and the speeds for rotation and lift off were reached. The aircraft had also rolled on the main wheels with the nose wheel off the runway for a much longer distance than during a normal take off.

The prescribed margins for stopping on the runway if there had been a mishap during the take off, and the obstacle clearance during climb out on one or two engines were therefore not available during this particular flight.

2.4.4 *The collision with the approach lights*

Inspection of the light fittings showed that the deformation of the lamp housings in the two rows of lights closest to the runway had been caused by the aircraft undercarriage. The damage to the third row of lights and other damage to the first and second rows were probably caused by the jet blast from the engines and pressure waves created by the aircraft aerodynamics while passing over the approach lights.

SHK estimates, on the basis of data from the flight recorder and the damage to the light fittings, that the height of the main wheels over the end of the runway was less than 30 cm.

2.4.5 *Analysis of the aircraft mass*

The following table shows the mass relationships that applied in the particular take off. All the values are in respect of take off from runway 30 with the mass given in kilograms.

Max. permitted take off mass according to GWC with the prevailing meteorological conditions.	Take off mass according to the load calculations by the crew.	Calculated correct take off mass. (Including the baggage in cargo compartment 1.)	True take off mass (with passenger weights from the survey).
67,956	70,169	70,536	71,104

The above shows that at take off the aircraft had a mass that exceeded the maximum permitted according to the GWC for runway 30 by 3,148 kg. There is however nothing to be gained by trying to recalculate for the greater mass such factors as the necessary runway length, as a number of other parameters – of which some are unknown – would affect the result.

2.5 General

2.5.1 *Terms and conditions for charter flying*

The circumstances that control the conditions for an operator in the charter branch usually differ radically from the equivalent conditions for a scheduled flights operator. Even though some of these have levelled out over time - dependent among other things on aviation deregulation – there still remain important differences.

The decision by a pilot in a scheduled airline, for technical or operational reasons to cancel, delay or limit the payload for a flight, does not normally result in any major consequences for the airline. There is usually a good chance that the passengers or load can be rebooked on the next flight, or the passengers can be transferred to another scheduled airline.

The conditions for a charter pilot are obviously the same in respect of the technical and operational regulations that cover the business. The consequence of a decision, for example for performance reasons, to not carry all the passengers may on the other hand for a charter operator lead to major economical consequences for the company. With only weekly departures from smaller destinations this can mean that a number of passengers must be rebooked to scheduled flights to their holiday destination.

Even if the contract is written such that the costs do not lie within areas that the operator can influence, situations such as that described above often mean that considerable expenses are also incurred by the operator. Traditionally charter companies have also been owned by or associated with travel agents, so that all additional costs are borne by their own businesses.

2.5.2 Production and safety

It is understood by SHK that the incident in the case of this particular departure from Åre/Östersund was the result of an excessively motivated crew who tried to complete their task using their own methods. It is hard to imagine that both pilots should have been unaware of all the factors that were excluded so as to arrive at the right side of the performance limitations.
The crew prioritised implementation of production in order to complete their task. It is not improbable that the crew, in their decision to make the flight, were influenced by the financial consequences that possibly could have been inflicted on their own company if not all the passengers and baggage could have been carried or if the flight had been replanned with an intermediate landing.

This event is an example of a deviation enforced by circumstances, on the grounds that the production-oriented requirements were not in balance with the existing operational conditions. The sum total of the deviations outlined in this report completely exhausted all the safety margins that should be present at take off in this class of aircraft. The reason that this incident did not develop into a serious aviation disaster can for the most part be ascribed to fortunate circumstances.

The incident that occurred should therefore encourage the company to review its policies, handling and training in respect of the balance between the production needs of the business and the established safety levels.

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 pilots had not been recruited in accordance with normal procedures.
d) The aircraft mass had been established within the prescribed time period.
e) The wind had altered direction by 150° from the forecast direction.
f) The crew had to change their landing plans from runway 30 to runway 12 on arrival.
g) Runway 30 was the most favourable from the performance viewpoint for take off planning.
h) The crew received a Met Report with the actual wind 23 minutes before take off.
i) The maximum permitted mass of the aircraft for that particular take off had been exceeded.
j) The mass of 29 bags in cargo compartment 1 had not been taken into account.
k) Calculation of the load result was performed manually by the crew.
l) The loading instructions were given verbally.
m) The performance calculations were performed manually by the crew.
n A correction for the tail wind was not performed.
o) A correction for the air pressure was not performed.
p A correction for the temperature was not correctly performed.
q The take off was performed with the air conditioning system switched off.
r) The take off was performed statically.
s) The crew did not have the correct knowledge of LMC.
t) The crew did not have the correct knowledge in respect of the improvement of performance with the air conditioning system switched off.
u) The true mass of the aircraft on take off exceeded the maximum permitted by the GWC by 3,148 kg.
ü) Rotation was initiated when 630 metres of the runway remained.
v) The aircraft rotated more slowly than normal.
w) The nose wheel lifted when 250 metres of the runway remained.
x) The main wheels lifted when 30 metres of the runway remained.
y) The height of the aircraft as it passed the runway threshold was less than 30 cm.
z) The aircraft collided with the approach lights for the opposite runway.

3.2 Causes of the incident

The incident was caused by deficiencies in the company's handling of the balance between flight safety and production. These deficiencies lead, among other things, to that take off performance calculations was carried out without some limiting factors, implying that the aircraft mass exceeded the maximum allowed under the prevailing conditions.

4 RECOMMENDATIONS

- The Swedish Transport Agency is recommended to increase the number of SAFA inspections (Safety Assessment of Foreign Aircraft), and in the international flight safety community work for that these inspections are completed with control of the statements regarding operational documentation of the actual flight. *(RL 2009:14e R1)*

- The Swedish Transport Agency is recommended to work for that the Austrian Civil Aviation Authority (Austro Control) follows up the work of improvement within the company in question regarding Safety Management System, employment routines and training of cockpit crew
(RL 2009:14e R2)