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**Air China B2442 accident 14 June 1996
at Stockholm/Arlanda airport, AB county,
Sweden**

L-44/96

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Swedish Civil Aviation
Administration

601 79 NORRKÖPING

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The Swedish Board of Accident Investigation (Statens haverikommission, SHK) has investigated an accident which occurred 14 June 1996 at Stockholm/Arlanda airport, AB county, Sweden, with an aircraft registered Air China B2442.

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

Olle Lundström

Monica J Wismar

Henrik Elinder

Contents

	SUMMARY	5
1	FACTUAL INFORMATION	6
1.1	Course of events	6
1.2	Personal injuries	6
1.3	Damage to the aircraft	6
1.4	Other damage	6
1.5	The crew	7
1.6	The aircraft	7
1.7	Meteorological information	7
1.8	Navigational aids	7
1.9	Radio communications	7
1.10	Airport data	7
1.11	Flight- and soundrecorder	7
1.12	Site of accident and aircraft damage	7
1.12.1	<i>Site of accident</i>	7
1.12.2	<i>Aircraft damage</i>	8
1.13	Medical information	8
1.14	Fire	8
1.15	Survival aspects	8
1.16	Special tests and investigations	8
1.16.1	<i>The docking bridge</i>	8
1.16.2	<i>The "Safelock" Docking Guidance System (DGS)</i>	8
1.16.3	<i>Door positions on aircraft types B747 and B747SP</i>	9
1.16.4	<i>Ground equipment</i>	9
1.16.5	<i>Markings</i>	9
1.17	The company's organization and management	9
1.18	Other information	9
1.18.1	<i>Earlier incidents</i>	9
1.18.2	<i>The handler agent</i>	10
2	ANALYSIS	10
3	CONCLUSIONS	11
3.1	Findings	11
3.2	Causes of the accident	11
4	RECOMMENDATIONS	11

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Report finalized 1997-06-06

<i>Aircraft; registration and type</i>	Air China B2442 , Boeing 747, SP-version
<i>Owner</i>	Air China, c/o Air China Office, Box 1131, 111 81 Stockholm
<i>Time of incident</i>	14-06-1996, 1140 hours in daylight <i>Note: All times in the report are given in Swedish summer time (SST) = UTC + 2 hours</i>
<i>Place</i>	Stockholm/Arlanda airport, AB county, Sweden (pos 5939N 1755E; 121 ft (37 m) above sea level)
<i>Type of flight</i>	Scheduled traffic
<i>Weather</i>	METAR Stockholm/Arlanda 11 50 hrs: wind 320°/10 kts, visibility >10 km, no clouds below 5 000 ft, temp./dewpoint +14/+2 °C, QNH 1019 hPa
<i>Numbers on board: crew</i>	22
<i>passengers</i>	108
<i>Personal injury</i>	None
<i>Damage to aircraft</i>	Substantial
<i>Other damage</i>	Damages to the docking bridge
<i>Captain's age</i>	48 yrs
<i>Captain's total flying hours</i>	8 736 hrs, of which 5 937 hrs on the type
<i>Captains flying hours last 90 days</i>	262 hrs, all on the type

The Board of Accident Investigation (SHK) was notified on 26 June 1996 that an accident with an aircraft registered Air China B2442 had occurred at Stockholm/Arlanda airport, AB county, on 14 June 1996 at 1140 hrs.

The accident has been investigated by SHK represented by Olle Lundström, chairman, Monica J Wismar, chief investigator flight operations and Henrik Elinder, chief technical investigator aviation.

The investigation was followed by Carl Olsson representing the Swedish Civil Aviation Administration.

The purpose of the investigations performed by SHK is solely to prevent accidents and incidents in the future.

SUMMARY

After landing the aircraft, a Boeing 747SP (B747SP), taxied towards docking bridge 17 at terminal 5. B747SP is a shorter version of the B747 normally used by the airlines at the airport. The handler agent meeting the flight was informed about the aircraft version but programmed the docking system "Safedock" for B747. When the aircraft approached the bridge he saw that the nosewheel passed the stop marks for B747SP. He realised that the aircraft was about to collide with the bridge and ran towards the terminal building. While running he could feel through the building construction that the aircraft collided with the bridge. It was later confirmed that the left wing had been damaged by the bridge. The passengers were evacuated without problems.

No malfunction has been found in the docking bridge or in the docking system.

The accident was caused by the handler agent on the docking bridge programming the wrong aircraft version into the docking system. Contributing to the accident were that the captain did not notice that the wrong aircraft version was displayed on the information board and that the personnel concerned did not have enough knowledge of all the functions of the docking and security system.

Recommendations

The Swedish Civil Aviation Administration is recommended to

- ensure that all personnel concerned have full knowledge of the risks in connection with docking, of the function of the systems and of adequate actions to be taken in abnormal situations, and to
- supplement the docking system so that it will be able to distinguish between different versions of the same aircraft type.

1 FACTUAL INFORMATION

1.1 Course of events

On 14 June 1996 Air China's scheduled flight CA 911 landed at Stockholm/Arlanda airport at 1136 hrs. Prior to the arrival, SAS Handling, responsible for the docking service, had been informed via fax that the aircraft was a Boeing 747SP (B747SP). This is a shorter version of Boeing 747 (B747) normally used by the airline. The handler agent meeting the aircraft at bridge 17, terminal 5, was duly informed but programmed the "Safedock" docking system (see further 1.16.29) for B747. The information sign on the terminal building thus showed the captain "B747 2 DOOR" instead of "B747SP". The aircraft approached the bridge at 1140 hrs. When it came closer, the handler agent saw the nosewheel pass the B747SP stop mark on the ground. When he, and a colleague also on the bridge, realized that the aircraft would collide with the bridge they ran towards the terminal building. As they ran they felt that the aircraft collided with the bridge. They returned towards the bridge. After a few seconds they heard the engine power increase and felt a new shock in the bridge. After that the engines were stopped. They observed that the left wing of the aircraft had struck the bridge.

The SAS technician responsible for technical service during the ground stop was standing below the bridge. When he saw the aircraft approach the stop mark on the ground with no apparent decrease in speed he realised that it was not going to stop there. He ran to the nosewheel where the interphone connection was, plugged in and shouted "STOP" several times.

The passengers were evacuated over the left wing and via the bridge.

The accident occurred in position 5939N 1755E; 121 ft (37 m) above sealevel in daylight.

1.2 Personal injuries

	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>	<i>Total</i>
Fatal	-	-	-	-
Seriously injured-	-	-	-	-
Slightly injured	-	-	-	-
No injuries	22	108	-	130
Total	22	108	-	130

1.3 Damage to the aircraft

The aircraft was substantially damaged.

1.4 Other damage

Damage to the docking bridge.

1.5 The crew

The captain was 48 years old at the time and had a valid license.

Flying hours

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	-	262	8 736
This type	-	262	5 937

1.6 The aircraft

<i>Owner:</i>	Air China, c/o Air China Office Box 1131, 111 81 Stockholm
<i>Type:</i>	Boeing 747, SP-version
<i>Serial number:</i>	21932
<i>Year of manufacture:</i>	1980
<i>Gross weight:</i>	Max. permissible 315,700 kg (695,374 lbs) current 187,044 kg (411,991 lbs)
<i>Total flying time:</i>	46,595 hours

1.7 Meteorological information

METAR Arlanda at 1150 hrs: wind 320°/10 kts, visibility > 10 km, no clouds below 5 000 ft, temp./dewpoint +14/+2 °C, QNH 1019 hPa.

1.8 Navigational aids

Not applicable.

1.9 Radio communications

Not applicable.

1.10 Airport data

Stockholm/Arlanda status according to AIP Sweden.

1.11 Flight- and soundrecorders

SHK has had no opportunity to get information from any recorder.

1.12 Site of accident and aircraft damage

1.12.1 *Site of accident*

The accident occurred at the docking bridge no 17 of the B jetty, terminal 5. The left wing of the aircraft passed under the bridge and stuck in its supporting construction. Photographs taken on the accident site after the aircraft had been pushed back a few

metres indicate that its left nosewheel was then on the marked centre line on the ground indicating the track to be followed by aircraft taxiing in.

1.12.2 *Aircraft damage*

Damage approximately 150x100 cm in size was caused to the upper surface of the wing. The skin plating of the wing was ruptured over an area of 24 x 17 cm. The adjacent fuel tank was not damaged.

1.13 **Medical information**

No information obtained.

1.14 **Fire**

There was no fire.

1.15 **Survival aspects**

The forces were not great enough to trigger the emergency transmitter.

1.16 **Special tests and investigations**

1.16.1 *The docking bridge*

The docking bridge is a link between the terminal building and the entrance/exit of the aircraft. Bridge equipment includes controls for manoeuvring the bridge vertically and laterally and a panel for programming the "Safelock" Docking Guidance System. There is nothing to indicate a fault in the bridge manoeuvring system.

1.16.2 *The "Safelock" Docking Guidance System (DGS)*

The DGS is an optical tool used to guide the pilot of a transport aircraft to safely taxi the aircraft into the correct position by the bridge. The system is computerised and uses a laser scanner to identify the aircraft type and to sense its exact position when close to the bridge. Driving guidance and position information are given to the pilots by a light panel placed on the terminal building straight ahead of the approaching aircraft.

Before every docking, the ramp personnel program the system with information on the type of aircraft. The programming is performed on the control panel with an information display on the bridge. On the panel, 20 function keys can be pre-programmed for the most frequent aircraft types and versions. For other types and versions, e.g. B747SP, the programming is performed from a sub-menu. With the configuration in use at the time of the accident, the laser scanner could not distinguish between different versions of the type because the system only recorded the front contour of the aircraft without consideration of its length.

The system contains different automatic safety devices intended to warn the operator and the pilot if a fault should occur. A warning will be given, for instance, if the aircraft type identified does not correspond with the type programmed. In addition there is a red emergency stop button in the center of the panel. When the button is pressed, the docking bridge will stop. At the same time the DGS stop function is

activated and "STOP" is indicated on the information board. The emergency stop was not activated when the accident occurred.

Since late 1995 the DGS has been installed at all the 20 bridges at terminal 5 at Arlanda. According to the Swedish CAA and SAS the system had certain teething troubles, but these have been remedied and the system is now generally considered to be fully dependable. The same system has been ordered for all bridges in terminal 4.

There is nothing to indicate a fault in the docking system.

1.16.3 *Door positions on aircraft types B747 and B747SP*

The B747 has two doors forward of the wing. At Arlanda the docking bridge is normally connected to the aft of these doors. B747SP has a shorter fuselage than the B747. Consequently the B747SP has only one door forward of the wing used for embarkation and disembarkation. The second door is over the wing and is intended for emergency evacuation only. The different positioning of the doors of the two aircraft types means that the B747SP must stop further away from the terminal building than the B747 in order to avoid the wing striking the bridge.

1.16.4 *Ground equipment*

On the wall of a service building below the bridge there is a panel with a red emergency stop button and a black button. By pressing the black button ground personnel can inform the system when stop chocks have been placed in position whereupon the information sign on the terminal building indicates "CHOCK ON". The red emergency stop button has the same function as the emergency stop on the control panel on the bridge. The function of this button was not known to the technician on duty.

1.16.5 *Markings*

A line to be followed by the nosewheel of the aircraft is painted on the ground. On this line are also marked transverse lines acting as stop marks for the nosewheels of the different aircraft types. The line marking the stop position for the B747SP was labelled "B747", as was the line for the B747 12 metres closer to the terminal building.

1.17 **The company's organization and management**

Not applicable.

1.18 **Other information**

1.18.1 *Earlier incidents*

On 9 June 1995 a B747SP registered EP-IAO from Iran Air collided with docking bridge 8 at Arlanda terminal 5. This bridge was normally used by Air China. A half-square-metre hole was made on the upper side of the left wing. The bridge had at that time a docking system named "Papa Board". That system did not include the possibility to program the SP-version, and for that reason B747 was programmed instead and an instruction for Air China's B747SP required a technician or equivalent to "talk in" the aircraft on the final part to the stop mark in direct contact with the captain. However, there was no general instruction for ramp personnel regarding the SP-version.

On 14 May 1996 a B747SP from Air China collided with docking bridge 35 at Kastrup airport, Copenhagen. The no 2 engine of the aircraft stuck under the bridge and was damaged. The docking bridge used the docking system Aircraft Parking &

Information System (APIS). The cause of the incident was wrong programming of the aircraft version due to misunderstanding of aircraft code in use.

1.18.2 *The handler agent*

The handler agent was an employee of SAS. He was qualified to perform the docking and had five years experience. He has told SHK that Air China used the B747SP on five flights of 31 during the period February - May and that he felt a little unsure when programming. When he became aware that the aircraft was about to collide with the bridge his only thought was to get away from it and for this reason he forgot to press the stop button.

2 ANALYSIS

The accident was very serious from a safety point of view. Had the wing tank been damaged in the collision a fire, difficult to control, could have started.

The handler agent responsible for programming of the DGS and manoeuvring the bridge was aware that the aircraft was a B747 SP-version. No malfunction of the docking bridge or its DGS has been found. In SHK:s opinion the fact that the aircraft proceeded beyond the correct parking position and collided with the docking bridge was the result of several operational mistakes:

- 1 The handler agent, for some reason, programmed a wrong aircraft version into the DGS.
- 2 The captain did not notice that the information board on the terminal building was showing a wrong aircraft version.
- 3 The handler agent did not press the emergency stop button when he realised that the aircraft had taxied too far.
- 4 The technician on the ground did not know the function of the emergency stop button on the service building.

When the captain increased power and tried to continue taxiing after the collision the material damage became worse.

It must be considered a shortcoming of the system that the DGS and its laser scanner lack the ability to distinguish between different versions of an aircraft type, which in this case meant that the safety function of the system, intended to warn crew and ground personnel of possible wrong programming, could not be activated.

The Board of Accident Investigation has noted the problems pilots encounter in connection with docking at airports with different docking systems. Stringent and unambiguous information to the pilots and uniformity between the different systems should be sought.

The occurrence furthermore points to the need for the docking personnel concerned to have additional training with emphasis on risks in connection with docking, the function of the systems and adequate actions required in abnormal situations. The markings of the working area should also be reviewed.

3 CONCLUSIONS

3.1 Findings

- a)* The captain was qualified to perform the flight.
- b)* The aircraft was airworthy.
- c)* The handler agent was qualified to program the docking system and to manoeuvre the bridge.
- d)* The handler agent programmed the wrong aircraft version.
- e)* The captain did not notice that the wrong aircraft version was displayed on the information board.
- f)* Neither the handler agent nor the technician pressed the emergency stop button.
- g)* The safety system of the DGS could not distinguish between the different versions of the same aircraft type.

3.2 Causes of the accident

The accident was caused by the handler agent on the docking bridge programming the wrong aircraft version into the docking system. Contributory causes were the captain's failure to notice that the wrong aircraft version was displayed on the information board and the fact that the personnel concerned lacked sufficient knowledge of all the functions of the docking and security system.

4 RECOMMENDATIONS

The Swedish Civil Aviation Administration is recommended to

- ensure that all personnel concerned have full knowledge of the risks in connection with docking, of the function of the systems and of adequate actions to be taken in abnormal situations, and to
- supplement the docking system so that it will be able to distinguish between different versions of the same aircraft type.