



Statens haverikommission
Swedish Accident Investigation Board

ISSN 1400-5719

Report RL 2007:03e

**Incident involving aircraft TC-AAP
at Skellefteå airport, AC county,
on 3 May 2006**

Case L-10/06

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

The material in this report may be reproduced free of charge provided due acknowledgement is made.

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

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

Statens haverikommission (SHK) Swedish Accident Investigation Board

Postadress
P.O. Box 12538
102 29 Stockholm

Besöksadress
Teknologgatan 8 C
Stockholm

Telefon
08-555 017 70

Fax
08-555 017 90

E-post
info@havkom.se

Internet
www.havkom.se



The Swedish Civil Aviation Authority

SE-601 73 NORRKÖPING, Sweden

Report RL 2007:03e

The Swedish Accident Investigation Board (Statens haverikommission, SHK) has investigated an aircraft incident that occurred on 3 May 2006 at Skellefteå airport, AC county, involving an aircraft with registration TC-AAP.

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

Åsa Kastman Heuman

Henrik Elinder

Content

	SUMMARY	4
1	FACTUAL INFORMATION	6
	1.1 History of the flight	6
	1.2 Injuries to persons	6
	1.3 Damage to the aircraft	7
	1.4 Other damage	7
	1.5 Personnel information	7
	1.5.1 <i>Commander</i>	7
	1.5.2 <i>Co-pilot</i>	7
	1.5.3 <i>Instructors</i>	7
	1.5.4 <i>Cabin crew members</i>	7
	1.5.5 <i>The crew members' duty schedule</i>	8
	1.6 The aircraft	8
	1.6.1 <i>General</i>	8
	1.6.2 <i>Control on the ground</i>	8
	1.6.3 <i>Auto Throttle System (ATS)</i>	8
	1.7 Meteorological information	8
	1.8 Aids to navigation	9
	1.9 Communications	9
	1.10 Aerodrome information	9
	1.11 Flight and voice recorders	9
	1.11.1 <i>Flight Data Recorder (FDR)</i>	9
	1.11.2 <i>Cockpit Voice Recorder (CVR)</i>	10
	1.12 Location of occurrence and aircraft	11
	1.12.1 <i>Location of the incident</i>	11
	1.12.2 <i>The aircraft</i>	12
	1.13 Medical information	12
	1.14 Fire	12
	1.15 Survival aspects	12
	1.15.1 <i>General</i>	12
	1.15.2 <i>Actions by the rescue services</i>	12
	1.16 Tests and research	12
	1.17 Organisational and management information	12
	1.18 Other	12
	1.18.1 <i>Equal opportunities aspects</i>	12
	1.18.2 <i>Environmental aspects</i>	13
2	ANALYSIS	13
	2.1 The incident	13
	2.2 Engine power	13
	2.3 Crew co-operation	14
3	CONCLUSIONS	14
	3.1 Findings	14
	3.2 Causes of the incident	14
4	RECOMMENDATIONS	14

Report RL 2007:03e

L-10/06

Report finalised 11 January 2007

<i>Aircraft; registration and type</i>	TC-AAP, B 737-800
<i>Class/airworthiness</i>	Normal, valid Certificate of Airworthiness
<i>Owner/Operator</i>	Gcass France SARL, 47 Boulevard de Courcelles, F-75008 Paris, France/Pegasus Basin Ekspres yolu no:2 Halkali 34660 Istanbul, Turkey
<i>Time of occurrence</i>	2006-05-03, 09:45 hours, in daylight <i>Note.:</i> All times are given in Swedish daylight saving time (UTC + 2 hours)
<i>Location</i>	Skellefteå airport, AC county, (pos. 6438N 02105E; 49 m above sea level)
<i>Type of flight</i>	Commercial air transport, charter
<i>Weather</i>	According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis: wind 180°/04 knots, visibility 10 km, clearing haze, cloud 2-4/8 with base at 2200 feet and 6-8/8 with base at 4500 feet, temp./dewpoint +7/+4 °C, QNH 1026 hPa
<i>Persons on board:</i>	
<i>crew members</i>	7
<i>passengers</i>	187
<i>Injuries to persons</i>	None
<i>Damage to the aircraft</i>	None
<i>Other damage</i>	None
<i>Commander:</i>	
<i>Gender, age, licence</i>	Male, 45 years, ATPL
<i>Total flying time</i>	13378 hours, of which 10622 hours on type
<i>Flying hours previous 90 days</i>	208 hours, all on type
<i>Number of landings previous 90 days</i>	65
<i>Co-pilot:</i>	
<i>Gender, age, licence</i>	Male, 30 years. Certification information not available
<i>Total flying time</i>	255 hours, of which 55 hours on type
<i>Flying hours previous 90 days</i>	55 hours, all on type
<i>Number of landings previous 90 days</i>	10, all on type

Instructor:

<i>Gender, age, licence</i>	Male. Age and certification information not available
<i>Total flying time</i>	1672 hours, of which 429 hours on type
<i>Flying hours previous 90 days</i>	178 hours, all on type
<i>Number of landings previous 90 days</i>	65, all on type
<i>Cabin crew members</i>	Three females and one male

The Swedish Accident Investigation Board (SHK) was notified on 3 May 2006 that an aircraft with registration TC-AAP had an incident at Skellefteå airport, AC county, that same day at 09:45.

The incident has been investigated by SHK represented by Åsa Kastman Heuman, Chairperson, Henrik Elinder, Chief technical investigator aviation, and Stefan Christensen, operations investigator

The accredited representative from the NTSB was Mr. William English. The investigation was followed by Max Danielsson, representing the Swedish Civil Aviation Authority.

Summary

The aircraft was to undertake a charter flight from Skellefteå in Sweden to Istanbul/Antalya in Turkey with the commander as PF (Pilot Flying). Taxying took the form of a backtrack on the runway for take-off from runway 10.

When the aircraft reached the end of the runway the commander performed a 180 degrees left turn to align the aircraft with the runway. Engine power was increased, according to the commander, first manually to about 40% power on both engines before the automatic throttle system (ATS) was activated and the brakes were released.

At this point the pilots perceived that the aircraft, in an uncontrolled manner, began to move and turned to the left, and the commander did not succeed in preventing it from departing from the runway despite the use of both nosewheel steering and brakes. In connection with the uncontrolled movement of the aircraft the pilots heard an unusual and “buzzing” noise from the nose of the aircraft. No-one on board was injured and the aircraft showed no visible signs of damage.

No technical fault has been found in the aircraft. The weather and runway condition were good. When ATS was activated for take-off the engine power was asymmetrical and the aircraft was not lined up on the runway. The buzzing sound heard by the pilots seems, together with nosewheel marks on the runway and tyre wear on the nosewheel to have been caused by the nosewheel skidding.

The pilots did not manage to restrain the leftwards turning by using only the nosewheel steering. Braking with the wheel brakes was performed late and with low brake pressure.

The incident was caused by the ATS being activated before the aircraft had been lined up on the runway and while the engine power was asymmetrical. A contributory factor was that the pilots did not correct the engine power in time, that the wheel brakes were applied too late and with too low brake pressure.

Recommendations

None.

1 FACTUAL INFORMATION

1.1 History of the flight

The Turkish operator was to undertake a charter flight from Skellefteå in Sweden to Istanbul/Antalya in Turkey as flight PGT 882, with planned departure time 09:30. Earlier that same morning the crew had flown without passengers from the company's operating base at Antalya, a flight which took about four hours and was carried out without incident. In addition to the normal crew, there was an instructor on board, with the task of instructing/supervising the co-pilot, who had limited flying experience.

After the passengers had boarded, the pilots started the engines and began to taxi out for take-off. The commander, who was the PF (Pilot Flying) on this flight, steered the aircraft on to the runway with the aid of nosewheel steering, which he controlled with the aid of a steering tiller. Take-off was to be from runway 10 and taxiing to the runway threshold took place by backtracking along the runway.

When the aircraft reached the end of the runway the commander performed a 180 degrees turn to align the aircraft with the runway. According to the commander, the aircraft was braked to a stop completely on the centre line with its nose facing the runway direction for several seconds before engine power was increased.

According to the commander, engine power was increased manually at first to about 40 % on both engines. After this the automatic throttle system (ATS) was activated, which gradually increased the engine power further, up to a previously set take-off power. At about the same time the commander released the brakes and the aircraft began to accelerate forward.

At this point the pilots saw that the aircraft began to move and turn in an uncontrolled manner to the left. The commander steered the nosewheel steering to the right and braked, but did not manage to prevent the aircraft continuing towards the left edge of the runway. The pilots reduced engine power to idling, but all three landing gears went off the edge of the runway before the aircraft stopped with its nose pointing 30 degrees to the left of the runway direction. In connection with the uncontrolled movement of the aircraft all the pilots heard an unusual and "buzzing" noise from the nose of the aircraft.

No-one on board was injured and the aircraft showed no visible signs of damage. The incident was observed by air traffic staff in the control tower, who sent airport staff to the scene, and these helped to evacuate those on board.

The incident occurred at Skellefteå airport on runway 10 at position 6438N 02105E; 49 m above sea level.

1.2 Injuries to persons

	<i>Crew members</i>	<i>Passengers</i>	<i>Other:</i>	<i>Total</i>
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	7	187	–	194
Total	7	187	–	194

1.3 Damage to the aircraft

None.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 Commander

The commander, male, was 45 years old at the time and had a valid Airline Transport Pilot Licence.

Flying hours

<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	–	–	13378
This type	4	208	10622

Number of landings this type previous 90 days: 65.

Flight training on type concluded on 21 February 1995.

Latest PC (Proficiency Check) carried out in November 2005 on the type B 737-800.

1.5.2 Co-pilot

Co-pilot, male, was 30 years old at the time. Certification information is not available.

Flying hours

<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	–	55	255
This type	4	55	55

Number of landings this type previous 90 days: 10.

Flight training on type concluded in 2006.

Information concerning the latest PC/OPC is not available.

1.5.3 Instructor

Instructor, male. Age and certification information not available.

Flying hours

<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	–	–	1672
This type	4	178	429

Number of landings this type previous 90 days: 65.

Flight training on type concluded in November 2006.

Information concerning the latest PC/OPC is not available.

1.5.4 Cabin crew members

The cabin crew consisted of three females and one male.

1.5.5 *The crew members' duty schedule*

Apart from the information that the commander had performed three flights within the five day period before the incident, no further information was provided concerning the pilots' duty and rest periods.

1.6 **The aircraft**

1.6.1 *General*

The aircraft

<i>Manufacturer</i>	Boeing
<i>Type</i>	B 737-800
<i>Serial number</i>	32736
<i>Year of manufacture</i>	2002
<i>Flight mass</i>	Max. authorised start mass 79000 kg, actual approximately 78500 kg
<i>Centre of mass</i>	MAC 19.9
<i>Total flying time</i>	13518 hours
<i>Number of cycles</i>	5109
<i>Flying time since latest inspection</i>	132 hours
<i>Fuel loaded before event</i>	Jet A1

ENGINE

<i>Engine manufacturer</i>	CFMI
<i>Engine model</i>	CFM56-7B
<i>Number of engines</i>	2
<i>Engine</i>	<i>No. 1</i> <i>No. 2</i>
<i>Total operating time, hrs</i>	13518 13518
<i>Hours after overhaul</i>	13518 13518
<i>Cycles after overhaul</i>	5109 5109

The aircraft had a valid Certificate of Airworthiness

1.6.2 *Control on the ground*

This type of aircraft is equipped with nosewheel steering, that is normally used when moving on the ground. The nosewheel steering can be operated both with the aid of the rudder pedals and by means of a tiller handle that is located to the left of the commander on the flight deck. At low speeds the nosewheel can be steered 78° in either direction.

1.6.3 *Auto Throttle System (ATS)*

The aircraft is equipped with an ATS system to automatically set the engine power. During acceleration for take-off the system ensures, among other things, that the power from both engines is increased with equal speed from the throttle controls to a predetermined level, and stabilised there. The engine power, or thrust, is measured as a percentage of the maximum permitted fan speed (low pressure turbine speed, N1).

1.7 **Meteorological information**

According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis: wind 180°/04 knots, visibility 10 km, clearing haze,

cloud 2-4/8 with base at 2200 feet and 6-8/8 with base at 4500 feet, temp./dewpoint +7/+4 °C, QNH 1026 hPa.

1.8 Aids to navigation

Not applicable.

1.9 Communications

There were normal radio communications between the aircraft and air traffic control at the airport before the take-off roll. After the incident, the pilots contacted the tower and requested assistance to evacuate the passengers and to tow the aircraft away.

1.10 Aerodrome information

The airport status was in accordance with AIP¹-Sverige/Sweden. The runway dimensions were 2100 x 45 metres, laid with asphalt. Runway 10 is aligned at 101 degrees and runway 28 at 281 degrees.

1.11 Flight and voice recorders

1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with a Flight Data Recorder of type Honeywell SSFDR-08509. Recorded data concerning the actual event was read out under the supervision of the Turkish aviation authority and sent to SHK for analysis.

The following table shows the relationship between the aircraft speed, engine power and turning speed during various stages of the incident, from when the commander commenced the 180 degree turn at the end of the runway until the aircraft stopped outside the edge of the runway.

Reading	Time	Phase	Recording
80204	07:31:29	Start of taxiing	Normal values
80316	07:33:21	Start backtrack	GS ² = 11 knots Moderate, symmetrical engine power adjustments.
80377	07:34:22	Start 180° turn	Speed reduction, left turn Moderate, symmetrical braking Max. turning rate = 8°/sec. N1/LE ³ = 26.0 % N1/RE ⁴ = 25.1 % GS = 13 knots
80408	07:34:53	Throttle increase	N1/LE max. = 22.0 % N1/RE max. = 22.7 %
80411	07:34:56	Aircraft about at right angles to runway direction	GS = 2.5 knots N1/LE = 26.5 % N1/RE = 27.6 %

¹ AIP – Aeronautical Information Publication

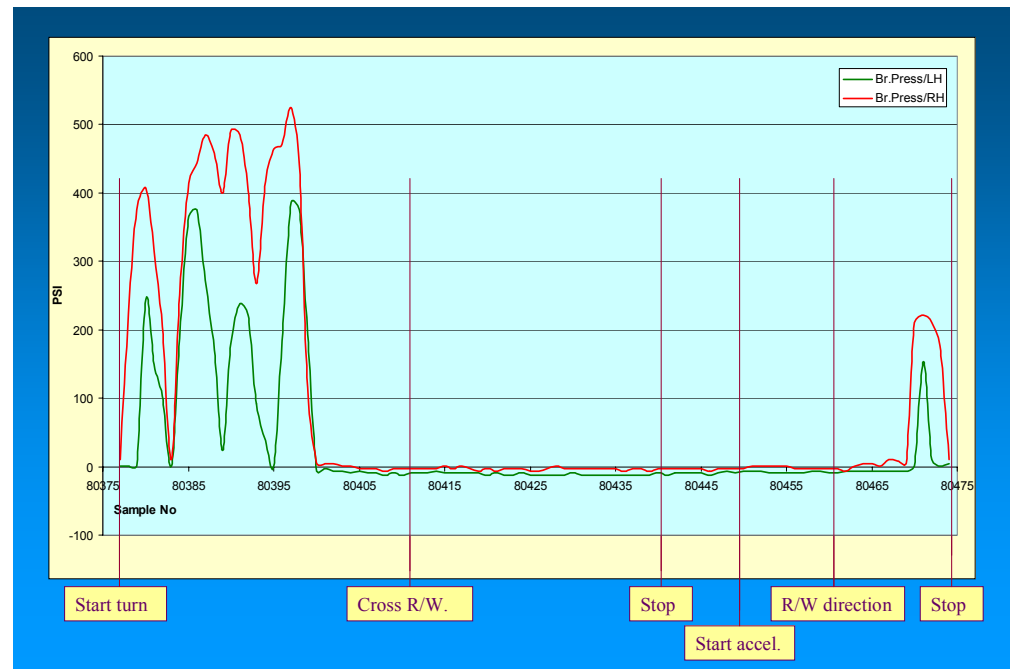
² GS – Ground Speed

³ N1/LE – Power from left engine

⁴ N1/RE – Power from right engine

80435	07:35:20	Left turn with no speed.	GS = 0 knots N1/LE = 21.9 % N1/RE = 21.9 %
80440	07:35:25	Aircraft completely halted.	Course = 114° N1/LE = 26.6 – 24.6 % N1/RE = 24.3 – 28.6 %
80447	07:35:32	Left turn continues	GS = 0 knots N1/LE = 25.3 – 25.1 % N1/RE = 30.8 – 33.5 %
80450	07:35:35	Acceleration begins	N1/LE = 24.9 % N1/RE = 34.8 %
80462	07:35:47	Aircraft aligned with runway	GS = 10 knots Turning rate = 2 °/sec. N1/LE = 32.4 % N1/RE = 85.9 %
80463	07:35:48	Highest recorded engine power	GS = 12 knots Turning rate = 2 °/sec. N1/LE = 35.4 % N1/RE = 89.5 %
80468	07:35:53	Highest recorded GS and turning rate	GS = 17 knots Turning rate = 4 °/sec. Course = 081° N1/LE = 27.5 % N1/RE = 42.2 %
80474	07:35:59	Stop	Course = 069° N1/LE = 20.5 % N1/RE = 23.5 %

The diagram below shows the brake pressures in the left and right brake systems during the same period.



Brake pressures in the left and right brake systems

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with a CVR of type Honeywell CVR120-04863. Sounds in the cockpit during the whole event were recorded. Speech

between the crew members and significant sounds in the cockpit have been printed out.

From the printout it can be read that normal procedures were followed for engine starting, taxiing out and preliminary preparations for take-off. Communication was mainly in English, with some Turkish. The take-off checklist was completed as the aircraft was turning through 180° at the end of the runway.

At this point there arose a misunderstanding between the pilots as to the setting of the gyro compass in relation to the runway direction of 101 degrees. The commander ordered a setting of 35 degrees, which the co-pilot acknowledged. The error was pointed out by the instructor, whereupon the co-pilot corrected the setting. During this exchange of words the aircraft stood still for about 10 seconds.

After this the commander was heard to say: “Stabilize...set takeoff thrust”, meaning that the engine power was stable and symmetrical, and the ATS activated, which is done by pressing a button.

During the subsequent 7.2 seconds a low frequency, rumbling and abnormal sound was recorded.

1.12 Location of occurrence and aircraft

1.12.1 Location of the incident

The incident occurred approximately 100 metres from the threshold of runway 10 at Skellefteå airport. At the time the runway surface was damp, but not wet.

Marks on the runway showed that the aircraft nosewheel was about four metres to the left of the centreline when acceleration began. The aircraft then moved to the left, and finally finished up with all wheels off the left edge of the runway. The nosewheel ploughed a ten metre long and about 30 cm deep furrow in the ground before the aircraft stopped.



The nosewheel markings, partly on the asphalt, and partly on the ground beyond the edge of the runway, showed that it had “jumped” or “skidded”, which indicates that it had been positioned at a large angle in relation to the direction of the aircraft. No clear signs of braking could be seen.

1.12.2 *The aircraft*

Apart from earth and grass being forced into the nosewheel hub, there was no damage to the aircraft.

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 *General*

At the time of the incident the aircraft speed was low and those on board were not subjected to any high G loadings. The pilots lost control of the aircraft during a critical phase of the flight, which is serious from a flight safety viewpoint.

1.15.2 *Actions by the rescue services*

The air traffic controllers observed the incident and immediately warned the airport rescue services, who quickly arrived on scene.

1.16 Tests and research

In conjunction with the airline technicians, SHK carried out functional checks on the systems that could have had an influence on the events in this incident. The tests included taxiing, turning and braking tests at different speeds. Nothing incorrect or abnormal could be found.

After inspection of the nosewheel and its attachment to the aircraft, and changing the nosewheel, the aircraft was placed back into service. The wear surface of the nosewheel were somewhat worn at an angle.

1.17 Organisational and management information

The airline is based in Istanbul, Turkey and mainly operates charter traffic within Europe. The company operates 17 Boeing 737 type aircraft.

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 not found.

1.18.2 *Environmental aspects*

The incident did not have any negative environmental effects.

2 ANALYSIS

2.1 The incident

The pilots perceived that the aircraft inexplicably turned and went to the left while power was being applied for take-off, and they were unable to prevent it leaving the runway. This means that they lost control of the aircraft during a critical phase of the flight, which is serious from a flight safety viewpoint.

No technical faults in the aircraft, nor external circumstances, concerning the aircraft or the weather situation, were found that could explain the events that took place.

According to the pilots' recollections, the aircraft stopped aligned on the runway before power was applied. The ATS was then activated when the power on both engines was set at 40 %.

As described in section 1.11, the recorded FDR data showed that the aircraft heading was at that time 114°, i.e. 13° to the right of the runway direction, and that the engine thrust was asymmetrical during the brief halt, and also during the initial acceleration.

The asymmetry in thrust increased from that time on. When the aircraft, moving at 10 knots and turning at the rate of 2°/second, "passed the runway bearing", the left engine power was about 32 %, while the right engine power was almost 86 %. This difference in engine power resulted in a powerful turning moment to the left. The aircraft was also at that time heavily loaded and in a left turn.

The buzzing sound heard by the pilots at that stage, and that was also recorded by the CVR, together with nosewheel marks on the runway and tyre wear on the nosewheel, appears to have been caused by the nosewheel sliding or skidding. This explains why the commander was unable to steer the aircraft back on to the runway direction. The nosewheel steering did not succeed in achieving sufficient turning moment to the right to counteract the asymmetrical thrust and inertia during the left turn of the aircraft.

Immediately before the aircraft left the runway, the pilot applied the wheel brakes, but it is evident from the diagram in section 1.11 that the brakes were applied too late and that the braking pressure was too low for this to prevent leaving the runway.

2.2 Engine power

From the FDR and CVR printouts it was shown that the engine power was asymmetrical at the time the ATS was activated for take-off. At that moment the power from the right engine was about 10 % higher than that from the left engine. On activation, the thrust from both engines began to increase at an even acceleration through the throttle controls.

Since engine acceleration normally takes place faster at a higher power, this meant that the asymmetry in thrust increased during the initial

acceleration of the aircraft. Before the pilots realised the situation and reduced power, the difference in power had reached over 54 %.

2.3 Crew co-operation

The crew in the cockpit consisted of the commander, who had a great deal of flying experience, a co-pilot with very limited flying experience and his instructor. The instructor had limited flying experience on this type. During the halt before acceleration, the commander gave an incorrect order to the co-pilot concerning the setting of the course gyro. This error was noticed and pointed out by the instructor, who thereby to some extent interfered with the flight. This could possibly have contributed to the commander not noticing that the ATS was activated, despite the fact that the engine powers were not symmetrical and the aircraft was not aligned with the runway.

That same morning the pilots had flown the aircraft from Turkey to Sweden, which meant that they had been on duty since very early in the morning. SHK has not succeeded in obtaining information concerning the pilots' duty and rest periods before the flight to Sweden, and it cannot be excluded that fatigue could have reduced the capabilities of the pilots.

3 CONCLUSIONS

3.1 Findings

- a) The pilots were qualified to perform the flight.
- b) The aircraft had a valid Certificate of Airworthiness
- c) No technical fault has been found in the aircraft.
- d) The weather and runway condition were good.
- e) When ATS was activated for take-off the engine power was asymmetrical and the aircraft was not lined up on the runway.
- f) The pilots did not manage to restrain the leftwards turning by using the nosewheel steering.
- g) Braking with the wheel brakes was performed late and with low brake pressure.
- h) Poor cockpit resource management could have contributed to the events that took place.

3.2 Causes of the incident

The incident was caused by the ATS being activated before the aircraft had been lined up on the runway and while the engine power was asymmetrical. A contributory factor was that the pilots did not correct the engine power in time, that the wheel brakes were applied too late and with too low brake pressure.

4 RECOMMENDATIONS

None.