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Final report RL 2013:12e

**Serious incident on 1 July 2012 involving
the aircraft TC-SNM and TC-SUO at
Stockholm/Arlanda Airport, Stockholm county.**

Ref no L-59/12

2013-07-01

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring again, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

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This document is a translation of the original Swedish report. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the report.

1. The Swedish Transport Agency, Civil Aviation and Maritime Department

Final report RL 2013:12e

The Swedish Accident Investigation Authority (Statens haverikommission, SHK) has investigated a serious incident that occurred on 1 July 2012 at Stockholm/Arlanda Airport, Stockholm county, involving two aircraft of type Boeing B737-800 with the registrations TC-SNM and TC-SUO.

In accordance with Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, the SHK investigation team hereby submits a final report on the results of the investigation.

The Swedish Accident Investigation Authority respectfully requests to receive, by 1 October 2013 at the latest, information regarding measures taken in response to the recommendations included in this report.

On behalf of the Swedish Accident Investigation Authority,

Mikael Karanikas

Nicolas Seger

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General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring again, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies. The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

Investigations of aviation incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation. The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

The investigation

On 1 July 2012, SHK was informed that a serious incident involving two aircraft with the registrations TC-SNM and TC-SUO had occurred at 09.05 hrs that day at Stockholm/Arlanda Airport, Stockholm county.

The incident has been investigated by SHK as represented by Mr Mikael Karanikas, Chairperson, Mr Nicolas Seger, Investigator in Charge, Mr Peter Swaffer, Operations Investigator and Mr Urban Kjellberg, Investigator specialising in Fire and Rescue Services.

The investigation team of SHK was assisted by Ms Gerd Svensson as an expert specialising in behavioural science.

The investigation was followed by Mr Jan V Eriksson of the Swedish Transport Agency.

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Aircraft A; reg, type, serial no	TC-SNM, Boeing B737-8BK, MSN 33023
Aircraft B; reg, type, serial no	TC-SUO, Boeing B737-86Q, MSN 30272
Class/Airworthiness	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC ¹) for both aircraft
Operator	SunExpress was the operator of both aircraft
Time of occurrence	01/07/2012, 09.05 hrs in daylight Note: All times are given in Swedish daylight saving time (UTC ² + 2 hrs)
Place	Stockholm/Arlanda Airport, Stockholm county, (pos. N5939.1 E01755.6; 31 metres above sea level)
Type of flight	Commercial aviation
Weather	According to Meteorological Aerodrome Report (METAR) at 09.20 hrs: Wind 210°/10 kts, visibility ≥10 km, 2-3/8 with the cloud base at 2600 feet, temp/dewpoint 20/14 °C, QNH ³ 1011 hPa
Persons on board aircraft A	144
Crew	6
Passengers	138
Persons on board aircraft B	175
Crew	6
Passengers	169
Injuries to persons	None
Damage to aircraft A	Limited
Damage to aircraft B	Limited
Other damage	None
Crew, aircraft A	
Commander:	
Age, licence	48 years, ATPL ⁴
Total flying hours	6109 hours, of which 2405 hours on type
Flying hours previous 90 days	259 hours, all on type
Number of landings previous 90 days	110

¹ ARC - Airworthiness Review Certificate.

² UTC - Universal Time Coordinated is a reference for the exact time anywhere in the world.

³ QNH indicates barometric pressure adjusted to sea level.

⁴ ATPL - Airline Transport Pilot Licence authorises a pilot to act in commercial traffic as pilot-in-command of a multi-pilot aircraft.

Co-pilot:	
Age, licence	24 years, CPL ⁵
Total flying hours	402 hours, of which 238 hours on type
Flying hours previous 90 days	238 hours, all on type
Number of landings previous 90 days	119
Cabin crew members	4
Crew, aircraft B	
Commander:	
Age, licence	38 years, ATPL
Total flying hours	10,485 hours, of which 10,213 hours on type
Flying hours previous 90 days	246 hours, all on type
Number of landings previous 90 days	94
Co-pilot:	
Age, licence	25 years, CPL
Total flying hours	688 hours, of which 478 hours on type
Flying hours previous 90 days	264 hours, all on type
Number of landings previous 90 days	120
Cabin crew members	4

Summary

Upon landing on Stockholm/Arlanda runway 26 a Boeing B737-800 aircraft with registration TC-SNM was cleared to taxi to stand 19. The aircraft was taxied to the apron via entry ZK. According to published taxiing instructions entry ZH should have been used instead. After having completed the turn at ZK they tried to pass behind a parked aircraft of the same type. Enough clearance was not available whereby the aircraft's left wingtip collided with the right elevator of the parked aircraft.

The taxi clearance issued by the traffic controller did not include any specific information other than “*taxi to stand 19*”. The commander had recently visited Stockholm/Arlanda and had then taxied via ZK, on that occasion for gate 20. Hence the crew assumed that it was possible to use ZK in order to reach gate 19, which is situated just past stand 20. The crew had performed a briefing of the expected taxi route, in which the use of ZK was considered to be the closest and most logical choice.

The crew had established a firm perception and belief on which taxi route to be used. Despite the fact that concern was expressed in the cockpit with regards to the obstacle clearance, this conviction was not broken during the continued

⁵ CPL – Commercial Pilot Licence authorises a pilot to act in commercial traffic as pilot-in-command of a single-pilot aircraft or as co-pilot of a multi-pilot aircraft.

taxiing. The commander was also of the belief that sufficient space was available and that they were on the correct taxi route.

According to local procedures the transponder should be on during taxiing, which it was. This led the crew to expect that the traffic controller would alert them should they taxi incorrectly. There were ground crew in the vicinity of the aircraft who the crew thought would react and attract their attention if there was not sufficient clearance.

The cause of the incident was that the crew misjudged the distance to the parked aircraft. Contributing causes were that neither did the briefing include, nor was the aircraft manoeuvred in accordance with the published route.

A more detailed clearance from the traffic controller along with a clear marking on the ground would have reduced the risk of a collision and also served in the interests of flight safety.

Recommendations

The Swedish Transport Agency's Civil Aviation and Maritime Department is recommended to take the measures deemed appropriate in order to limit the risk factors specified in 3.3. (*RL 2013:12 RI*)

1. FACTUAL INFORMATION

1.1 History of the flight

On the morning of 1 July 2012, an aircraft of type Boeing B737-800 with registration TC-SNM (Fig. 1) conducted a scheduled flight from İzmir Adnan Menderes International Airport in Turkey to Stockholm/Arlanda Airport in Sweden. SunExpress was the operator of the flight.



Fig. 1. Aircraft TC-SNM. Photo: Mathias Henig.

After landing on runway 26, the aircraft was cleared by air traffic control to “*taxi to stand 19*”. According to AIP⁸-Sweden's published taxiing instructions for arriving aircraft to stand 19, entry ZH to apron BC must be used (Fig. 2). However, after taxiing on taxiway Z, the aircraft performed a left turn at entry ZK in order to arrive at apron AB.

TC-SNM then turned right, whereby the aircraft's left wingtip later collided with the right elevator of an aircraft of the same type and operator with registration TC-SUO, parked at stand 20 (Fig. 3).

Both aircraft incurred damage to the extent that they could not continue their planned flights after this. No injuries to persons or other damage arose.

⁸ AIP - Aeronautical Information Publication. Covers topics such as information on aircraft, airspace and national regulations. The Swedish Transport Agency is responsible for published information.

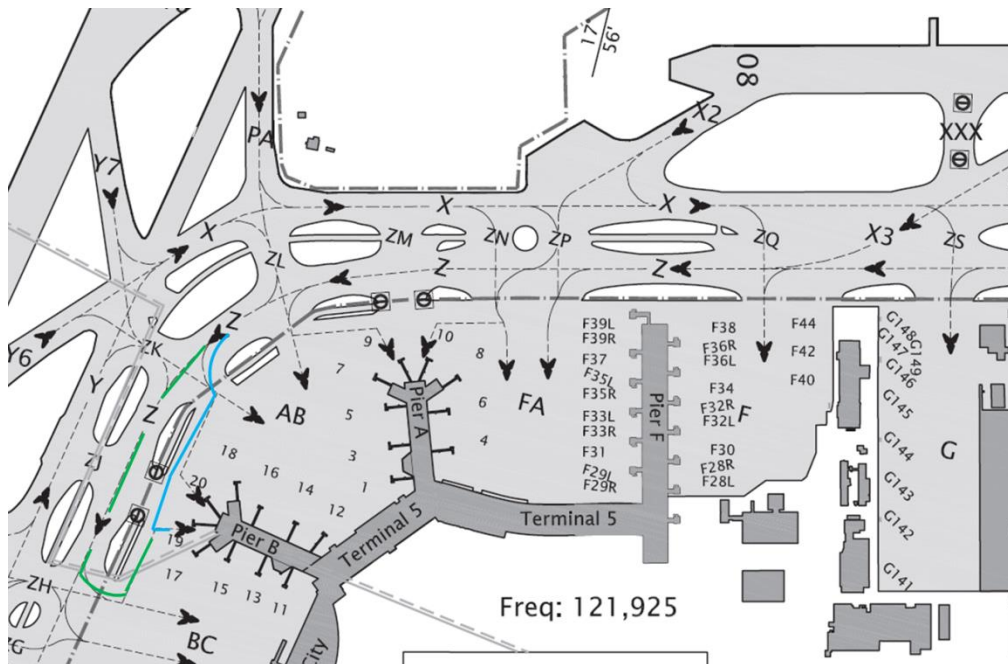


Fig. 2. AIP Sweden with a map of ground movements for arriving aircraft. The route taken by TC-SNM is marked in blue. The published taxi route has been marked in green.

Figure 3 has been taken from a video sequence from a simulation of the situation based on data from the A-SMGCS⁹ recording. The sequence has been provided by Swedavia¹⁰ and shows, among other things, markings for the relevant taxiways and apron. The figure shows TC-SNM's route via entry ZK to stand 19. The image shows TC-SNM's position in relation to the centre line and the parked aircraft TC-SUO.

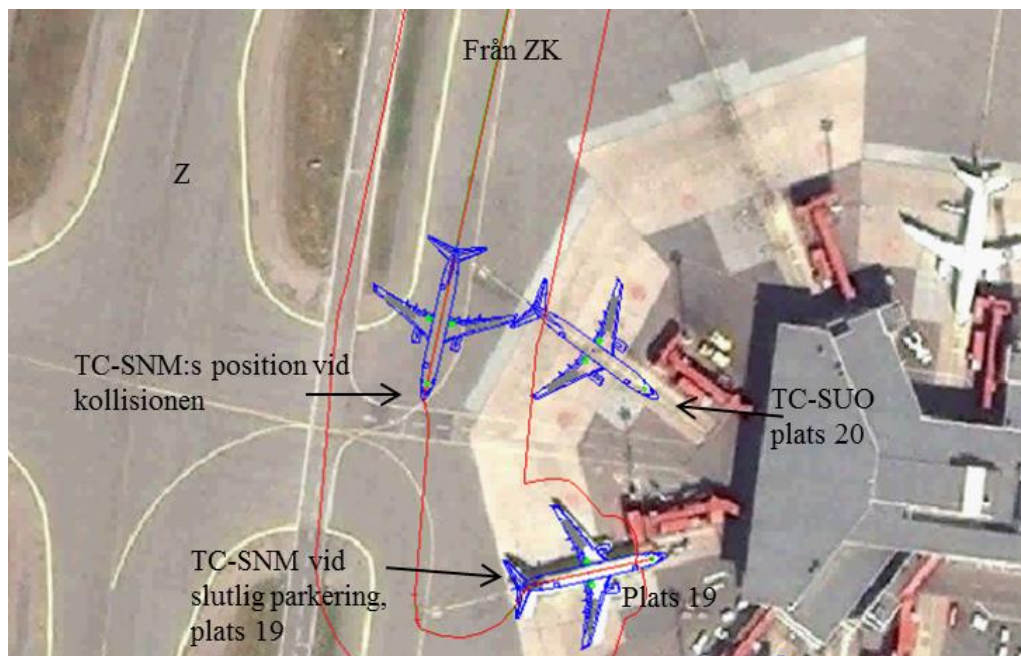


Fig. 3. TC-SNM's position at the time of collision.

⁹ A-SMGCS - Advanced Surface Movement Guidance and Control System - A monitoring system for air traffic control which enables an aircraft's ground movements to be followed via ground radar and by means of signals from the aircraft.

¹⁰ Swedavia - A state-owned group that owns, operates and develops airports in Sweden.

From the CVR¹¹ and interviews with the crew, it has been discovered that a verbal briefing of taxiing and the expected parking place was performed before approach was initiated. From the CVR, it was also evident that the crew planned to taxi via ZK to stand 19 or stand 20. The briefing was performed by PF¹², who was the co-pilot while the aircraft was airborne, which was in accordance with the airline's operational procedures. After landing, however, the roles switched, and the commander was PF during taxiing. The commander was seated in the left position in the cockpit. It is also from the left side that the aircraft is normally taxied. Before approach was initiated, the crew had been informed by its ground handling company that they would be allocated stand 19 for parking.

According to the CVR, the co-pilot questioned on a number of occasions during the latter stage of taxiing whether their current route was the correct one for stand 19 and whether the space really allowed for passage.

The incident occurred at position N5939.1 E01755.6; 31 metres above sea level.

1.2 Injuries to persons

None.

1.3 Damage to the aircraft

Damage to the two aircraft was limited and not such that the incident can be classified as an accident. However, the damage incurred by the aircraft was such that they could not continue their planned flights.

The upper part of the left winglet¹³ of aircraft TC-SNM was torn off and became lodged in the right elevator of the parked aircraft TC-SUO (Fig. 4).



Fig. 4. TC-SNM's winglet and TC-SUO's elevator. Photo: SHK.

¹¹ CVR - Cockpit Voice Recorder - A sound recorder which picks up sound and speech in the cockpit and radio communication to and from the cockpit, e.g. from air traffic control.

¹² PF - Pilot Flying - The pilot currently in control of the aircraft.

¹³ A winglet is a wing-mounted device found on modern aircraft which is used to reduce the drag (see explanation under point 1.6.2).

1.4 Other damage

No other damage was incurred.

1.5 Personnel information

1.5.1 Crew, aircraft A

1.5.1.1 Commander

The commander was 48 years old at the time and had a valid ATPL.
At the time of the incident, the commander was PF.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	No data	21	259	6 109
This type	No data	21	259	2 405

Number of landings this type previous 90 days: 110.
Type rating concluded on 5 July 2006.
Latest PC¹⁴ was conducted on 12 June 2012 on B737-800.

1.5.1.2 Co-pilot

The co-pilot was 24 years old at the time and had a valid CPL.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	No data	18	238	402
This type	No data	18	238	238

Number of landings this type previous 90 days: 119.
Type rating concluded on 6 March 2012.
Latest PC was conducted on 6 March 2012 on B737-800.

1.5.2 Crew, aircraft B

1.5.2.1 Commander

The commander was 38 years old at the time and had a valid ATPL.
At the time of the incident, the commander was PF.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	No data	21	246	10 485
This type	No data	21	246	10 213

Number of landings this type previous 90 days: 94.
Type rating concluded on 12 February 1999.
Latest PC was conducted on 9 February 2012 on B737-800.

¹⁴ PC - Proficiency Check - A periodic theoretical and practical test of a pilot's flying skills.

1.5.2.2 Co-pilot

The co-pilot was 25 years old at the time and had a valid CPL.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	No data	13	264	688
This type	No data	13	264	478

Number of landings this type previous 90 days: 120.

Type rating concluded on 21 November 2011.

Latest PC was conducted on 13 January 2012 on B737-800.

1.5.3 Cabin crew members, aircraft A and B

At the time of the incident, each aircraft had four cabin crew members.

1.5.4 The pilots' duty schedule

The pilots' hours of duty were within permitted limits. During the interviews, both pilots stated that they were rested prior to the shift in question.

1.6 Aircraft information

1.6.1 Airworthiness and maintenance

Aircraft A, TC-SNM

TC-holder	The Boeing Company
Model	737-8BK
Serial number	33023
Year of manufacture	2005
Gross mass	Max authorised take off/landing mass 75,000/66,360 kg, actual 58,500 kg
Centre of gravity	22.18
Total flying time	24,648 hours
Flying time since latest inspection	1,612 hours
Number of cycles	10,817

Aircraft B, TC-SUO

TC-holder	The Boeing Company
Model	737-86Q
Serial number	30272
Year of manufacture	2001
Gross mass	Max authorised take off/landing mass 77,000/66,360 kg
Centre of gravity	21.36
Total flying time	43,343 hours
Flying time since latest inspection	5,583 hours
Number of cycles	20,910

Both aircraft had a Certificate of Airworthiness and a valid ARC.

1.6.2 Description of parts or systems related to the incident

The aircraft TC-SNM was fitted with winglets. These are mounted on the wingtips and improve the aircraft's aerodynamic properties. A winglet of a Boeing B737-800 measures 1.2 metres in length and 2.5 metres in height.

1.6.3 Availability and serviceability of the transponder

The aircraft was fitted with a transponder. A transponder transmits a signal that allows air traffic control to identify the aircraft and its position. The transponder's signal also allows traffic controllers the opportunity to follow the aircraft's movements on the ground, provided the transponder has been activated.

According to AIP-Sweden for Stockholm/Arlanda, the transponder is to be activated after landing until such time as the aircraft reaches its parking stand. According to interviews with the crew of TC-SNM, the transponder was active during taxiing.

1.7 Meteorological information

According to Meteorological Aerodrome Report (METAR) at 09.20 hrs:
Wind 210°/10 kts, visibility ≥ 10 km, 2-3/8 with the cloud base at 2600 feet, temp/dewpoint 20/14 °C, QNH 1011 hPa.

1.8 Aids to navigation

The pilots on board TC-SNM used maps containing both taxiing instructions in the form of a graphical layout and instructions and restrictions in text form. The map material was of type LIDO from Lufthansa Systems. The material was in line with the current edition (see Fig. 5).

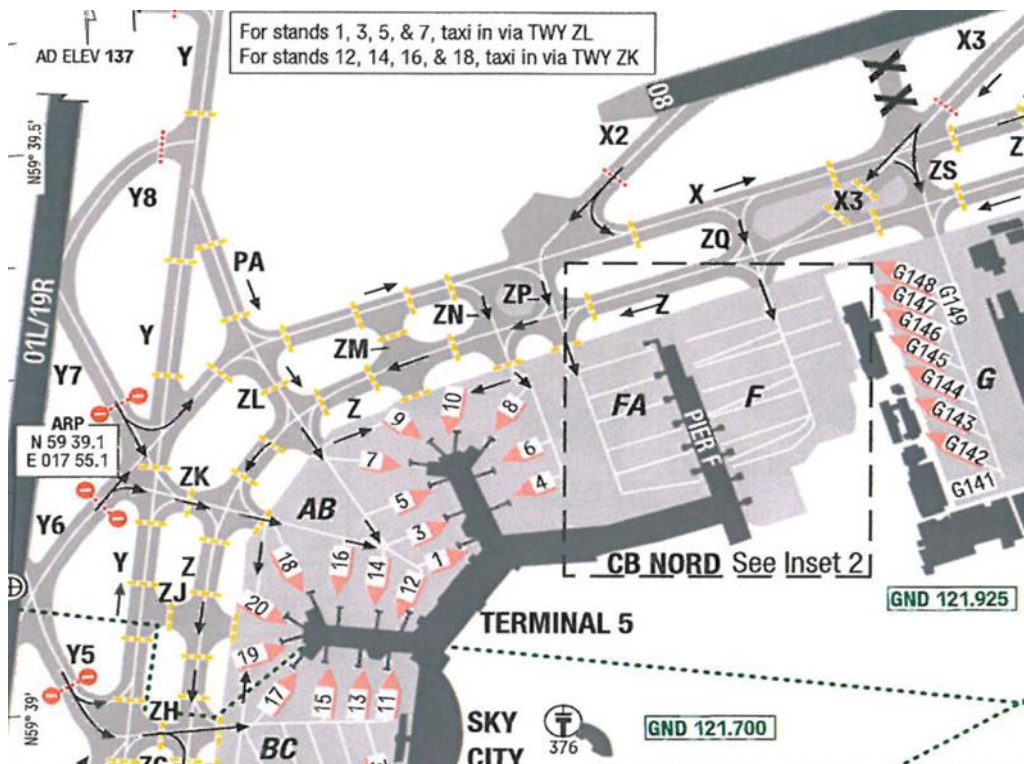


Fig. 5. Map from LIDO of ground movements for arriving aircraft.

1.9 Radio communications

Via the CVR, SHK has listened to the radio communication between the aircraft and air traffic control, as well as the crew's internal communication in the cockpit.

1.10 Aerodrome information

The airport was registered as an approved airport in AIP-Sweden. AIP-Sweden has published instructions for taxiing which have formed the basis for the map material from LIDO.

AIP-Sweden, p. AD2 ESSA 1-14 Chapter *3.1 Taxi restrictions* states that taxiing on the apron is not allowed between entries ZH and ZK. The same information is found in the map material in question from LIDO.

1.11 Flight recorders and A-SMGCS

1.11.1 Flight Data Recorder (FDR¹⁵)

The FDR was recovered by SHK. An analysis was deemed unnecessary and was therefore not carried out.

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft's CVR was recovered by SHK. Sound recordings from the CVR have been used in the investigation.

1.11.3 A-SMGCS

TC-SNM's movement on the ground during taxiing was recorded by A-SMGCS. The information from the recording is illustrated in Figure 3.

1.12 Site of the incident

Stockholm/Arlanda Airport (ESSA), Stockholm county, just west of stand 20, position N5939.1 E01755.6; 31 metres above sea level (see Fig. 3).

1.13 Medical information

Nothing indicates that the mental and physical condition of the pilots were impaired during or in connection with the flight.

1.14 Fire

There was no fire.

¹⁵ FDR – Flight Data Recorder.

1.15 Survival aspects

1.15.1 The rescue operation

The airport's operations centre called the airport's rescue services and asked if they were aware of a collision between two aircraft at stand 19 and stand 20. The airport's rescue services had no knowledge of the incident, but in view of the information, the rescue service personnel decided on their own initiative to drive to the site to perform a closer inspection of the circumstances.

Before the fire vehicles reached the site, the tower was contacted. From the tower, the message was received that it had just been informed of the incident via Atos¹⁶. No information about the incident had been communicated from the two aircraft in question. Upon the arrival of the rescue services, it was established that there were no injuries to persons. There was limited damage to both aircraft. There had been no spillage and no measures needed to be taken by the rescue services.

1.16 Tests and research

SHK has visited the site of the incident in order to, among other things, take photographs and perform measurements of distances. During the visit, a taxiing was also executed in order to give an idea of the scenario in question and to better understand information provided by the crew on what they saw and experienced (see Fig. 6). The taxiing was conducted by means of a height-adjustable loading vehicle.



Fig. 6. South-facing view from cockpit height. Photo: SHK.

¹⁶ Atos - Airside technical & operative supervisor.

1.16.1 Interviews with the crew of aircraft TC-SNM

SHK has conducted interviews with the pilots of TC-SNM. The SunExpress Flight Safety Officer (FSO¹⁷), also a commander for the airline, was interviewed.

1.16.1.1 Commander

The commander stated that the airline was allocated stand 19 or 20 every time. During the last visit prior to the incident, the commander received clearance to stand 20 and on that occasion used ZK. The commander believed that ZK could be used for taxiing to both stands 19 and 20. His understanding was that it was possible to taxi from both directions to the respective stands, given the north-south and south-north arrows on the taxi chart (Fig. 5). He also stated that the transponder was active and that he therefore expected air traffic control to inform them of any error in their taxiing.

The commander stated that when they approached the aircraft parked at stand 20, he believed it had stopped slightly before its parking place. He therefore taxied slightly to the right, turned round in order to check for obstacle clearance and felt they could pass.

The commander found the co-pilot easy to work with and was aware that the latter was less experienced.

1.16.1.2 Co-pilot

The co-pilot stated that it was his first flight to Stockholm/Arlanda. He explained that during the flight, the commander had said that they were to taxi via ZK, which the co-pilot also felt was the quickest and most logical route. During the turn at ZK, he saw that the ground was marked with the number 20 and that there was too little space between the yellow taxi line and the elevator of the parked aircraft. He pointed this out to the commander. As the commander steered to the right at the same time as he was looking backwards and to the left, the co-pilot thought he had also understood this.

The co-pilot was of the understanding that the yellow marking that led from ZK past stand 20 also continued to stand 19 (see Fig. 6). He stated that the transponder was active and that there were ground crew at stand 19 who he expected would react if there was no obstacle clearance for passage.

The co-pilot named three factors that contributed to why he did not believe they would collide with the parked aircraft; the commander said that the left wing was free for passage, the transponder was active, and finally, the ground crew did not react.

During the interview, the co-pilot said that he did not experience any difficulties in terms of speaking up or being heard and respected, despite differences in experience and age between him and the commander. He stated that their cooperation was good and that the commander would listen to his viewpoints.

¹⁷ FSO - Flight Safety Officer - An administrative post in an airline for flight safety-related issues.

1.17 Organisational information

The airline was founded in 1989 as a subsidiary of two other airlines. The airline has conducted operations to and from Arlanda for a long time.

1.17.1 Operative regulations

The airline's operative manual OM-A (Revision 15, Chapter 8.3) states that the aircraft must be brought to a stop if there is uncertainty as to its position.

1.18 Additional information

1.18.1 Environmental aspects

The incident did not entail any environmental impact.

1.18.2 Air traffic control

Air traffic control is responsible for the mutual separation of aircraft within the manoeuvring area, which covers runways and taxiways. The site of the incident was the apron, which is not part of the manoeuvring area.

According to the ANS's¹⁸ operations manual (Part 3, Section 7, Chapter 3, point 4.1.1), air traffic control shall provide taxi clearance containing “*simple and clear instructions and appropriate information that help the pilot to follow the correct taxi route and avoid collisions with aircraft, vehicles or objects*”.

According to the manual (Part 3, Section 7, Chapter 3, point 4.1.3), air traffic control was however not obligated to provide clearance containing a complete route with the designations of all relevant taxiways, as there was a published one with respect to exit X3 at runway 26 to stand 19.

The A-SMGCS system and the signals transmitted by an aircraft's transponder allow air traffic control the possibility to follow an aircraft's movement on the ground.

1.18.3 Measures taken

The operator has taken the following measures with reference to the incident:

- a) Issued SAFRECs¹⁹ (Safety Recommendations) containing information on taxiing, dimensions for the aircraft and the use of LIDO map material, with competency test. Potential risks in the event of uncertainty on the aircraft's position have been illustrated, as well as how a crew should then act.
- b) Amendments to the operative manuals OM-A (Revision 16) and OM-B (Revision 19) concerning taxiing procedures.
- c) Letter to all CRM²⁰ instructors, urging them to emphasise training relating to situations in which a crew is uncertain of their position during taxiing.

¹⁸ ANS – Air Navigation Services.

¹⁹ SAFRECs - Safety Recommendations - An internal document in which an airline can convey recommendations of a safety nature to its personnel.

²⁰ CRM - Crew Resource Management - A term which refers to efficient resource allocation and optimisation of the crew's actions when handling an aircraft with a multi-pilot system.

1.19 Special or effective methods of investigation

Not applicable.

2. ANALYSIS

2.1 Approach preparation

The co-pilot commenced a briefing regarding taxi route, to which the commander added that ZK was to be used for stands 19 and 20.

This addition to the briefing may be explained by the fact that the commander had recently visited Stockholm/Arlanda and had been cleared to stand 20 and had on that occasion taxied via ZK. He probably expected to use ZK on this occasion too, as stand 19 is situated just past stand 20.

With the commander's previous experiences as a basis, the crew was satisfied that ZK was a likely taxi route; a taxi route that was also considered to be the closest and most logical. This probably contributed to the co-pilot's acceptance of the commander's opinion on the expected taxi route.

2.2 Taxiing

The crew was of the understanding that the yellow marking that led southwards from ZK past stand 20 also continued to stand 19 (Fig. 6). This probably contributed to the fact that they did not realise an unallowed taxi route had been selected. However, this understanding did come to change as regards the co-pilot as they approached the site of the collision. The fact that the transponder was active led the crew to expect that the air traffic controller would prompt them if they should taxi incorrectly by mistake.

Just after performing the turn at ZK and towards the yellow marking (see Fig. 6), the co-pilot expressed concern on two occasions over whether the correct route had been chosen. He pointed this out to the commander, as well as his opinion that passage might not be possible. In this situation, the commander had probably not considered that their choice of route could be incorrect, given his understanding and expectations. This conviction was not broken during the continued taxiing. Pilots, like everyone, are prone to the unconscious tendency to continue with an original plan despite the fact that conditions may have changed. This is known as plan continuation bias²¹.

The reason that the commander steered to the right as they approached the parked aircraft was that he believed it was parked too far out. There were ground crew at stand 19, who the aircraft crew thought would react and attract attention if there was no obstacle clearance. As the crew's expectations were not met, this strengthened the belief that they had obstacle clearance.

The commander assessed that they could pass the parked aircraft, as he had checked this by looking at the left wing.

²¹ Dismukes R.K., Berman B. & Loukopoulos The limits of expertise. Rethinking pilot error and the causes of airline accidents. Ashgate Publishing Ltd, Aldershot, 2007, p. 297.

According to the airline's operational manual, the aircraft should be brought to a stop if there is any uncertainty as to its position. The commander, however, had no doubt about the position and had established that there was sufficient room for passage, which is why he did not stop.

Studies have shown that first officers in general are less direct in questioning commanders than commanders are with respect to first officers²². This may explain the co-pilot's relatively cautious questioning of the taxi route.

2.3 Clearance

Air traffic control issued clearance in line with applicable rules and regulations. As there was a published route from exit X3 at runway 26 to stand 19, a more detailed clearance does not need to be given. However, according to air traffic control's operations manual, taxi clearances shall contain “*simple and clear instructions and appropriate information that help the pilot to follow the correct taxi route and avoid collisions with aircraft, vehicles or objects*”.

It is SHK's opinion that a more detailed clearance from air traffic control would have been helpful and also served the interests of flight safety.

3. CONCLUSIONS

3.1 Findings

- a) The pilots were qualified to perform the flight.
- b) The Certificate of Airworthiness had a valid ARC.
- c) The crew's briefing of the taxi route did not include the published route to stand 19.
- d) Taxiing was not performed in accordance with the published route.

3.2 Causes of the serious incident

3.2.1 *Factors as to cause*

The distance to the parked aircraft was misjudged.

3.2.2 *Contributing factors*

The briefing of the taxi route did not include the published route to stand 19.

The aircraft was not manoeuvred in accordance with the published route.

²² Fischer, U. & Orasanu J.2000, ref. in Dismukes R.K., Berman B. & Loukopoulos The limits of expertise. Ashgate Publishing Ltd, Aldershot, 2007, p. 125.

3.3 Risk factors

As taxiing on the apron between ZH and ZK is not permitted and constitutes a potential collision risk, it is SHK's opinion that a more detailed taxi clearance and clear marking on the ground and in AIP-Sweden would help to increase flight safety.

4. RECOMMENDATIONS

The Swedish Transport Agency's Civil Aviation and Maritime Department is recommended to take the measures deemed appropriate in order to limit the risk factors specified in 3.3. *(RL 2013:12 R1)*