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Swiss Accident Investigation Board SAIB

Aviation Division

Final Report No. 2181 by the Swiss Accident Investigation Board SAIB

concerning the accident involving the
BAE146-200 aircraft, registration G-ZAPN

on 26 December 2011

Sion/VS airport (LSGS)

Causes

L'accident est dû à une collision entre l'avion et le terminal de l'aéroport consécutive à une erreur de cheminement de l'équipage.

Facteurs ayant contribué à l'accident:

- non transmission du cheminement par le contrôleur sol
- présence d'un seul placeur
- marquage prêtant à confusion

General information on this report

This report contains the Swiss Accident Investigation Board's (SAIB) conclusions on the circumstances and causes of this accident.

In accordance with Art. 3.1 of the 10th edition, applicable from 18 November 2010, of Annex 13 of the Convention on International Civil Aviation (ICAO) of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this report to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, this may give rise to erroneous interpretations.

The definitive version of this report is the original in the French language.

All times in this report, unless otherwise indicated, are stated in coordinated universal time (UTC). At the time of the accident, Central European Time (CET) applied as local time (LT) in Switzerland.

The relation between LT, CET and UTC is: $LT = CET = UTC + 1 \text{ hour}$.

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Final Report

Introduction

Owner	Titan Airways Ltd, Enterprise House, Stansted Airport, Stansted, Essex CM24 1RN, UK
Operator	Titan Airways Ltd, Enterprise House, Stansted Airport, Stansted, Essex CM24 1RN, UK
Manufacturer	British Aerospace PLC
Aircraft type	BAE146-200
Country of registration	United Kingdom
Registration	G-ZAPN
Location	Sion airport, Sion municipality, Switzerland
Date and time	26 December 2011 at 11:55 UTC

Investigation

The accident occurred at 11:55 UTC on Monday 26 December 2011. It was immediately notified to the Swiss Accident Investigation Board (SAIB) and an investigation was opened on the same day.

The SAIB reported the accident to the British authorities, which nominated an accredited representative.

The final report is published by the SAIB.

Synopsis

Shortly after landing at Sion airport, the crew of the BAE146-200 aircraft, registration G-ZAPN, was cleared to taxi to the *Transit Parking* adjacent to the terminal. During this manoeuvre, the aircraft collided with the south-west corner of the building and its right wingtip became lodged under the eaves.

None of the occupants of the aircraft was injured and passenger disembarkation took place in the normal way.

The wingtip damage required the temporary replacement of the right wingtip in order to enable the return flight of the aircraft.

Causes

The accident is due to a collision between the aircraft and the airport terminal following a crew's routing error.

Factors which contributed to the accident:

- No instruction of the routing by the ground controller
- Only one single marshaller available
- Markings leading to confusion

1 Factual information

1.1 History of the flight and taxiing on the ground

1.1.1 General

The description of the pre-history and history of the flight is based on:

- the recordings and transcripts of the radio communications between the crew and Sion airport air traffic control
- the testimony of members of the cockpit crew, controllers and Sion airport personnel

The commander, seated in the left-hand seat of the cockpit, assured guidance of the aircraft on the ground.

1.1.2 Pre-history

Before this accident the crew had already made some twenty flights to Sion at the controls of this aircraft type and had already manoeuvred on the *Transit Parking* of the tarmac of this airport.

1.1.3 History of the flight

On 26 December 2011, the BAE146-200 type aircraft, registration G-ZAPN and operating as flight number ZAP41S, took off from London Stansted airport (EGSS) at 10:00 UTC, destination Sion (LSGS). It was carrying 54 passengers and five crew members, including two pilots.

The aircraft landed at Sion at 11:52 UTC. During the roll to reach the Transit Parking, the instructions given by the ground controller were as follows:

“ZAP four one sierra, behind short final traffic cross runway behind and look after marshaller.”

The ground controller did not issue any other instruction to the crew, who continued to taxi towards the marshaller following the yellow centreline of taxiway Alfa (see Figure 1), which is adjacent to the airport terminal.

At the entrance to the *Transit Parking*, the yellow line of taxiway A splits into two lines of the same colour, one bearing the numbers 1, 2 and 3 and the other number 4, designating the parking stands (see Figure 4).

The marshaller, wearing an orange jacket and with guide wands, was positioned in the extension of the line of stand number 4 intended as the final position of the aircraft (see Figure 1).

The marshaller was facing the aircraft, which was following taxiway A and, according to his statement, indicated to the pilot that he should continue straight on, to guide him onto line 4. The commander decided of his own volition to turn right. The marshaller, again according to his statement, gave indications to correct the aircraft's trajectory. As the pilot continued his turn, the marshaller moved towards the centre of the *Transit Parking* and made a sign for him to stop.

During the turn, the copilot, sitting on the right in the cockpit, observed the right wing and indicated to his commander not to turn further to the right, and then immediately afterwards he told him to stop. The captain stopped the aircraft when the wingtip contacted, and became lodged under, the eaves of the terminal, at the south-west corner of the building.

The engines were stopped and the passengers disembarked normally. The aircraft was on the line for stands 2 and 3.

No passengers were injured; only property damage occurred.

Both pilots stated that they did not feel or hear the collision with the terminal.

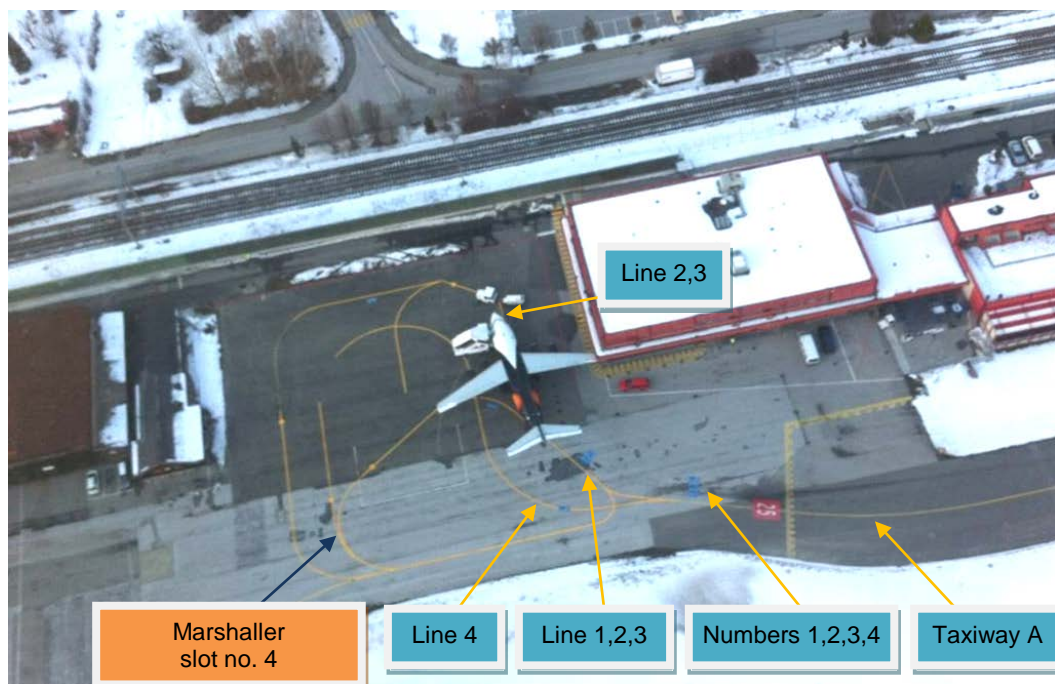


Figure 1: Aerial view of the *Transit Parking* after the accident

1.1.4	Location of the accident	Sion/VS airport (LSGS)
	Location of the accident	Sion/VS airport (LSGS)
	Date and time	26 December 2011 at 11:55 UTC
	Natural lighting conditions	Daylight
	Coordinates	N 46° 13' 09" / E 007° 19' 37" (WGS 84)
	Elevation	482 m/AMSL 1581 ft AMSL
	Location	South-west corner of the airport terminal on the <i>Transit Parking</i>
	Reference publications	AIP Switzerland, LSGS AD 2.24.1 -1 of 19 November 2009

1.2 Injuries to persons

1.2.1 Injuries to persons

Injuries	Crew	Passengers	Total persons on board	Other
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	5	54	59	1
Total	5	54	59	1

1.3 Damage to aircraft

The aircraft was badly damaged. The end of the right wing, 117 cm, was lodged under the eaves of the terminal, requiring replacement of the wingtip to enable the return flight of aircraft.

1.4 Other damage

Scratches and a slight dent in the structure of the terminal were found.

1.5 Personnel information**1.5.1 Flight Crew****1.5.1.1 Pilot/commander**

Person	British citizen, born 1949
Licence	Airline transport pilot licence aeroplane - ATPL(A) according to Joint Aviation Requirements (JAR), first issued by the Civil Aviation Authority (CAA) on 3 November 2009
Type rating	AVRORJ/BAe146, valid till 30 October 2012
Ratings	Instrument rating IR(A) Radiotelephony in English Language proficiency: English
Last proficiency test	AVRORJ/BAe146/IR, 23 October 2011
Medical certificate	Class 1, with VDL restriction (must wear corrective spectacles) and OML restriction (Class 1 valid only as or with a qualified co-pilot), valid till 12 April 2012
Last medical examination	7 October 2011

1.5.1.1.1 Flying experience, approaches and landings

Total hours	18000 hours
Of which on the type involved	7000 hours
During the last 90 days	44:15 hours
Of which on the type involved	44:15 hours
During the last 24 hours	2:00 hours
Of which on the type involved	2:00 hours
Total number of approaches	Over 8000
Of which on the type involved	Over 3000
Number of approaches during the last 90 days	47
Of which on the type involved	47
Number of landings during the last 90 days	47
Of which on the type involved	47

1.5.1.1.2	Duty times and rest periods	
	Start of duty during the 48 hours before the accident	26 December 2011 at 09:15 UTC
	Duty time during the 48 hours before the accident	3:00 hours
	Rest period during the 48 hours before the accident	45:00 hours
	Duty time at the time of the accident	2:25 hours
1.5.1.2	Copilot	
	Person	British citizen, born 1985
	Licence	Commercial pilot licence aeroplane - CPL(A) according to Joint Aviation Requirements (JAR), first issued by the Civil Aviation Authority (CAA) on 24 July 2008
	Type rating	AVRORJ/BAe146, valid till 30 March 2012
	Ratings	Instrument rating IR(A) Radiotelephony in English Language proficiency: English
	Last proficiency test	AVRORJ/BAe146/IR, 24 March 2011
	Medical certificate	Class 1, without restriction, valid till 22 April 2012
	Last medical examination	8 April 2011
1.5.1.2.1	Flying experience, approaches and landings	
	Total hours	1306 hours
	Of which on the type involved	1066 hours
	During the last 90 days	66 hours
	Of which on the type involved	66 hours
	During the last 24 hours	0 hours
	Of which on the type involved	0 hours
	As copilot	504 hours
	Total number of approaches	over 1000
	Of which on the type involved	over 700
	Number of approaches during the last 90 days	52
	Of which on the type involved	52
	Total number of landings	over 1000
	Of which on the type involved	over 500
	Number of landings during the last 90 days	25
	Of which on the type involved	25

1.5.1.2.2 Duty times and rest periods

Start of duty during the 48 hours before the accident 26.12.2011 at 09:15 UTC

Rest period during the 48 hours before the accident 40:15 hours

Duty time at the time of the accident 2:25 hours

1.5.2 Air traffic control service personnel

The controller who was occupying the Ground function and who cleared the crew of G-ZAPN to make their way to the *Transit Parking* began his career in 1989 at Sion airport. He also performed the function of OJTI (on job training instructor) there.

1.5.3 Marshaller

Sion airport marshallers could perform various functions such as those of fire-fighter, refueller or even handling agent. In particular situations like scheduled or charter flights, one aircraft responsible was appointed. His task was to locate the aircraft and organise the ground assistance.

The marshaller on duty that day had been a Sion airport employee since 2009.

He had taken a two-month training course provided internally by the head of division and by external companies, for the performance of certain tasks.

1.6 Aircraft information

1.6.1 General information

Registration	G-ZAPN
Aircraft type	BAE 146-200
Manufacturer	British Aerospace PLC
Year of manufacture	1989
Serial no.	E2119
Owner	Titan Airways Ltd, Enterprise House, Stansted Airport, Stansted, CM24 1RN, UK
Operator	Titan Airways Ltd, Enterprise House, Stansted Airport, Stansted, CM24 1RN, UK
Engines	4 x Lycoming ALF502R-5
Operating hours	Airframe: 37989:16 hours time since new – TSN
Number of airframe cycles	41921
Maximum permitted mass	42184 kg on take-off 36740 kg on landing
Mass and centre of gravity	Mass of the aircraft at the time of take-off: 39858 kg Mass at the time of the accident: 35925 kg The mass and centre of gravity were within the limits prescribed by the aircraft flight manual - AFM.

Maintenance	The last mandatory periodic <i>C-check</i> was performed on 27 October 2011, at 37 832:29 hours and 41 758 airframe cycles
Technical limitations	None
Type of fuel authorised and used on the accident flight	Jet A1 kerosene
Fuel quantity	The residual quantity on landing was approx. 4000 kg.
Registration certificate	Issued by the CAA on 20 September 1999, Certificate Number G-ZAPN/R1
Airworthiness certificate	Issued by the CAA on 7 November 2007, valid till revoked
Airworthiness review certificate	Date of issue: 15 November 2011 Date of expiry: 14 November 2012
Type of use	Commercial operation
Category	IFR category II / B-RNAV (ICAO RNAV 5)
Dimensions of the aircraft	Wingspan: 26.83 m Length: 28.60 m Height: 8.59 m

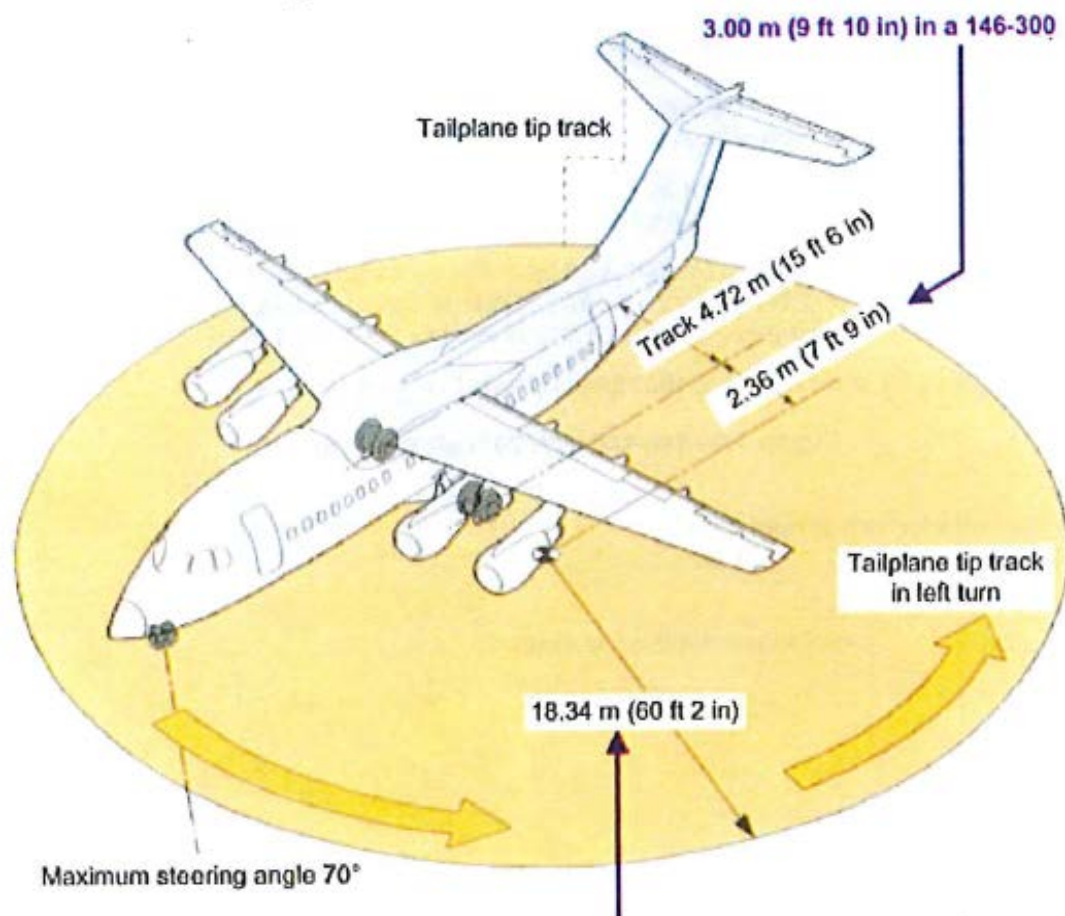


Figure 2: Turning radius, BAE 146-200 with 70° left steering
Minimum diameter permitting a 360° turn: 36.68 m

1.7 Meteorological information

1.7.1 General meteorological situation

A pronounced high pressure extended from the Bay of Biscay to the Black Sea. At altitude, a ridge extended from the eastern Atlantic to northern Germany. The Alps were on the eastern side of the ridge.

1.7.2 Meteorological conditions at the location and time of the accident

Sunny weather and light winds prevailed on the airport. A wind from the eastern sector was blowing at 5 knots and was expected to weaken in the next hour.

Weather/cloud	1/8 altocumulus, 12,000 ft AAL
Visibility	40 km
Wind	090°/ 5 kt
Temperature / dew point	0 °C / - 4 °C
Atmospheric pressure	QNH 1038 hPa

1.7.3 Astronomical information

Position of the sun	Azimuth: 186°	Elevation: 20°
Natural lighting conditions	Daylight	

1.8 Aids to navigation

Not applicable.

1.9 Communications

The radio communications between the crew and the air navigation service took place normally and without difficulty.

1.10 Aerodrome information

1.10.1 General

Sion airport is located in the Alps, some 100 km east of Geneva airport, and is used by both civil and military traffic. Civil and military air traffic control is managed by air traffic controllers employed by skyguide. The ground markings and the marshalls responsible for aircraft parking are the responsibility of Sion civil airport.

1.10.2 Runway equipment and dimensions

Runway 25 is equipped with an instrument approach system, type instrument guidance system - IGS.

Its dimensions are as follows:

Runway designations	Dimensions	Elevation of runway thresholds
25/07	2000 x 40 m	1581/1578 ft AMSL

1.11 Flight recorders

The cockpit voice recorder - CVR was no longer useful because over 30 minutes had elapsed before the power supply was switched off.

1.12 Impact information and information on the aircraft after the accident

1.12.1 Impact information

To release the aircraft, the right wingtip of which was under the eaves of the terminal, a technician sent to Sion by the operator of the aircraft carried out a transfer of fuel to the right wing and deflated the right shock absorber of the main land-

ing gear in order to lower the right wing. These measures made it possible to move the aircraft without causing any additional damage

1.12.2 Work carried out

A wingtip was fitted to the right wing on a temporary basis, to allow a ferry flight to be made to England. The aircraft took off for Stansted (EGSS) on 27 December. Subsequently, several structural elements of the right wingtip were replaced or repaired in England.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

Not applicable.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

Not applicable.

1.17 Organisational and management information

The BAE 146-200 involved in this accident belonged to the British company Titan Airways Ltd., based in Stansted/GB, which possessed an AOC (Aircraft Operator Certificate) issued by the CAA (Civil Aviation Authority). It specialised in commercial charter traffic and cargo transport.

1.18 Additional information

1.18.1 Earlier accident

On 3 March 2011, a similar incident involving a Gulfstream GV type aircraft occurred at the same location: during the parking manoeuvre to reach the same stand no. 4, the winglet of the aircraft's right wing became lodged under the eaves of the terminal.

At the time of the GV incident, the guiding line on the ground was red and the stand was named "Transit Red".

Following this incident, the management of Sion airport defined the following procedure with the Sion tower manager:

- The civil AIS will communicate to the tower the specific location assigned to by marking it on the STRIP
- the ground controller will forward to crews the routing which they are assigned in an instruction of the type "*Taxi to transit parking via RED line, follow marshaller instructions*"

In addition, the management of Sion airport decided to equip its marshaller with an orange jacket to distinguish him from other employees walking on the tarmac.

1.18.2 Ground markings at Sion airport

According to the management of Sion airport, the *Transit Parking* marking was applied in 2001. It was partially corrected following the GV incident on 3 March 2011, and this change was notified on 4 March 2011 to the FOCA as a corrective measure, following the notification of an Occurrence Report. The marking was applied on the basis of the directives of ICAO Annex 14, of ICAO Doc 9774, of the ACI (Airport Council International) manual "Apron Markings and Signs" and on CAA (Civil Aviation Authority) manual "Visual Aids Handbook".

According to the management of Sion airport, the marking is consistent with the recommendations of the ICAO and has not been the subject of a non-conformity report by the FOCA.

The management of Sion airport also stated that Sion airport is certificated by the FOCA as fulfilling the requirements on civil airport operations, in accordance with the criteria defined in Volume I of Annex 14 and in ICAO Document 9774.

1.18.3 The *Transit Parking* location

The *Transit Parking* location is primarily for aircraft whose stay on the tarmac is limited. At this location, only position 4 can be used by a BAe 146-200 type aircraft.

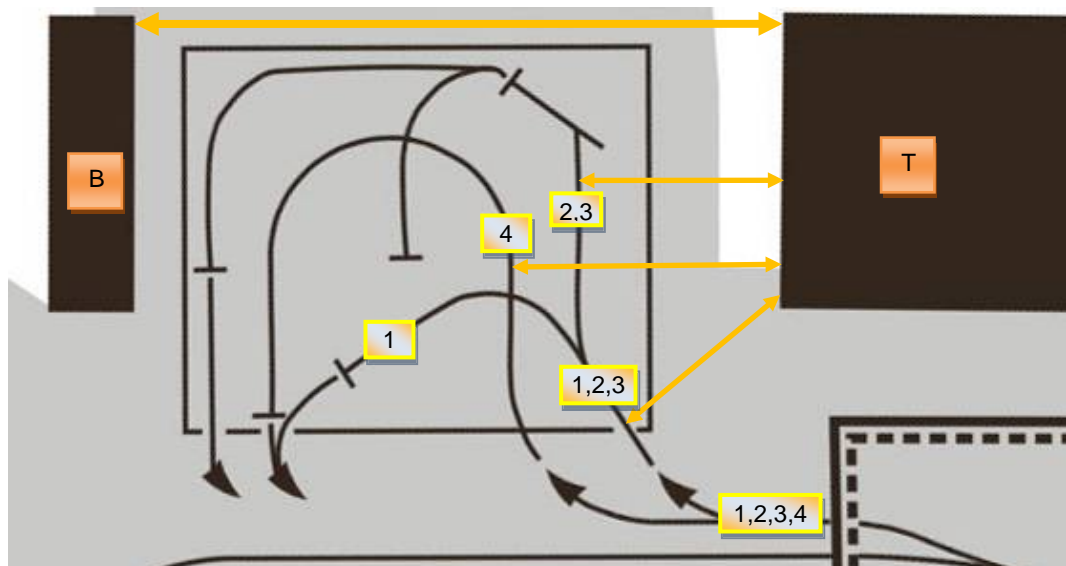


Figure 3: *Transit Parking* markings (source: AIP); the yellow arrows and the numbers have been added by the SAIB.

- Distance between Terminal T and line 1, 2, 3: 13.90 m
- Distance between Terminal T and line 2, 3: 12.60 m
- Distance between Terminal T and line 4: 19.55 m
- Distance between Terminal T and Building B: 61.10 m



Figure 4: *Transit Parking* markings



Figure 5: *Transit Parking* markings

The images above indicate the marking of the *Transit Parking* location as it was at the time of the accident. Figure 4 shows the numbering of the lines giving access to the four parking stands on the *Transit Parking*.

The numbering of the stands was not shown on the AIP ground charts; this is the official source of all publications made available to crews. Furthermore, the square shown on the chart did not correspond to the existing marking on the ground (see Figure 3).

To facilitate the allocation of parking spaces intended for this purpose, the Sion airport (Gate C) employees have available a table specifying the wingspans and maximum allowable lengths for each stand. A non-exhaustive list of the aircraft

using the tarmac at Sion completes this document, which also stipulates the wingspan and length of each type.

1.18.4 Directives intended for marshallers

These were defined in a document entitled "*Procédure de guidage des aéronefs à l'arrivée et au départ*", which means: Guidance procedure for aircraft on arrival and departure.

In addition to the general points applicable to this function, the document also specifies the gestures appropriate to all manoeuvres intended to guide an aircraft to its parking stand.

2 Analysis

2.1 Technical aspects

The investigation did not reveal any technical defect which could have contributed to or caused the accident.

2.2 Human and operational factors

The crew were aware of the specific features of the *Transit Parking*, since they had used this facility on several occasions. The ground controller ordered them to refer to the instructions of the marshaller without to instruct about the routing, contrary to what had been decided between the chief of Sion's tower and the airport management.

The commander, on his own initiative, initiated a right turn contrary to the instructions given by the marshaller. This situation may have arisen from a misunderstanding, the origin of which could not be determined. During this manoeuvre, the commander no longer had visual contact with the marshaller and was therefore unable to continue to follow his instructions.

If the aircraft had followed line "4" it would not have collided with the corner of the terminal.

The markings on the ground and more particularly the numbering give rise to confusion. In addition, the documentation available to crews was not complete with respect to the marking of the *Transit Parking*.

The presence of a person positioned between the right wing of the aircraft and the corner of the terminal could possibly have prevented the accident.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- The investigation did not reveal any technical defect which could have contributed to or caused the accident
- Structural elements of the tip of the right wing were damaged

3.1.2 Infrastructure aspects

- The yellow line "2/3" does not permit the passage of a BAE146
- The yellow line "4" does permit a BAE146 to park on the *Transit Parking*
- The illustration of the *Transit Parking* in the AIP does not mention any numbering of the tracks

3.1.3 Human aspects

- The documents provided indicate that the pilots were in possession of an adequate licence and a valid medical certificate
- There is no indication that their state of health was affected at the time of the accident

3.1.4 History of the flight

- The crew has not been instructed by the ground controller about the track to follow when entering the Transit Parking, contrary to what had been decided following the GV incident
- A single marshaller was present to guide the aircraft and ensure that it used the correct track
- The crew initiated a right turn too early
- The marshaller was equipped with visible gear on the tarmac

3.1.5 General conditions

The weather conditions did not play a role in this accident

3.2 Causes

The accident is due to a collision between the aircraft and the airport terminal following a crew's routing error.

Factors, which contributed to the accident:

- No instruction of the routing by the ground controller
- Only one single marshaller available
- Markings leading to confusion

4 Safety recommendations and measures taken since the accident

4.1 Safety recommendations

None.

4.2 Measures taken since the accident

Mails were exchanged between the Federal Office of Civil Aviation (FOCA), skyguide and the management of Sion airport to establish an adequate procedure for the parking of aircraft on the *Transit Parking*.

According to the information received by the management of Sion airport, the following measures were taken:

- For Titan Airways flights, the presence of a wingman at the entrance of the *Transit Parking* ensuring the passage between the aircraft's wing and the terminal.
- Reminder to skyguide about the agreement for the procedure regarding the indication to the crew of the position number in the *Transit Parking*.

The management of Sion Airport also said that the following work is completed or being completed:

- Demolition of the first wooden building on the west side of the *Transit Parking* (space saving 11meters).
- Change of marking of the yellow line 4 (plans sent to the FOCA for approval).
- Publication in the AIP of a *Ground Movement Chart* including the *Transit Parking* (ongoing by the charting of the FOCA).

Payerne, 22 May 2013

Swiss Accident Investigation Board

This final report was approved by the management of the Swiss Accident Investigation Board SAIB (Art. 3 para. 4g of the Ordinance on the Organisation of the Swiss Accident Investigation Board of 23 March 2011).

Berne, 9 July 2013