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Final report RL 2012: 10e

**Serious incident on 3 June 2010
to aircraft SE-DFY
at Tarbes Pyrénées Airport, France.**

Case no: L-63/10
2012-03-22

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Swedish Transport Agency

601 73 NORRKÖPING

Final report RL 2012: 10e

The Swedish Accident Investigation Authority (SHK) has investigated an aircraft incident that occurred on 3 June 2010 at Tarbes Pyrénées Airport France involving an aircraft with the registration SE-DFY.

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 containing the results of the investigation.

On behalf of the SHK investigation team

Mikael Karanikas

Stefan Christensen

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APPENDIX

1. SAS Company Investigation Report (CIR) OB-0510, dated 19 November 2010

General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is an independent government 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 and causes, as well as any damages and other consequences, of such events. The results of an investigation shall provide the basis for decisions aiming at preventing similar events from occurring again, or limiting the effects of such an event, as well as for an assessment of the operations performed by the emergency services and, when appropriate, for improvements to these emergency 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. Accidents and incidents are, therefore, neither investigated nor described in the report from any such perspectives. Issues of that kind may on the other hand be dealt with by judicial authorities or, for example, by insurance companies. The task of SHK also does not cover 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 3 June 2010 SHK was informed that an incident involving one aircraft with the registration SE-DFY had occurred at Tarbes Pyrénées Airport in France on the same day at 17.20.

The investigation was transferred to SHK by the Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA) in accordance with ICAO Annex 13, since the aircraft was registered in Sweden.

The incident has been examined by an SHK investigation team, consisting of Mr. Göran Rosvall, as Chairperson until 25 January 2012, thereafter Mr. Mikael Karanikas, Mr. Stefan Christensen, Investigator in Charge, and Mr. Stefan Jönsson, Technical Investigator.

Accredited representative has been Miss Servane Sauter of the BEA¹.

The investigation has been followed by Mr. Ola Johansson of the Swedish Transport Agency.

¹ BEA: Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile, French accident investigation for aircraft

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Aircraft: registration and model	SE-DFY, DC-9-82 in the Swedish register from 23 Dec 2009, previously LN-ROW
Class	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC)
Operator	SAS Sverige AB, Dept STOJU, 195 87 Stockholm/The Consortium SCANDINAVIAN AIRLINES SYSTEM
Time of occurrence	3 June 2010 at 17.20 in daylight Note: All times refer to European summer time (UTC+ 2 hours)
Place	Tarbes Pyrénées Airport, France (pos. 43°11' N, 000°00' W; 384 m above sea level)
Type of flight	Positional flight after long-term parking
Weather	According to METAR: Wind variable 2 knots, visibility >10 km, scattered cloud with base 5,000 ft, temp./dewpoint +24/+9 °C, QNH 1014 hPa
Persons on board: crew	3
Injuries to persons	None
Damage to aircraft	Minor damages
Other damage	None
Commander:	
Age, licence	44, ATPL
Total flying time	8,100 hours, of which 4,100 hours on type
Flying hours previous 90 days	80 hours
Number of landings previous 90 days	29
Co-pilot: :	
Age, licence	48, ATPL
Total flying time	12,800 hours, of which 7,000 hours on type
Flying hours previous 90 days	200 hours
Number of landings previous 90 days	50
Engineer:	
Age, licence	44, AML ²

Summary

An aircraft model DC-9-82 was long-term parked at the maintenance provider TARMAC at Tarbes-Pyrénées Airport in southern France. A ferry flight should be carried out by the operator SAS, from Tarbes to Oslo/Gardemoen. The intention during the flight was to perform a number of systems checks. The aircraft did a normal takeoff but during climb out the crew was contacted by ATC³ on the airport and informed that an object had been found on the right hand side of runway in the direction of takeoff. The crew had not noticed anything irregular during takeoff and the part found on the runway gave no clear indication of any identifiable part of the aircraft. The crew continued the flight with reduced speed and the systems checks were abandoned. ATC offered the crew help in the form of a visual inspection of the aircraft by the French air

² AML = Aircraft Maintenance Licence

³ ATC = Air Traffic Control

force. The French crew of the fighter plane could not observe any lost or missing panel/cover. The crew decided to continue the flight, but with a landing at Stockholm/Arlanda for better assistance if measures after the flight should be required. The aircraft landed on Arlanda and it was concluded that it was the right upper panel located between fin and vertical stabilizer that had separated.

A review of the maintenance supplier and its working procedures revealed that the type-rated engineer certifying the work performed before it was handed over to SAS did not follow the procedures outlined within the company. The subjected incident was the second on a short time period where opened panels had not been assembled in accordance with the type certificate holder's maintenance instructions.

Recommendations

None

1. FACTUAL INFORMATION

1.1 History of the flight

The air carrier Scandinavian Airlines System (SAS) had parked a number of aircraft of the model DC-9-82 (MD-82) long-term at the maintenance provider Tarbes Advanced Recycling and Maintenance Company (TARMAC) at Tarbes-Pyrénées Airport (LFBT) in southern France. An agreement was established between the parties to govern measures influencing airworthiness that would be carried out during the time the aircraft were parked with the company. During the incident the aircraft was on a positioning flight from Tarbes to Oslo/Gardemoen for pre-sale preparation. It was intended to carry out a number of technical system checks during the flight.

The aircraft had climb out on runway 02⁴ ready for takeoff and departed. Shortly after takeoff ATC contacted the crew and informed them that an object measuring 180x45x15 cm had been found on the runway on the right side in the direction of takeoff between taxiways Delta and Charlie. The crew had not noticed anything irregular during takeoff.

The description of the part found on the runway gave no clear indication of any identifiable part of the aircraft. The technician on board suspected after hearing the description by ATC that the part found could be one of the four panels that surround the stabilizer root to the fin. Based on this the crew continued the flight with reduced speed. They did not carry out the tests as intended during the flight to Oslo.

The crew of the aircraft contacted ATC and asked the airport operator to contact the maintenance company at the airport in Tarbes for help with identification of the object found. The results took time. During this time ATC offered the crew help in the form of a visual inspection of the aircraft by the French air force, which the crew accepted. A few minutes later a Mirage aircraft came alongside and checked the civil aircraft from different angles. The crews had direct contact via radio and the French crew of the fighter plane could not identify any lost or missing panel/cover.

The information that everything looked good and that the aircraft was behaving perfectly normally resulted in the crew deciding to continue the flight, but with a landing at Stockholm/Arlanda for better assistance if measures after the flight should be required.

During the flight the maintenance provider identified the object found as panel number 3806A, which is fitted to the stabilizer's right upper side. Before landing, this information was sent to the contact at Arlanda from whom the maintenance provider had received maintenance documentation during the time the aircraft was parked in France. The contact was working normal office hours and had left work when the e-mail arrived. The information could therefore not be communicated to the crew during the flight.

During the landing at Stockholm-Arlanda, the airport fire department and the police were present to hear a statement about the event. A subsequent inspection on site in the hangar clarified that it was the panel identified by TARMAC that had separated from the aircraft during takeoff in Tarbes.

The incident occurred at position 43°11' N, 000°00' W; 384 m above sea level.

⁴ Runway 02 = runway main direction expressed in 10's of degrees and rounded off; here 20°

1.2 Injuries to persons

	Crew mem- bers	Passengers	Total	Other
Fatalities	–	–	–	–
Seriously injured	–	–	–	–
Slightly injured	–	–	–	Not applicable
No injuries	3	–	3	Not applicable
Total	3	–	3	–

1.3 Damage to aircraft

Panel number 3806A on the right upper side of the stabilizer, which was found next to the runway, was fitted with four screws NAS 1203 out of a total of sixteen intended (see fig. 1.). When the panel separated from the aircraft, one screw was pulled out of its anchor nut (fixed in one of four holes in mounting number two) and hit the elevator. In fastening number three there was two screws tightened, and here the nut part was pressed out of the fastening and stayed in the panel when it separated from the aircraft (see figure 2). The two rear screws on the panel were tightened and remained in place throughout the flight (see fig. 2.) The rear of the panel was broken off in front of these two screws. A clear fracture surface with plasticization was visible.



Fig. 1 The area where panel number 3806A should have been mounted, looking backwards

Similarly, not all the screws were in place/tightened in accordance with AMM⁵ on panel number 3705A on the left side. For a more detailed description of the damage and the assembly of the fasteners, see appendix 1, SAS CIR OB-0510.

⁵ AMM = Aircraft Maintenance Manual

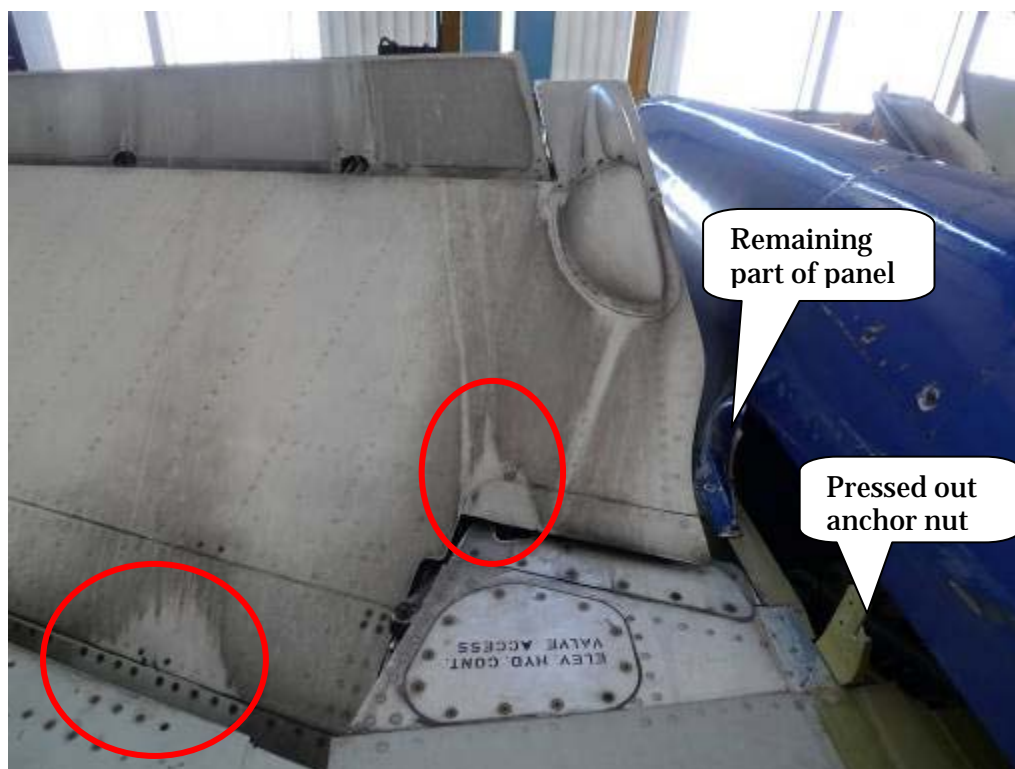


Fig. 2 Scratch marks on the right elevator from panel number 3806A as it separated from the aircraft (marked with red ellipses)

1.4 Other damage

No other damage.

1.5 Crew members

1.5.1 Commander

The commander was 44 at the time and had a valid ATPL⁶, and was also appointed Fleet Chief⁷ and Check Pilot⁸ MD-80 at the company. During the incident the commander was the Pilot Flying (PF).

Flying time (hours)				
Previous	24 hours	7 days	90 days	Total
All types	-	-	-	8,100
Current type	0.1	21	80	4,100

Number of landings, current type, previous 90 days: 29.

Flight training on type was completed in 2001.

Latest PC (proficiency check) took place on 16 September 2009.

⁶ ATPL = Air Transport Pilot Licence

⁷ Fleet Chief Pilot for MD-80

⁸ Check Pilot, appointed pilot with check flight training

1.5.2 Co-pilot

The co-pilot was 48 at the time and held a valid ATPL.

Flying time (hours)				
	24 hours	7 days	90 days	Total
Previous	24 hours	7 days	90 days	Total
All types	-	-	-	12,800
Current type	0.1	20	200	7,000

Number of landings, current type, previous 90 days: 50.

Flight training on type was completed in 1995.

Latest PC was completed on 6 September 2009.

1.5.3 Type rated engineer

During the incident there was an engineer with a valid AML and type rating on the DC-9 (PW JT8D)/MD-80 Series (PW JT8D)/MD-90 (IAE V2500) on board.

1.5.4 Pilots' schedules

The pilots had both flown during the days prior to the event. The commander was on day four of the work schedule with 21 hours of accumulated flight time and the co-pilot was on day three with 18 hours of accumulated flight time. The engineer was on day two of his work schedule. All had had a normal daily rest period the night before the incident.

1.6 The aircraft

1.6.1 Airworthiness and maintenance

The aircraft

TC holder	The Boeing Company
Model	DC-9-82, (MD-82)
Serial number	49438
Year of manufacture	1987
Gross mass	Max permissible takeoff/landing mass 67,812/58,967 kg, current 52,405 kg
Centre of gravity	25.6% MAC ⁹
Total flight hours	48,524 hours
Total number of cycles	38,722
Flight hours since latest inspection, 3B-Check	116 hours
Fuel loaded before incident	14,000 kg Jet A1

Engines

TC holder	Pratt & Whitney Division
Model	JT8D-217C
Number of engines	2

Remaining remarks

MEL ¹⁰	-
HIL ¹¹	2

The aircraft had a Certificate of Airworthiness and a valid Airworthiness Review Certificate (ARC¹²).

⁹ MAC – Mean Aerodynamic Chord of the wing

¹⁰ MEL – Minimum Equipment List, summary of equipment that is permitted be out of function on an airworthy aircraft

¹¹ HIL – Hold Item List, summary of equipment/defects that require measures but which do not affect airworthiness

¹² ARC - Airworthiness Review Certificate

The aircraft was parked at Arlanda airport for more than two months in summer 2009. A number of preservation measures with a calendar time of seven to 28 days were carried out on both the fuselage and the engines during this time. On 8 September an inspection (WP SAS 20090801789 and "Maintenance check" under LMPG, issue 13, 07 April 2009) was carried out after long-term preservation to make the aircraft ready to fly to Tarbes. The flight took place without any disruptions. Scheduled tests were conducted and the results were accepted.

Two days later, on September 10, the maintenance company TARMAC performed an initial preservation of the aircraft in accordance with the agreed documentation from SAS Maintenance Planning (MP) at Arlanda. Several subsequent maintenance operations were carried out with varying frequency in accordance with the Boeing MD-80 maintenance manual (Aircraft Maintenance Manual MD-80, AMM MD-80) until the aircraft was to return to Scandinavia for preparation prior to sale.

1.6.2 Description of the part or system related to the incident

The stabilizer jack screw and stop must be lubricated as part of the preservation of the aircraft. AMM 12-21-02 Section 7 page 322 describes which panels are to be opened and how many points should be greased and oiled (see fig. 4). Appendix 1 contains extracts from AMM.

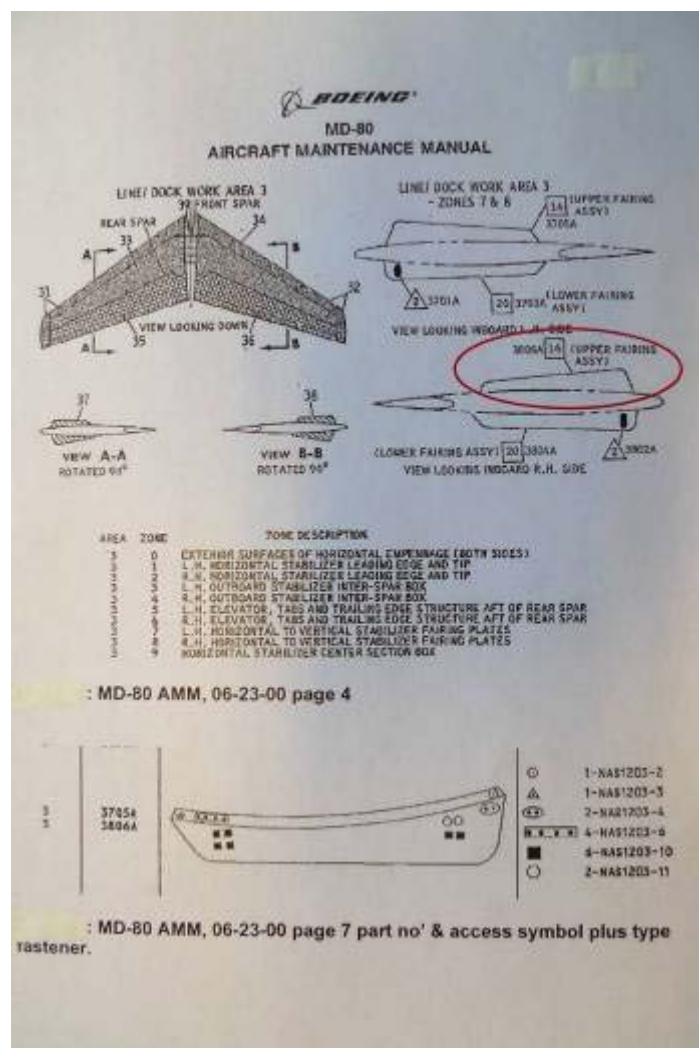


Fig. 3 Horizontal stabilizer – extract from AMM with identification of panel number 3806A

Access for lubricating of the jack screw and stop is gained by the removal of two panels. Fig. 4 shows the location and identification of the two panels on the aircraft vertical stabilizer; the top panel is number 3701A and the lower panel is number 6401A.

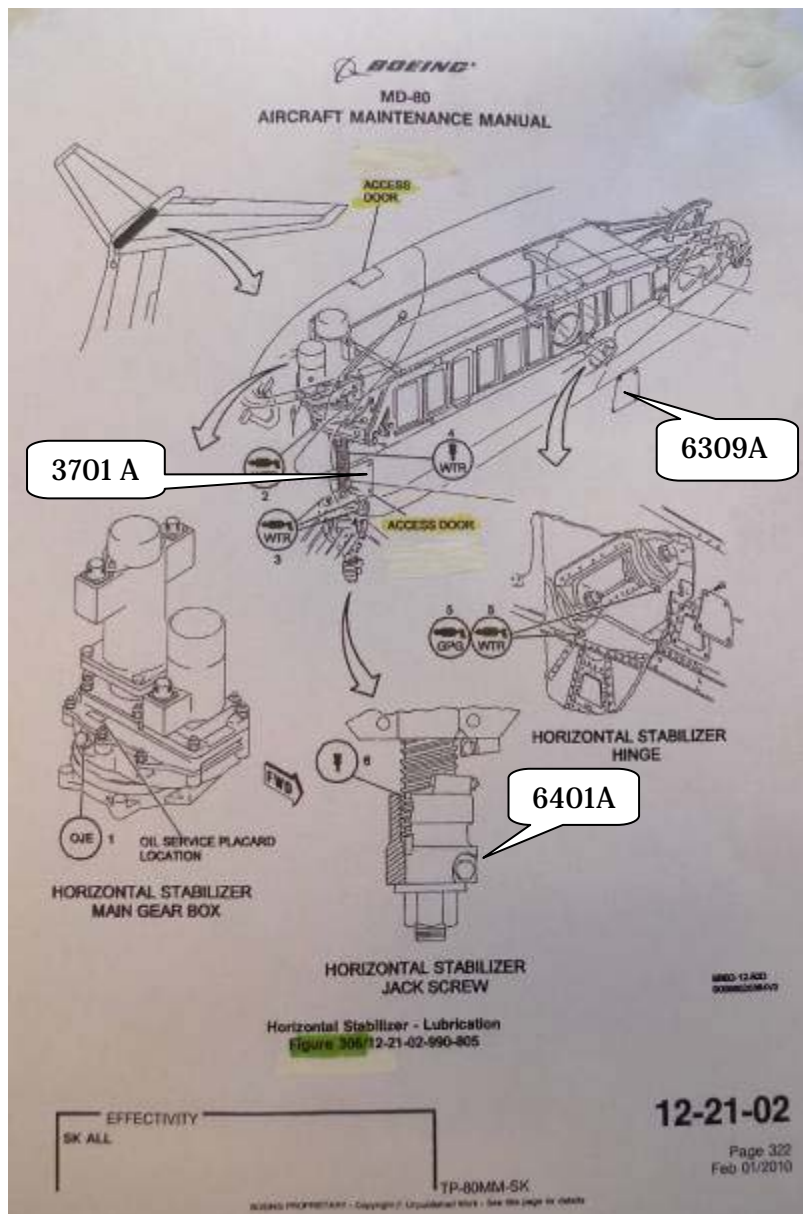


Fig. 4 Lubrication of the jack screw and removal of panel numbers 3701A and 6401A, see also fig. 6 for positioning of the panels

The panels with numbers 3705A and 3806A had been removed and later partially re-fitted to improve access to the spaces above the stabilizer jacks. In the technical log that was available for the time the aircraft was parked, there is no note of any maintenance work carried out on that part of the aircraft.

1.6.3 SAS maintenance of the aircraft before long-term parking

It has not been possible to identify any work carried out by SAS or an organization contracted by SAS in which access to panel number 3806A was required or deemed necessary during the time before the flight to Tarbes. After parking

at Arlanda airport, which preceded the flight to Tarbes in September 2009, the airplane, was visually checked by engineers from SAS, see section 1.6.1.

1.7 Meteorological information

METAR LFBT at 19:00: Wind variable 2 knots, visibility >10 km, scattered clouds at 5,000 feet, temperature/dew point +24/+9 °C, QNH 1014 hPa. It was daylight at the time of the incident.

1.8 Aids to navigation

Not relevant.

1.9 Radio communications

Not relevant.

1.10 Airfield data

The airport status was in accordance with AIP¹³-France, LFBT. Runway directions 02/20, runway length 3000m, asphalt surface, elevation 384 m above MSL (see fig. 5).

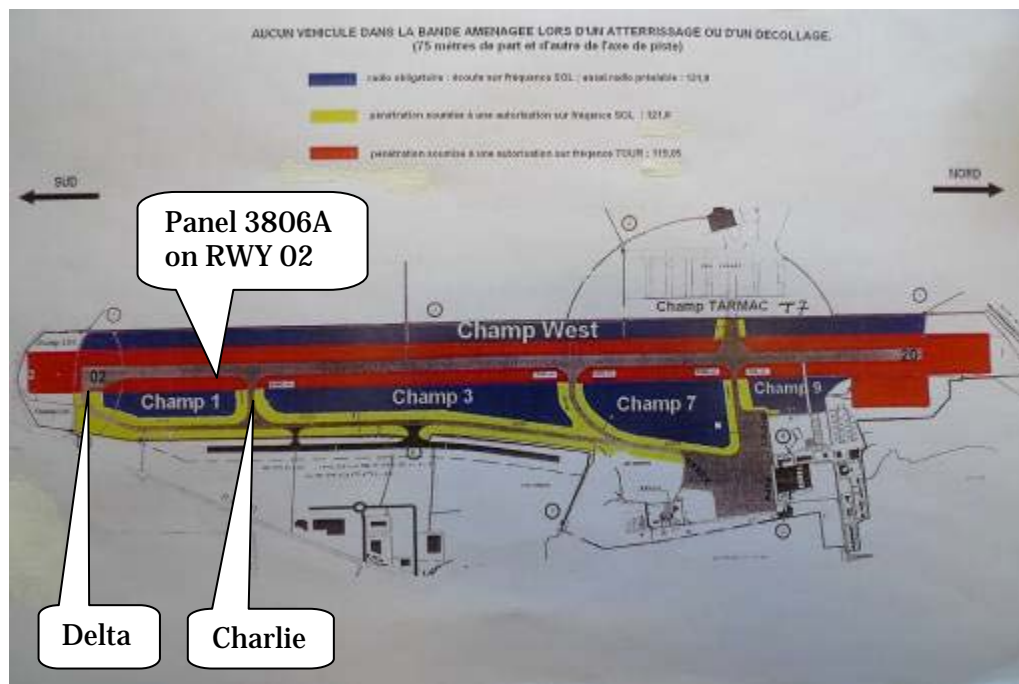


Fig. 5 Airport Tarbes Pyrénées, panel number 3806A lying on runway 02

1.11 Flight recorders

Data from flight recorders has not been used in the investigation.

¹³ AIP – Aeronautical Information Publication

1.12 Location of incident and aircraft

1.12.1 Location of the incident

Panel number 3806A separated from the aircraft in the early stages of takeoff and lay on runway 02 west of area Champ 1. The panel was found in a position equal to one-third of the aircraft's total ground roll distance (see fig. 5).

1.12.2 The aircraft

There was minor damage in the form of scratch marks and a dent from a screw head in the right elevator surface skin. Panel number 3806A was broken in front of the rear faster. There was also damage to the faster/faster element of panel number 3806A.

1.13 Medical information

Nothing has emerged to suggest that the pilots' mental or physical condition was impaired before or during the incident.

1.14 Fire

There was no fire.

1.15 Survival aspects

1.15.1 Rescue measures

Air traffic control service alerted the airport emergency services which together with the police gathered on the apron at Arlanda airport when the aircraft taxied into the parking slot. The commander gave an account of the incident and described measures taken during the flight.

The emergency locator transmitter (ELT) was not activated during the incident.

1.15.2 The crew and passengers' location and injuries

It was a positioning flight without passengers.

1.16 Tests and research

1.16.1 Initial preservation

On 8 September 2009 the aircraft was flown from Arlanda to Tarbes. The maintenance company TARMAC noted in the technical log the sequence L658 for initial preservation of the aircraft. AMM Task 10-30-00 pages 201 to 206 and 206 to 207 and 207 to 218 and 221 to 224 and 224 to 227 ordered on 10 September 2009. The item was to be carried out initially at the start of preservation and then repeated annually. Work performed was signed in the technical log on 25 September 2009. A small motor driven hydraulic lift was used for access to the fin and was operated from the work platform. The lift only allowed access to one side of the fin for each lifting operation. Below follows an explanation of the step-by-step parts of the work procedure reported up until the lubrication of the jack screw on the stabilizer.

In the AMM preservation procedures for aircraft task¹⁴ 10-30-00 on pages 204 to 207, this refers to the AMM lubrication schedule task 12-21-02 on page 301 onwards. Paragraph 7 horizontal stabilizer lubrication describes in detail how all the tasks are to be performed and AMM figure 306 shows which panels are to be removed for access to lubrication points and grease nipples. The numbers of grease nipples are shown per component in order to clarify the scope of work. The removal of panels 3705A and 3806A (the panel that separated from the aircraft during ground rolling in Tarbes) is not mentioned in this task.

To further clarify which panels are related to each component of the aircraft, AMM 06-25-00 Config 3 pages 2 and 4 lists, among other things, the panels (access door number¹⁵) associated with the lubrication of the stabilizer jacks and threads.

1.16.2 *Checks of preservation work carried out*

The preservation status of the jack screw was inspected on 15 May 2010 according to Work Card JC2010-AWO-49438-005 and Job Card EOL 270119. The description of the work was a detailed visual inspection for the presence of lubrication on the horizontal stabilizer jack screw assembly. There was no discrepancy noted and the unit was re-lubricated after inspection.

1.16.3 *Inspection prior to delivery to SAS*

On 3 June 2010 TARMAC completed the close-up and final inspection of the aircraft in accordance with the Work Card JC2010-CLO-49438-000. This work was the conclusion of the preservation work on the aircraft, as well as a check that all panels were refitted and that tools had been removed from the aircraft.

Commissioned by SAS, TARMAC carried out a Maintenance Service Check (MSC), which is an inspection of those parts of the aircraft on which work had taken place and a general inspection, and then declared the aircraft airworthy (Released to Service). This inspection was the last work carried out by TARMAC on the aircraft and signed under its authorization.

1.16.4 *Delivery to SAS*

Later in the day on 3 June 2010, SAS accepted taking over responsibility for the aircraft via their type rated engineer who signed the acknowledgement of receipt (Acceptance Certificate) in accordance with the PPM¹⁶. The SAS engineer carried out a Pre-Flight Inspection (PFI) and the commander carried out an External Inspection (EI) before they took their places in the cockpit. It should be noted that the panel which separated from the aircraft during ground rolling was on top of the right stabilizer about 7-8 m above the ground and could not be inspected without lifting aids. At this time the panel was in place, but it was not fastened with all the screws.

1.16.5 *SAS system tests and information for SAS Maintenance Planning*

The flight from Tarbes to Gardemoen was planned as a combined positioning flight and a systems test flight prior to the upcoming sale of the aircraft. The aim was initially to test the aircraft systems after long-term parking. Due to the incident with the separated panel none of the system tests was carried out.

TARMAC contacted SAS Maintenance Planning during the flight from Tarbes to Arlanda when they had identified the separated panel. In the SAS handbook

¹⁴ Task describes maintenance/inspection

¹⁵ Access door number – removable panel fastened with screws for rapid access

¹⁶ PPM - Parking Procedure Manual

for long-term parking (Parking Procedure Manual) that TARMAC had access to, it is clearly stated that all urgent messages are to be sent through the SAS Emergency Contact¹⁷, which did not happen in this case. Instead TARMAC contacted an employee from whom they had received maintenance documentation during the time the aircraft was parked in Tarbes. He had already completed his work day and was no longer present to pass on the information to the crew operating the aircraft.

1.16.6 *Similar events*

In May 2010 an aircraft, model MD-82 with registration OY-KGZ, was delivered to Arlanda after long-term parking at TARMAC's site in Tarbes. After a routine inspection at Arlanda airport damage was discovered to both the left and right flap inspection panels (Bute doors) mounted on the underside of the wings in front of the flaps, see reference in Appendix 1, SAS Technical Report 18492, part of CIR OB-0510. The panels were secured with only one and two screws respectively (out of a larger number) and these were not tightened to contact. The remaining screws, not fastened, were in plastic bags on the inside of the two panels. The left panel exhibited minor damage after the flight. TARMAC was contacted and it was found that the certifying staff had performed work that did not follow the established the company working procedure. Gradually it was discovered that it was the same type-rated engineer who had worked with and signed for maintenance work on both aircraft; first OY-KGZ and later also SE-DFY.

1.16.7 *SAS positioning flight with the lower-left stabilizer panel removed*

The panels covering the area around the variable stabilizer are individually drilled with holes for the anchor nuts, which fasten the panel. This means that they cannot be exchanged if the panels need to be replaced. In October 2010 SAS needed to move an aircraft which was missing one panel to their maintenance base for the installation of a replacement panel. In this case the aircraft was flown in a degraded condition to the maintenance base. Since the company's Minimum Equipment List (MEL) did not cover this case of degradation, the type certificate holder, Boeing, was contacted to obtain an appraisal of whether the flight could take place. Boeing issued a No Technical Objection (NTO) based on the application from SAS, with a number of limitations as compensatory factors for carrying out the flight. Most apparent was the limitation in speed and that the flight should take place under conditions without any risk of aircraft icing. The flight was conducted without any problems from Tarbes to Barajas airport in Madrid.

1.16.8 *Review of work procedure for lubrication of stabilizer and jackscrew*

SHK has monitored on site the lubrication of the stabilizer in accordance with the Boeing MD-80 AMM 12-21-02, page 305 onwards, pos 7 Horizontal Stabilizer Lubrication. In all parts the work followed the AMM and access to lubrication points was via panel 6401A on the left side of the fin and panel 3701A on the left side of the panel 3703A (see also figs. 6 and 8). To access the stabilizer hinge, panel 6309A was opened (see fig. 9). In order to ensure the best accessibility and to visually check that the grease reaches the intended positions, the corresponding panels on the right side of the fin were removed. At SAS the work was carried out by two engineers, one injecting the grease and the other visually checking the grease penetration at each lubrication point.

¹⁷ Emergency Contact 24-7



Fig. 6 Opened panels on the left side for lubrication of stabilizer jack screw and stabilizer hinges in accordance with Boeing MD-80 AMM

There is no need to remove panels 3705A and 3806A (which separated during takeoff) above the stabilizer when using the work platform which SAS Technical Services had access to at Arlanda. The engineers who carried out the work said that these two panels are generally removed when the oil in the gearbox of the stabilizer jack screw needs to be changed.



Fig. 7 Lubrication of stabilizer jack screw gimbal ring via panel 3701A

The Planning Department (SAS STOMP¹⁸) confirmed that the maintenance documentation attached for TARMAC did not include an order for changing the oil in the gearbox, or any work for which Boeing AMM prescribes the removal of panel number 3806A.

¹⁸ STOMP Stockholm Maintenance Planning at Arlanda

In fig. 7 the three points are lubricated and access to the grease nipples is good. When the panels are opened on either side of the work area, the procedure can be checked well.



Fig. 8, Lubrication of the stabilizer jack screw support assembly via panel 3701A



Fig. 9 Lubrication of stabilizer hinges via panel 6309A

When using tools recommended by the type certificate holder access was good for lubricating the points monitored by SHK. There was no immediate need to remove additional panels in order to implement those parts of the corrosion-preventive maintenance work which SAS had ordered, according to the work documentation that was available and which TARMAC had used as a signing list.

1.16.9 *Work procedure at TARMAC*

The contract with SAS included maintenance with a frequency of mainly one to 90 days, in some cases longer periods. The daily checks and inspections were carried out by people with different experience of the MD-80. Work was performed by type-rated engineers (Certifying Staff, CS) who inspected completion and signed the technical documentation.

All the work carried out while the aircraft were parked in Tarbes was managed by SAS at Arlanda (STOMP). The agreement set up between SAS and TARMAC regulated the contacts and responsibilities that TARMAC had while the aircraft were parked in Tarbes.

TARMAC's work procedures are described in the company's workshop handbook (Maintenance Organisation Exposition, MOE) and were approved by the French aviation authority. Procedures followed usual work practices and quality systems that exist in well-established aviation organizations.

Those parts of the work documentation that SHK has examined and that relate to the incident when the panel separated from the aircraft are described well and follow the company's work procedures as in the MOE. The inspections and measures carried out were implemented by a number of company employees and signed by the type-rated engineer. The work was carried out in accordance with the Boeing AMM that SAS at Arlanda (STOMP) supplied TARMAC with, which was drawn up for the model.

At the time when the SAS MD-82 aircraft were parked with TARMAC there was access to a simple lifting device, unlike the working platforms that SAS uses at Arlanda airport for similar work on fin and stabilizer. With the relatively small and less stable lift only single-sided access was possible to the aircraft fin and the panels that needed to be removed for a corrosion inspection of the stabilizer jack screw. If the lifting device is moved to the opposite side of the fin the panels can be accessed, but SHK judges after the visit to the company that access must take place in two steps if the panels on both sides of the fin are opened.

1.16.10 *Visit to TARMAC*

SHK, together with BEA, carried out a visit to TARMAC to examine the procedures that were utilized for work on SAS aircraft. Signing was done on a daily basis according to the established Work Card Inspections and Procedures, and major maintenance work (30-day preservation and similar) was also reported in the SAS technical log. Maintenance work carried out was monitored by SAS Arlanda (STOMP) and communication channels were well established.

The personnel file for the engineer who was CS¹⁹ on the MD-80 until mid-May 2010 could not be shown. Current regulations specify that personnel files must be kept for at least 24 months after the person has left his/her post.

1.16.11 *Changes to working procedures adopted by TARMAC*

After two separate incidents where their quality system has shown weaknesses, TARMAC started work to ensure that panels removed/opened are also fastened/closed in a satisfactory fashion after work is completed.

¹⁹ CS: Certifying Staff, type-rated engineer

TARMAC has drawn up a form to gather relevant information in one place. The form has a heading containing all standardized information in three main columns: Panel number, Panel opened and Panel closed. The information in the two last columns is in the form of a date and a signature or stamp on it showing who carried out the work. The form was put into use at the end of 2010. Recently, the company has integrated the information contained on the form into the computer-based tracking system used for recording maintenance work carried out.

The type-rated engineer who performed the major part of maintenance and signed Work Cards up until 20 May 2010 worked on both SE-DFY and OY-KGZ. After the incident involving OY-KGZ the engineer ended his employment with TARMAC. The engineer has continued to work with maintenance of heavy aircraft at another company.

1.17 The maintenance company TARMAC's organization and management

The French company Tarbes Advanced Recycling & Maintenance Aircraft Company, TARMAC Aerosave, is a Maintenance, Repair & Overhaul Facility or MRO with long-term parking and scrapping as its main operations. The company began operations in February 2009 and has several well-known major shareholders, including Airbus and Snecma (Safran Group). Airbus works for the creation and management of a product's total life cycle, from production to scrapping after completed flying time. TARMAC has an EASA Part-145 authorization for most Airbus models and the MD-80 model was added for SAS demand. Operations are based at Tarbes Pyrénées Airport with about 25 employees, of whom 15 are engineers and 9 are type rated engineers. The bulk of activities consisted (in January 2011) of maintenance of aircraft parked there long term.

A contract was drawn up between TARMAC and SAS in which the procedures that would be applied during the time the aircraft were parked were described in a procedural document for long-term parking (Parking Procedure Manual, PPM), dated 13 November 2009. The document describes the procedures that were the basis for maintaining airworthiness during the time the aircraft were under TARMAC's responsibility. TARMAC was the supplier of maintenance services and was operating under its authorization when the prescribed work on the Boeing MD-80 AMM was carried out.

During the time the aircraft was parked there, TARMAC was responsible for:

- Basic service - all work described in AMM Chapter 10
- Additional service – all work except AMM Chapter 10 to keep aircraft airworthy
- Additional service – ordered by SAS and agreed to by TARMAC

SAS carried out an audit of TARMAC and the outcome was satisfactory. How the transfer between SAS and TARMAC would be carried out was described in the agreement (PPM).

SAS was responsible for all activities in accordance with EASA Part-M Sub-section C (continuing airworthiness). The work was ordered by SAS through a summary, an SAS work card, or other relevant input data passed on to TARMAC. In the PPM there was also a list of all identified contacts persons and addresses in the flow of information.

The company had the capacity to perform regular maintenance on the aircraft model in question; in this case it was the MD-80 Series and the authorization was valid from 31 July 2009. The French aviation authority conducted active supervision of the company with visits approximately once each quarter. The engineers who were Certifying Staff (CS) were qualified to carry out work on the Boeing MD-80 series aircraft.

1.18 Additional information

1.18.1 Equality issues

Not relevant.

1.18.2 Environmental aspects

Not relevant.

2. ANALYSIS

2.1 SAS maintenance on the aircraft before the flight to Tarbes

A review of the maintenance carried out before the flight to Tarbes showed that there was no documented work that required removal of the two panels above the stabilizer. Panel number 3806A separated early and without warning during the aircraft's acceleration on the runway from Tarbes. This suggests that the panel was not included in the work carried out at Arlanda airport before departure to Tarbes. The aircraft technical log had a note that a maintenance check had been carried out before departure from Arlanda.

2.2 The flight from Arlanda to Tarbes

After the flight to Tarbes two remarks were noted in the technical log; both concerned observations made during the flight. None of these remaining notes was connected with the aircraft exterior.

2.3 TARMAC and its work procedures

Following an examination of the maintenance work ordered by SAS STOMP, SHK has not been able to find any indications that any of the relevant panels should need to be removed to perform the maintenance work. Nothing in the reviewed work documentation shows that TARMAC's personnel signed off work or maintenance in the area in question. One plausible explanation is that whoever carried out the maintenance/inspection had poor knowledge of the aircraft type and no "hands-on" experience of the work to be carried out for corrosion checks.

Based on the information gained by SHK during a review of the work procedures on site in the SAS hangar at Arlanda airport, access to the lubricating points included in the corrosion check is not improved by removing panel numbers 3705A and 3806A. It is a reasonable assessment that the limited ability to move freely on both sides of the fin made access more restricted when the jack screws were to be checked for corrosion.

It was the same type-rated engineer who performed the major part of maintenance on both SE-DFY and OY-KGZ. It cannot be excluded that the irregulari-

ties noted can be linked to a personal approach which was not in conformity with the company's MOE or sanctioned by the company.

A review of the personnel file for the type-rated engineer was not possible since it was not available when SHK made its visit.

According to TARMAC did the company relieve the engineer of his duties; the decision was taken since the company did not feel that the engineer's work methods corresponded with the company's documented procedures. SHK believes it was unfortunate that no quality audits were performed on the objects for which the engineer had acted as Certifying Staff. The incident with SE-DFY shows these did not take place.

The improvements which TARMAC has made after the incidents that occurred would probably not have prevented the incident involving SE-DFY, since according to Boeing documentation the panel that separated from the aircraft should not be removed for the work planned. It would not therefore have been included in the summary of panels that should be checked prior to a declaration of airworthiness.

2.4 The flight from Tarbes to Arlanda

The crew carried out the inspections and checks that SAS regulations prescribe for long-term storage and parking. The possibility of making an external inspection of the aircraft was limited since type-adapted ladders or platforms were not available.

The flight took place without any initial disruptions. Only after contact with air traffic control were the crew aware that one of the aircraft panels may have been missing. Based on the dimensions of the panel found, the engineer on board concluded that it could be one of the panels enclosing the fin that had been found on the runway. The subsequent visual inspection in the air by a French fighter aircraft and the fact that no direct effect on the aircraft could be seen meant that the crew did not receive a clear indication that the separated panel actually belonged to their own aircraft. The system tests were cancelled and the crew decided to change the destination to Stockholm/Arlanda as a precaution in the event that technical assistance might be required after landing. It was decided that a reduction in speed was reasonable given the uncertainty that arose when they were unable to confirm the aircraft's external integrity.

At 19:00 TARMAC contacted the SAS department for maintenance planning and announced that the panel found came from an MD-82. The correct procedure would have been to contact the SAS Emergency Contact (24-7) which would have been able to contact the crew and to clarify what had happened during the flight.

The crew was well qualified for the flight and based on the known facts made a reasonable assessment of the flight safety for this positioning flight.

2.5 Flight with panels removed

Later in the autumn of 2010, a similar positioning flight was made with one of the four panels covering the vertical stabilizer removed. The measures taken to ensure a reasonable level of flight safety, i.e. to reduce speed and to avoid flying in icing conditions, were written in the permit as compensatory measures.

In view of the permit that Boeing issued in the latter case and its application to the flight from Tarbes to Stockholm/Arlanda, it may be considered that the crew made a correct assessment to continue the flight.

The crew did not know unequivocally in what state the aircraft was, but based on how it felt to fly and the fact that no extraneous noise or vibrations were present, the decision can be assessed reasonable.

3 STATEMENT

3.1 Findings

- a)* The crew had authorization to perform the flight.
- b)* The aircraft had a Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC).
- c)* The maintenance organization was qualified to carry out the commissioned work.
- d)* The panel that separated did not need to be removed for the maintenance ordered.
- e)* A visual inspection was carried out in the air without any finding.
- f)* The flight was conducted at reduced speed, without further remark.
- g)* The type-rated engineer at the maintenance organization did probably not follow established work procedures.
- h)* After the type-rated engineer left the company no quality audit of the remaining aircraft where he was certifying staff was carried out.
- i)* A review of the work done lacked adequate documentation at the detailed level with reference to the opened/closed panels.

3.2 Causes of the incident


The incident was caused by a lack of quality assurance of work procedures at the maintenance company.

4. RECOMMENDATIONS

None.

APPENDIX

1. SAS Company Investigation Report (CIR) OB-0510, dated 19 November 2010

		Company Investigation Report CIR OB-0510		
CIT Chairman (Name/Dept) and signature		SENTINEL reference No.	Date of occurrence	Date of issue
Company Chief Investigator, STOOB-I		On File	2010-06-03	19th Nov 2010
Flight No.	Aircraft registration	Aircraft type	Routing	Place of occurrence
SK9198	SE-DFY	MD-82	LDE-OSL	LDE

This Company Investigation has been conducted according to requirements described in AOP 2.4. The purpose of a Company Investigation is to prevent accidents. It is most important that adequate relevant measures are promptly taken to prevent recurrences. It is not the purpose of this activity to apportion blame or liability. All factors, deemed relevant to conclusions made, have been included in this Company Investigation Report.

Title Loss of fairing, MD80, LDE.

CIT SAS Company Investigation Team conducted this Investigation.

Occurrence Description The aircraft had been parked at a parking facility in France for several months and was being returned to OSL for preparation for onward sale. After departure the right upper horizontal stabilizer fairing was discovered on the runway. With the aircraft handling normally the flight was continued, but diverted to ARN for access to repair facilities.

Purpose of the investigation The purpose of the investigation is to discover the cause of the loss of the fairing.

Comments To the Report The report paragraphs are numbered according to ICAO Annex 13. Paragraphs not relevant to the investigation are excluded.

All times in UTC (Universal Time Coordinated) unless otherwise stated.

Factual information **1.1 History of the flight**

- McDonnell Douglas MD-82, SE-DFY (previously registered as LN-ROW), 48524 flying hrs, 38722 cycles.
- Non-Revenue flight SK9198 LDE-OSL 03 Jun 10.
- Scheduled Time of Departure (STD) 1630 – Actual Time of Departure (ATD) 1708.
- Scheduled time of arrival (STA) 2015 (OSL) – Actual time of arrival (ATA) 2024 (ARN).
- 3 Crew, Nil PAX.

1.1.1 Extracts from the SENTINEL occurrence reports.

Flight Occurrence report:

“The purpose of the flight was to perform a test flight after a long term parking and to ferry the aircraft to a home base where it could be prepared for a delivery flight to USA.

After departure we were contacted by ATC who stated that they had made a runway inspection and that a large piece of metal had been found on the runway that could originate from our aircraft. The piece was triangular and measured approximately 180x45x15 cm. Since the information about the finding was rather unclear and no vibrations or unusual

OB-0510

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noises were heard we decided to continue the flight at reduced speed until more information was received. We also decided to refrain from testing in order to avoid unnecessary stress on the aircraft if we actually had lost some part of the airframe. Our Test Flight Engineer suspected early that the piece could possibly be one of the four horizontal stabilizer fairings based on the measurements.

We suggested that the airport authority should contact our local maintenance organization TARMAC for a positive identification of the finding. Later it turned out that the staff at TARMAC already had gone for the day. ATC then offered us the possibility to have a visual inspection of our aircraft performed by French airforce which we gladly accepted. A Mirage intercepted us five minutes later and made an inspection. We had direct communication with the fighter but they informed us that they could not see any missing part. With this information at hand and the fact that the aircraft behaved perfectly normal we decided to continue the flight but choose to divert to STO for easier repair if it turned out that something actually was missing.

The rest of the flight was uneventful. After landing we were met by the fire brigade and the police who wanted a statement of the occurrence. A post flight inspection revealed that it actually was the right hand upper stabilizer fairing that was missing.

CPHOP, STOOP, OF duty manager, NPH CAW, NPH FO and Chief Pilot in STO were all informed by phone.”

1.1.2 Interviews.

The CIT visited TARMAC Aerosaves facility in Tarbes and met with the CEO, the quality manager and the maintenance manager. All of whom, offered assistance and were cooperative with the investigation. Engineers, airport staff and the local representative of the aviation authority were also met. The results of these interviews has been used to create a narrative describing TARMACs activities in following section 1.17 Organisational and management information.

The CDR of flight 9198 was also questioned and his description of events concurs with his written Sentinel Flight Occurrence Report.

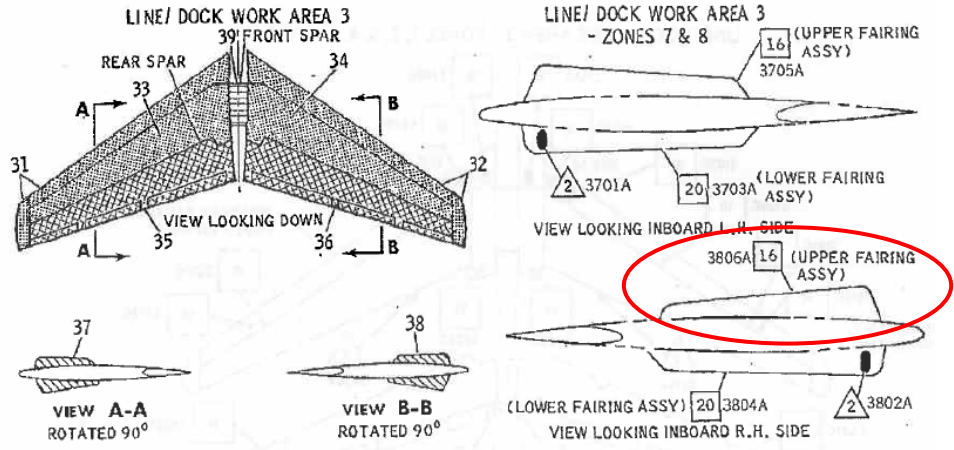
1.3 Damage to Aircraft

1.3.1 The RH upper fairing assembly

On each side of the horizontal to vertical stabilizer are fairing plates on the upper and lower side. The RH upper fairing (Part no 3806A, MD-80 AMM, 06-23-00.) became detached from the airframe and was found on the runway.



MD-80
AIRCRAFT MAINTENANCE MANUAL



AREA	ZONE	ZONE DESCRIPTION
3	0	EXTERIOR SURFACES OF HORIZONTAL EMPENNAGE (BOTH SIDES)
3	1	L. H. HORIZONTAL STABILIZER LEADING EDGE AND TIP
3	2	R. H. HORIZONTAL STABILIZER LEADING EDGE AND TIP
3	3	L. H. OUTBOARD STABILIZER INTER-SPAR BOX
3	4	R. H. OUTBOARD STABILIZER INTER-SPAR BOX
3	5	L. H. ELEVATOR, TABS AND TRAILING EDGE STRUCTURE AFT OF REAR SPAR
3	6	R. H. ELEVATOR, TABS AND TRAILING EDGE STRUCTURE AFT OF REAR SPAR
3	7	L. H. HORIZONTAL TO VERTICAL STABILIZER FAIRING PLATES
3	8	R. H. HORIZONTAL TO VERTICAL STABILIZER FAIRING PLATES
3	9	HORIZONTAL STABILIZER CENTER SECTION BOX

Figure 1: MD-80 AMM, 06-23-00 page 4

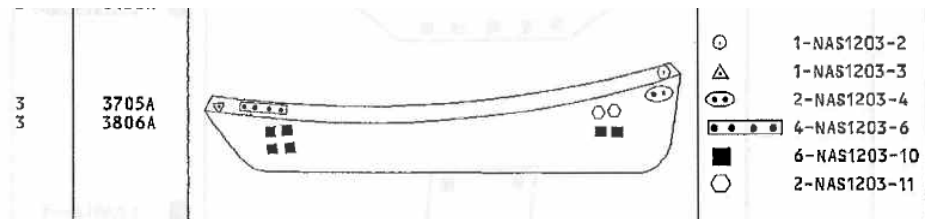


Figure 2: MD-80 AMM, 06-23-00 page 7 part no' & access symbol plus type fastener.



Photo 1: Area of RH horizontal stabilizer showing missing upper fairing.

Forward screw hole on the horizontal surface (1-NAS1203-2 from fig2) was found to be undamaged.



Photo 2: 1-NAS1203-2 position, RH fairing.

The 2 screw holes on the vertical surface (2-NAS1203-4) were found to be undamaged as was the mounting bracket for these.



Photo 3: 2-NAS1203-4 position, RH fairing.

The 4 screw holes on the vertical surface (2-NAS1203-11 + 2-NAS1203-10) were found to be undamaged as was the mounting bracket for these.

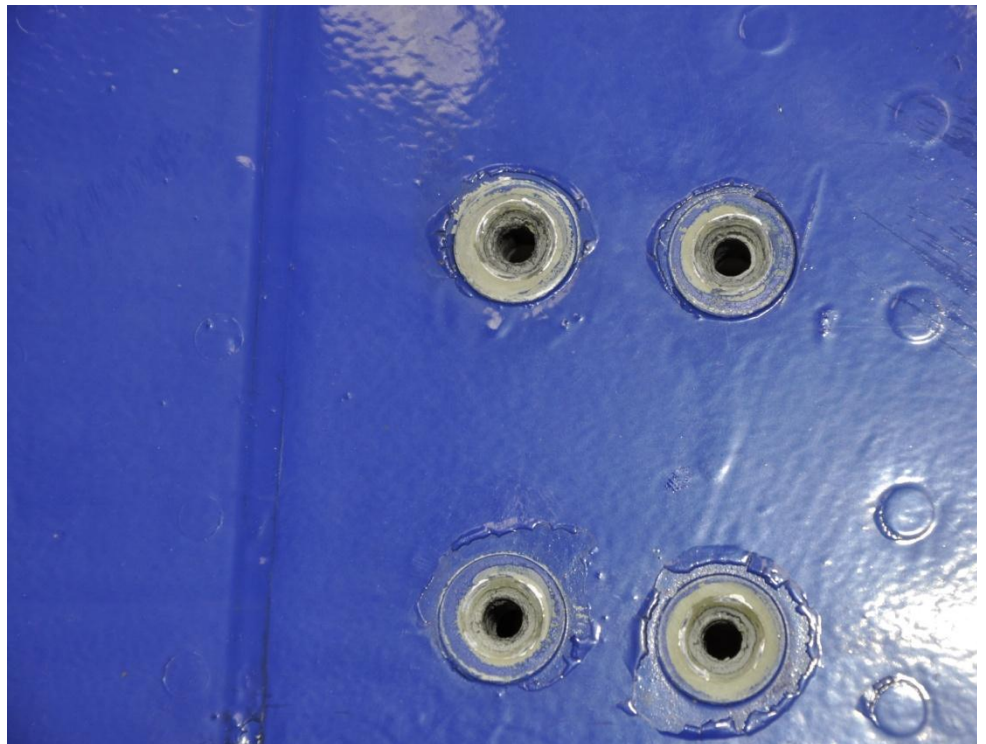


Photo 4: 2-NAS1203-11 + 2-NAS1203-10 position, RH fairing.



Photo 5: Mounting brackets for 2-NAS1203-4 & 2-NAS1203-11 + 2-NAS1203-10, RH horizontal stabilizer.

Where the 4 NAS1203-10 screws were mounted 3 holes showed no damage to the fairing or bracket. In the upper RH hole (looking inboard) the screw was protruding but still attached, with its fastener and part of the bracket still present on the inside. The bracket assembly received damage in the form of deformation as the attached fairing pulled away and then tearing as the metal failed and a piece remained attached to the screw as the fairing departed.



Photo 6: 4-NAS1203-10 location, RH fairing. Showing 1 remaining screw.



Photo 7: Internal view of the fairing showing the remaining screw, fastener and attached failed piece of bracket.

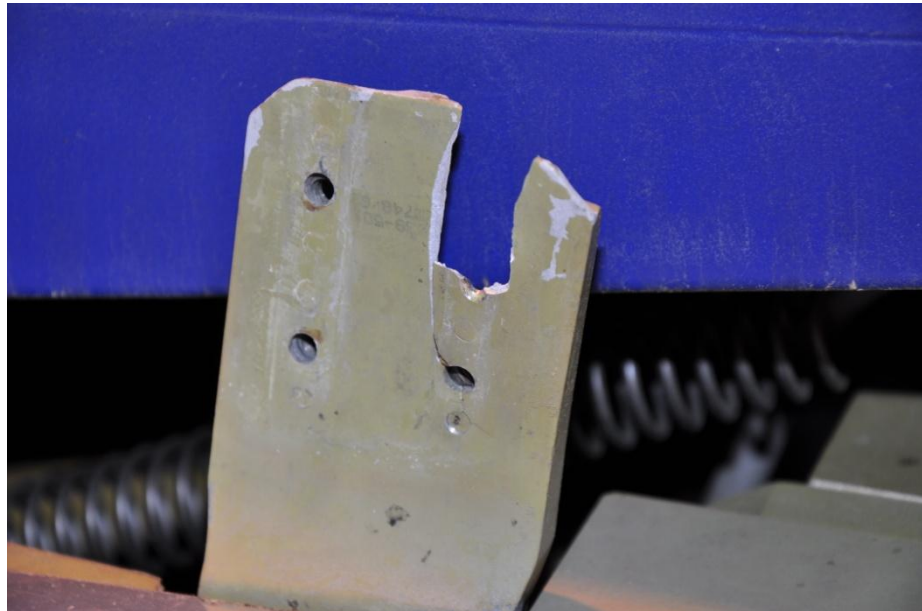


Photo 8: The failed bracket, showing outward bending and failure of the metal around the screw hole.

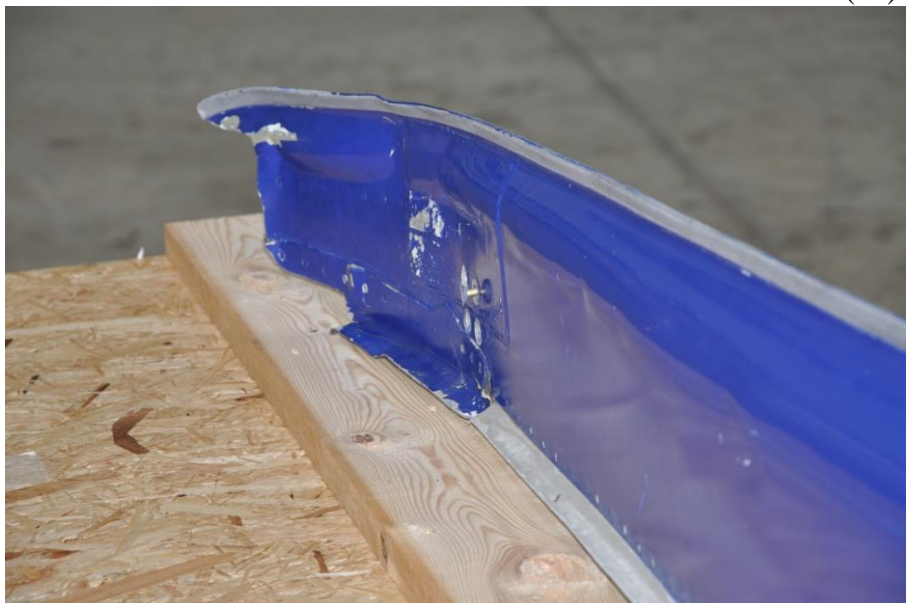


Photo 10: The rear end of the fairing showing bending, buckling and a tear failure.



Photo 11: Failed part of fairing still attached to A/C with screws NAS1203-6 and (out of sight) bolt NAS1203-3

The screws in the horizontal surface NAS1203-6 were, in fact, just 2 in number and not 4 as shown in figure 2 taken from the AMM. Each fairing is individually drilled to match the holes / brackets on the aircraft and it is conceivable there are some differences.



Photo 12: The rear of the fairing is in line with the wooden strip, this illustrates a bend in the fairing of approximately 60deg.

Scratches.

There were also some small scratch marks found on the horizontal stabilizer surface, which were indicative of the fairing “swinging out” in a horizontal plane.

Missing Screws.

The missing screws have not been located.

1.3.2 The LH upper fairing assembly

After landing at ARN the a/c was inspected and the LH upper fairing (item 170) was found to be intact but with some missing screws and some screws loose.



Photo 13: L/H upper fairing as found.

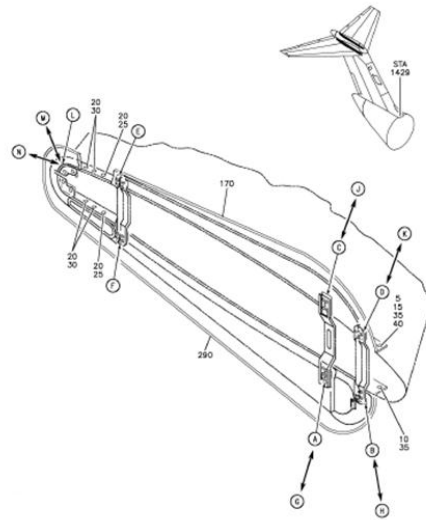


Figure 3.

Front end

Item 5 (from fig 3).

IPC P/N NAS1203-7 Length (L) = 0.714

Actual P/N NAS333-13 L=1.417

Bolt was loose and protruding.



Photo 14: Item 5 (from fig 3) bolt.

Rear end

Item 20 (from fig3), 2 each.

IPC P/N PIC239-3-4 L=?

Actual fwd P/N NAS333-12 L=1.299

Actual aft P/N NAS333-13 L=1.417

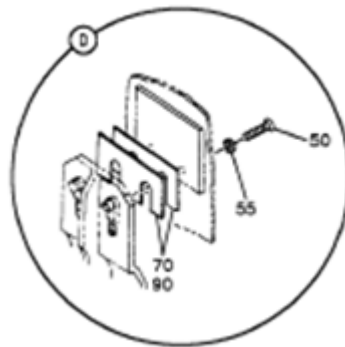
Bolts were loose and protruding.



Photo 15: Rear of Fairing.

View D

Item 50, 2 each.



IPC P/N NAS1203-4 L=0.526

Actual P/N ? L=0.630

Fwd bolt loose and protruding, Aft bolt missing.

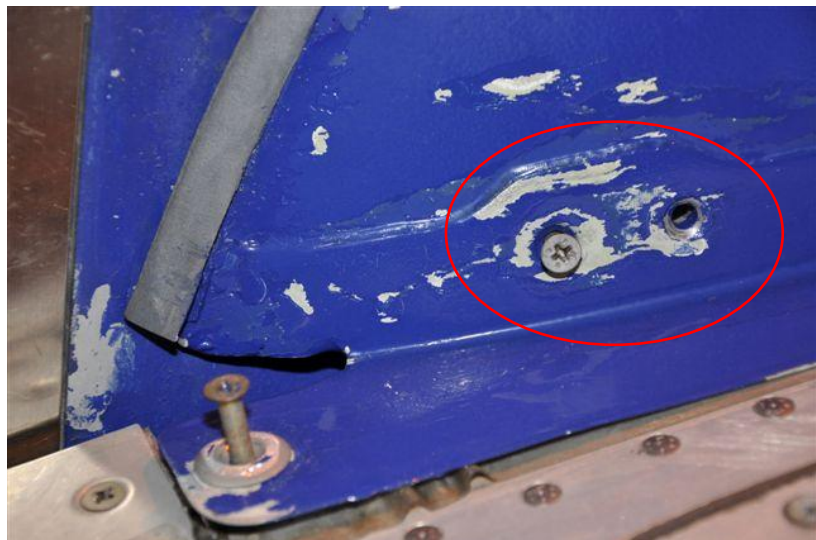
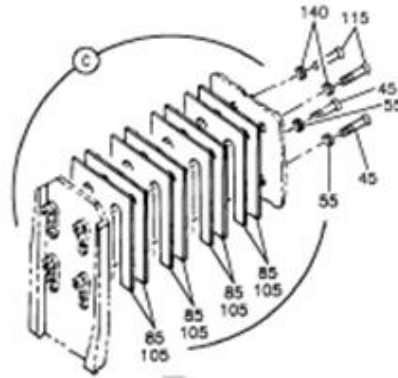


Photo 16: Area of view D.

View C

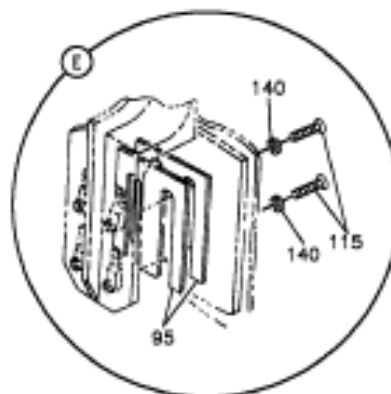
Item 45, 2 each lower;
 IPC P/N NAS1203-11 L=0.964
 Actual fwd Missing
 Actual aft P/N NAS 333-12 L=1.299

Item 115, 2 each top;
 IPC P/N NAS1203-10 L=0.901
 Actual fwd P/N NAS333-13 L=1.417
 Actual aft P/N NAS333-12 L=1.299

Screws on top tightened, lower fwd screw missing and lower aft screw loose and protruding.



Photo 17: Area of view C.

View E

Item 115, 4 each.
 IPC P/N NAS1203-10 L=0.901

Actual top fwd P/N NAS333-6 L=0.781
 Actual top aft P/N NAS333-? L=0.866
 Actual lower fwd P/N NAS333-6 L=0.81
 Actual lower aft Missing

The 3 remaining screws were loose and protruding.

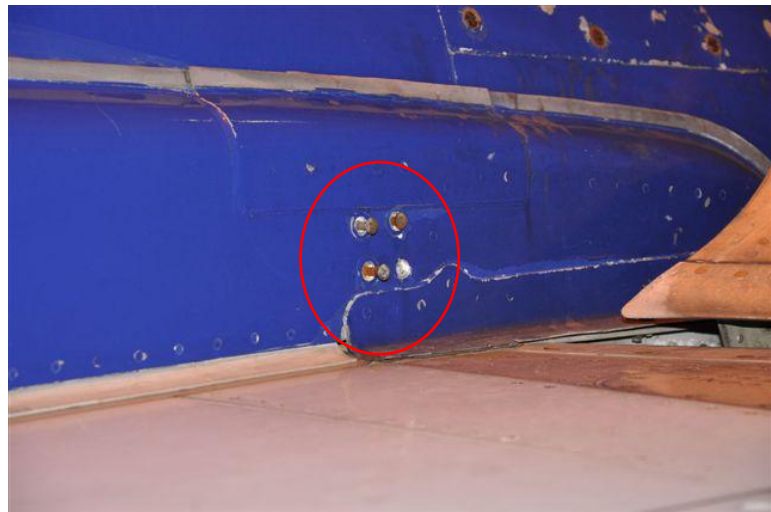
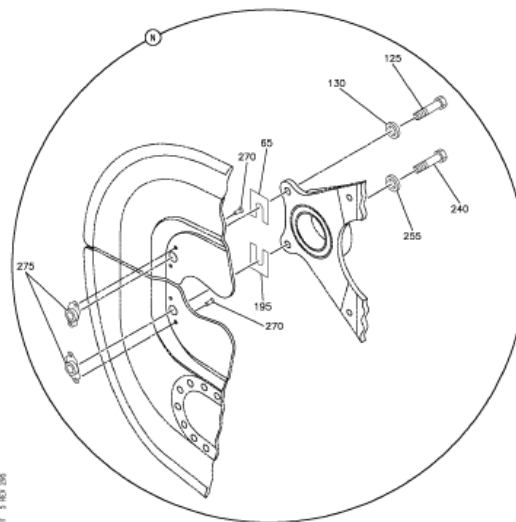


Photo 18: Area of view E.

NAS Screw types.

NAS333CPA and NAS1203 bolts are similar in diameter, head size and strength. However, because the thread lengths are not identical, they are not directly interchangeable parts and not generally interchangeable without analysis of installation.

View M



Item 150 1 ea	IPC actual	P/N NAS1104-14 P/N NAS6204-13D
Item 230 1 ea	IPC actual	P/N NAS1104-9D P/N NAS6204-12D

NAS1104 and NAS6204 are interchangeable.

1.5 Personnel Information

Crewmembers were certified and qualified according to Aviation Authority and SAS Company requirements.

1.6 Aircraft Information

Work performed at ARN in connection with the parking and preservation in STO

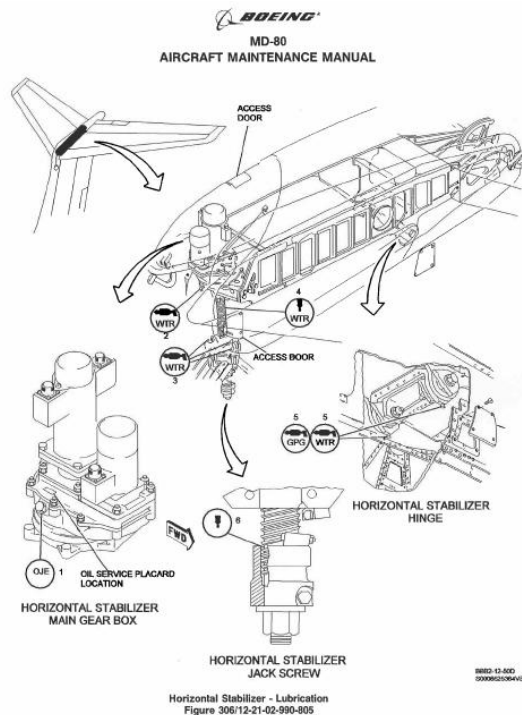
Order No	Discrepancy	Log page	Date
WO1017017	MPD 27-040-02 DI - DETAILED INSPECTION OF THE ACME SCREW AND NUT FOR WEAR. INSPECTION INITIATED BY KTO-271189		2009-06-26
WO1034965	ATA 10-SHORT TIME PARKING (7 DAYS)		2009-07-01
CW1051728	SHORT TIME PARKING PROCEDURE (7DAYS) PERFORMED IAW AMM 10-10-00. SUBSTITUTE COVERS USED IAW NOTE 2.	L650	2009-07-07
WO1044849	INITIAL ENGINE PRESERVATION 7-28 DAYS		2009-07-27
WO1044850	INITIAL AIRCRAFT PRESERVATION (MD80 STORE FRL649)		2009-07-28
	WP SAS 20090801789 and maintenance check acc LMPG performed	L654	2009-09-08

2009-09-08 Testflight and ferry flight to LDE performed.

Order No	Discrepancy	Log page	Date
WO1061523	ATA 10-LONG TERM PARKING OF A/C. Re: EO-MD80-100021 CARRIED OUT INITIAL AIRCRAFT PRESERVATION IAW AMM TASK 10-30-00 PAGE 201 TO 206 AND 206 TO 207 AND 207 TO 218 AND 221 TO 224 AND 224 TO 227. REF TLB SEQ L658.	L658	2009-09-09

1.6.1 Jack screw lubrication

As part of the preservation procedure detailed in the MD-80 aircraft maintenance manual (AMM) the horizontal stabilizer should be lubricated and this includes lubrication of the jack screw stop. AMM 12-21-02 section 7 (see attachment 2) and described in the following figure.



The lubrication of the jack screw is done via two access doors as shown in the figure. Removal of the top cowling and /or removal or loosening of the fairings may conceivably make the lubrication task easier but that is not described. The preservation procedure is scheduled to be repeated every 90 days.

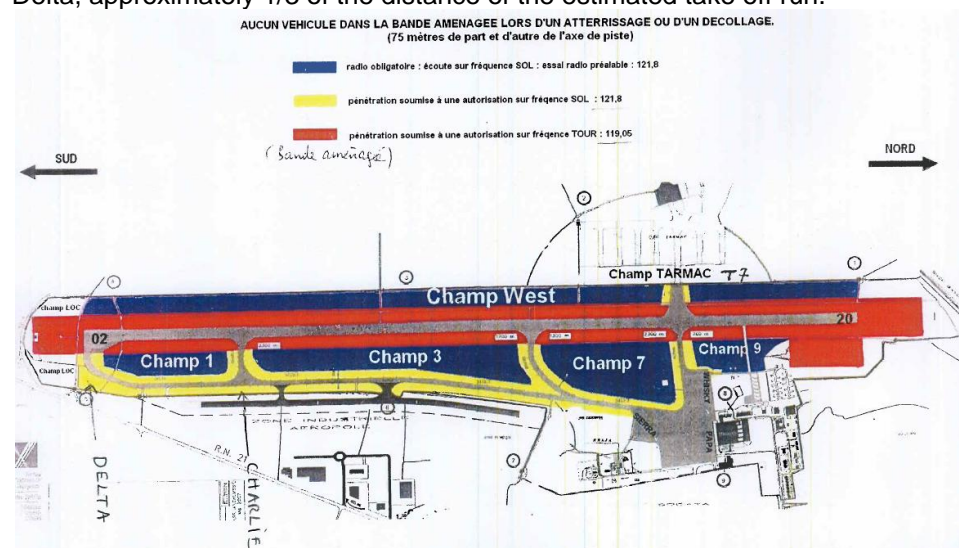
1.7 Meteorological Information

METAR (Actual observation) information for Tarbes / Lourdes airport (LFBT)

METAR LFBT 031700Z VRB02KT 9999 FEW050 24/09 Q1014 NOSIG=

1.10 Aerodrome Information

The RH upper fairing was found on runway 02, between taxi way Charlie & Delta, approximately 1/3 of the distance of the estimated take off run.



1.17 Organisational and Management Information

1.17.1 TARMAC Aerosave.

TARMAC (Tarbes Advanced Recycling & Maintenance Aircraft Company) Aerosave is an MRO with parking and scrapping as their major activities, established in 2007 and starting operation in February 2009. The reason for the establishment of this company was based upon an idea from Airbus of taking responsibility for the lifecycles of an aircraft and be able to offer airlines an environmental way of scrapping time served airframes. The major shareholders are Airbus, SITA and Snecma services. They are based at Tarbes / Lourdes airport in the Pyrenees region of France, employing currently 27 staff. TARMAC has a French approval certificate No 145.627 (see attachment 1 & 4). Capability was already for Airbus A300, A300-600, A310, A318/A319/A320/A321 and A330/A340, MD80 approval was given in July 2009 to meet the requirement of SAS.

Prior to parking aircraft with TARMAC, SAS visited the site in June 2009 and an assessment (Attachment 1) was made, recommending TARMAC as a suitable parking facility. This first time assessment was conducted by the CAMO as per the SAS CAME Contractor selection procedure (Attachment 5) and a further re-assessment would not otherwise be required for 24 months. A Parking procedure manual (PPM) was produced by SAS to describe procedures to be used by TARMAC for the long term parking of MD-80 & A340. This document became effective 13 Nov 09.

SAS parked in total 8 (6x MD80, 2x A340) aircraft at this facility and SE-DFY was the second to last to leave.

TARMAC employed a suitably MD-80 qualified engineer to oversee work on these a/c and several other engineers, on a temporary basis, to conduct tasks. These engineers were from the region, which has a large aviation industry presence, and mainly had a background in a/c manufacture.

This MD-80 qualified engineer oversaw and signed off all the work conduct on SE-DFY described in section 1.6 during this time, up until May 2010 when he was suspended due to the incident described in section 1.17.2 below. By the time of the CIT visit in mid-June TARMAC has dismissed him. As there was no MD-80 maintenance ongoing at the time of the CIT visit, the temporary workers and the replacement MD-80 qualified engineer were not available to be interviewed. It was the new replacement MD-80 qualified engineer who signed for the close up and final inspection work card on the day of SE-DFYs return and incident.

1.17.2 Previous incident

One of the aircraft previously stored with TARMAC, OY-KGZ, also suffered an incident, where on its return to SAS in May 2010, it was found that several screws were missing in the Bute doors on both the LH and RH wing. Each Bute door had only one or two screws installed but not tightened, the LH Bute door suffered slight damage. All the missing screws were subsequently found in plastic bags taped to the inside of each door. (reference SAS Tech report 18492). Upon further questioning of the TARMAC management it was ascertained that the same engineer that was responsible for signing off the work on this a/c was the same as the incident a/c SE-DFY. In response to SAS questions over the Bute door incident, TARMAC suspended the engineer in question, conducted a quality review and recommended a new procedure to document which panels had been open and a sign off that they were secure. This procedure was still not in place at the time of the CITs visit in June.



Photo 19: LH Bute door screws in bag, OY-KGZ.



Photo 20: RH Bute door screws in bag, OY-KGZ.

Analysis

2.1 History of the flight

The narrative reproduced from the SENTINEL report gives a concise version of the flight. The decision to continue was reasonable and justified as the A/C was handling normally, it was not positively determined that the part found was from SE-DFY at that time and the airborne visual inspection showed no cause for concern.

2.3 Damage to Aircraft

2.3.1 The RH upper fairing assembly

It appears that the RH upper fairing was only secured in three locations, the rear bolt NAS1203-3, two rear screws NAS1203-6 and one of the four screw holes in the rearward vertical bracket, NAS1203-10. These were the only locations that remaining fasteners were found. All the other screw holes were empty, "clean" and showed no signs at all of being damaged by either a tight or loose screw working free or being pulled out.

Examining the detached fairing, seeing the bend in it and scratch marks, it appears that the fairing became caught in the airflow and was pulled outwards in a horizontal plane, while being secured at the rear, until about 60deg when the fairing and bracket failed and the fairing became detached, passing over the elevator and falling clear onto the runway behind the A/C. There is little evidence of any "flapping" of the fairing as there are no other witness marks to support this.

There was some potential for the departing fairing to damage the horizontal stabilizer and damage or possibly jam the elevator surface, which could have had serious consequences during the take off. The fairing also posed a serious FOD risk to other a/c using the rwy subsequently.

2.3.2 The LH Upper fairing assembly

The LH upper fairing was secured loosely. Of the required fastenings, 8 were loosely fitted, 3 were missing and only 3 were securely tightened. Two of these secure screws were in the area of the view C diagram on the fwd part of the fairing and the other secure bolt was at the rear (view M) of the fairing. As the fairing was secured (albeit not fully) at the front and back it appears that the fairing was not able to move out and be effected by airflow. The loosely fitted screws would also have helped in keeping the fairing flush and spreading any load.

It would appear that another type of screw than those specified had been used and due to the weathering and blue paint evident, it seems they had been fitted for some time. As the screws did not fail and are very similar in type to those specified the significance of this is not considered high but the differences in length may have affected how they were fitted. How which screws were placed in each relevant hole though could well have been influenced by any actions completed in removing the fairing at TARMAC.

2.6 Aircraft Information

There was no work carried out previous to the parking at TARMAC that recorded or possibly needed the fairings to be removed or loosened. As the fairing departed cleanly very early in the take off run and as there were no witness marks indicating loose screws vibrating or falling out as the panel potentially gradually became loose it is the CITs opinion that the panels were left unsecure during the aircrafts parking at TARMAC. A review of the work carried out at TARMAC also showed no record of the fairings being removed or loosened but part of the initial preservation work order prescribes the lubrication of the horizontal stabilizer and part of this is the lubrication of the jack screw (1.6.1). It is conceivable that the fairings were loosened to assist in either the removal of the top panel or the lubrication task itself. As the technician who carried out the work was unavailable, it cannot be positively determined that was the technique used to complete the lubrication task. As the task was also scheduled to be repeated after 90 days, it is also conceivable that the fairings were only left loosely secured to assist in the ease of access.

2.7 Meteorological Information

Wind was light and variable and the meteorological situation played no part in the incident.

1.10 Aerodrome Information

As the fairing was found in a location on the runway that would have been early on in the A/Cs take off run, it is likely that the fairing detached as soon as there was sufficient speed to generate an airflow over the surface and this indicates that the fairing was only loosely secured at the front, if at all. As it came away so easily it appears unlikely that the A/C was previously flown in this condition.

2.17 Organisational and Management Information

2.17.1 TARMAC Aerosave.

TARMAC Aerosaves personnel were very cooperative but nothing definitive could be obtained as there was no one available to interview who had actually carried out the work on SE-DFY or any of the SAS MD-80s.

2.17.2 Previous incident

The previous incident that occurred on OY-KGZ was of a similar nature in that panels were not properly secured. This is indicative of the likely working practices at TARMAC and a suitable process to quality check the securing of panels was planned but not in place by the time of SE-DFYs incident.

Conclusions

3.1 Findings

It can be concluded that:

- The fairing found on the rwy at LDE was the RH upper fairing from SE-DFY.
- The LH upper fairing on SE-DFY was only loosely secured.
- SAS had conducted an assessment of TARMAC and provided proper documentation (Parking procedure manual).
- TARMAC met authority requirements and was suitably qualified as an MRO.
- As an MRO TARMAC are completely separate to the SAS quality system and it is not required for SAS to conduct quality audits of such organisations.
- SAS has suitable procedures for the selection of contractors.
- A procedure for logging open panels and signing off their closure was planned but not in place at TARMAC at the time of the incident.
- There was no record of work being carried out on the fairings either before or during storage in STO or whilst stored at TARMAC.

It can be reasonably concluded that:

- As the TARMAC MD-80 technician had been dismissed that a “just culture” does not exist at that company.
- The previous incident is indicative of the working practices on the MD-80 at TARMAC.
- The fairings were left unsecured after work likely carried out at TARMAC
 - That work was likely to be the procedure to lubricate the horizontal stabilizer which included the jack screw.
 - The procedure for lubrication of the jack screw does not require the removal of the fairings but it can be achieved by doing that.

Safety recommendations made in relation to the incident:

Safety Recommendation 1	Responsible function
That when the remaining A/C parked at the TARMAC facility is collected, that a thorough inspection is made by suitably qualified SAS technician before flight.	STOOM
Safety Recommendation 2	Responsible function
That if the TARMAC facility is to be used again a thorough audit of their quality system and working procedures is conducted by SAS before approval.	STOOM STODQ (Info)
Safety Recommendation 3	Responsible function
That the criteria and interval requiring suitable re-assessment and/or audits of third parties taking care of our A/C are reviewed.	STOOM STODQ (Info)

Attachments

No attachments included in this version

Attachment 1: SAS Assessment of TARMAC Aerosave including part 145 certificate.

Attachment 2: MD-80 AMM Relevant sections regarding aircraft preservation procedures and the lubrication of the horizontal stabilizer.

Attachment 3: TARMAC Work orders.

Attachment 4: Part 145 Certificate including MD-80 qualification.

Attachment 5: SAS CAME 4.1.1 Contractor selection procedure.

Note: Names redacted from documents as investigation policy.

