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Swiss Accident Investigation Board SAIB

Aviation Division

Final Report No. 2166 by the Swiss Accident Investigation Board SAIB

concerning the serious incident – Airprox

involving the Airbus A320-232 aircraft,
under radio call sign CFG 366

and the Airbus A340-642 aircraft,
under radio call sign QTR 020

on 25 October 2010

3 NM north-east DVOR Trasadingen TRA

General information on this report

This report contains the Swiss Accident Investigation Board's (SAIB) conclusions on the circumstances and causes of the serious incident which is the subject of the investigation.

In accordance with Art 3.1 of the 10th edition, applicable from 18th November 2010, of Annex 13 to the Convention on International Civil Aviation 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 investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

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

All times in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the serious incident, Central European Summer Time (CEST) applied as local time (LT) in Switzerland. The relation between LT, CEST and UTC is:
LT = CEST = UTC + 2 hours.

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Final Report

Synopsis

Aircraft 1	
Owner	Wells Fargo Bank Northwest, National Association, Salt Lake City, Utah, USA
Operator	White Airways S.A., 2740-303 Porto Salvo, Portugal
Manufacturer	Airbus S.A.S, Toulouse, France
Aircraft type	A320-232
Country of registration	Portugal
Registration	CS-TQK
ATC call sign	CFG 366
Radio call sign	Condor three six six
Flight rules	IFR
Type of operation	Charter flight on behalf of Condor Flugdienst GmbH
Departure point	Munich (EDDM)
Destination point	Palma de Mallorca (LEPA)
Aircraft 2	
Owner	Mukeinis Leasing Limited, Qatar
Operator	Qatar Airways, Doha, Qatar
Manufacturer	Airbus S.A.S, Toulouse, France
Aircraft type	A340-642
Country of registration	Qatar
Registration	A7-AGB
ATC call sign	QTR 020
Radio call sign	Qatari zero two zero
Flight rules	IFR
Type of operation	Scheduled flight
Departure point	Paris Charles de Gaulle (LFPG)
Destination point	Doha (OTBD)
Location	3 NM north-east DVOR Trasadingen TRA
Date and time	25 October 2010, 17:43 UTC
ATS unit	Zurich ACC
Airspace	Class C
Closest point of approach of the aircraft	3.1 NM laterally and 500 ft vertically
Applicable minimum separation	5 NM laterally or 1000 ft vertically
Airprox category of the serious incident	ICAO category A - high risk of collision

Investigation

The serious incident occurred on 25 October 2010 at 17:43 UTC. The notification was received by the Aircraft Accident Investigation Bureau (AAIB) on 28 October at 06:22 UTC. After comprehensive preliminary clarifications, which are usually necessary with this type of serious incident, the investigation was opened on 8 November 2010.

The AAIB reported the serious incident to the authorities of the Republic of Portugal and the Emirate of Qatar. Both countries designated an authorised representative.

The present final report is published by the Swiss Accident Investigation Board.

Summary

On the evening of 25 October 2010, among other aircraft, three aircraft were at or climbing to flight level (FL) 370 under the control of sector M5/M6 of the Zurich Area Control Centre (Zurich ACC). Two of them were flying eastward (QTR 020 and IJM 539); the westward flight path of the third aircraft (CFG 366) was planned by air traffic control sector M5/M6 between the other two. The air traffic control's plan to keep the involved airplane on track by giving radar headings and let the CFG 366 climb to FL 370 and let it pass behind IJM 539 led to distances close to the applicable minimum separation. This triggered a traffic advisory (TA) in the CFG 366. Because the separation of CFG 366 to QTR 020, the latter on a direct course to waypoint MADEB, was also close to the applicable minimum separation and led the crew of CFG 366, in contrary to the given radar heading, to initiate a right turn on their own authority that triggered a further TA in their cockpit. This TA was triggered 39 seconds after the end of the first TA. The two aircraft CFG 366 and QTR 020 closed to a lateral separation of 3.1 NM. The altitude difference at this time was 500 ft.

Causes

The serious incident is attributable to the fact that the crew of an aircraft, during night and based on visual contact to another aircraft plus a traffic advisory from their traffic alert and collision avoidance system, initiated on its own authority a lateral and vertical avoidance manoeuvre. The result was that an inadvertent convergence of this aircraft and another occurred, involving a high risk of collision.

The fact that the supervising air traffic controller was unable to interfere because of a technical fault may possibly have contributed to the serious incident.

The following factors did not directly cause the serious incident but have, in the context of the investigation, been identified as factors to risk:

- The air traffic control did not provide a traffic information to the crew of the involved aircraft although they had chosen a separation concept that led to distances close to the minimum separation and resulted in a triggering of a traffic alert in the traffic alert and collision avoidance system.

1 Factual information

1.1 Prehistory and history of the serious incident

1.1.1 General

For the following description of the prehistory and the history of the serious incident, the recordings of the radiotelephony, radar data and the statements of the crew members and air traffic control officers were used.

At the time of the serious incident the copilot was acting as pilot flying (PF) and the commander was acting as pilot not flying (PNF) in the cockpit of the aircraft with the ATC call sign CFG 366. With regard to the crew of the aircraft with the ATC call sign QTR 020, the commander was pilot flying (PF) and the copilot was pilot not flying (PNF).

Both flights were conducted under instrument flight rules.

In air traffic control, Zurich Area Control Centre (Zurich ACC) was involved with the combined workstations M5 and M6.

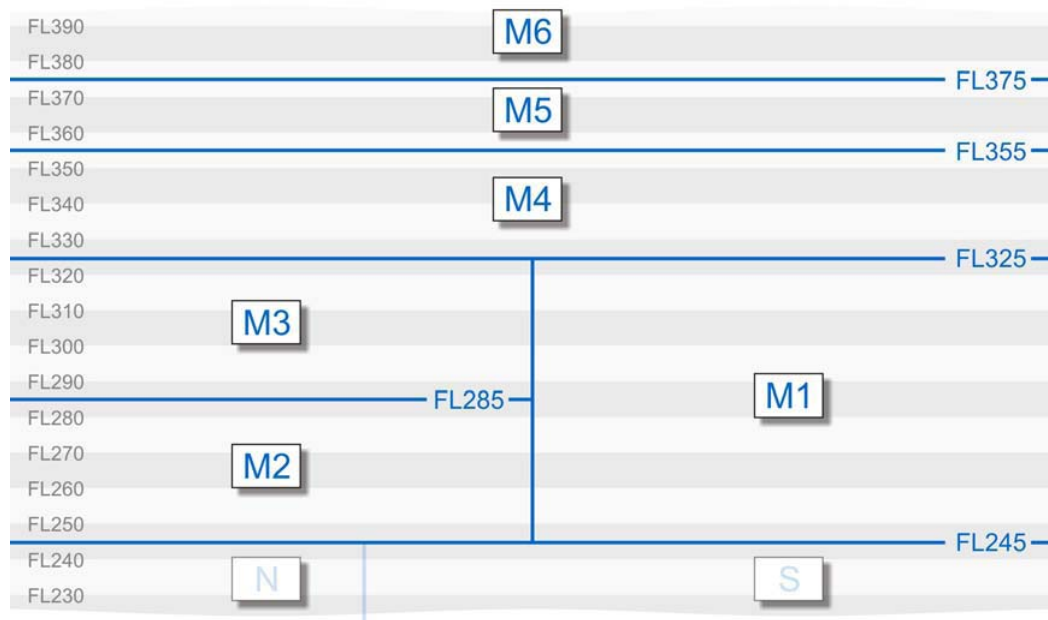


Figure 1: Schematic representation of the distribution of upper airspace in ACC Zurich.

1.1.2 Prehistory

The two control sectors M5 and M6 had been combined for technical reasons related to traffic. The reason for the combination was, according to the air traffic control officers (ATCOs) who were asked, the very low volume of traffic in both sectors. The altitude in sector M5/M6 to be controlled included all flights at flight level (FL) 360 and above.

The workstations in sector M5/M6 consisted of the radar executive M5/M6 (RE M5/M6) and the radar planner M5/M6 (RP M5/M6). At the RE M5/M6 workstation there was a trainee air traffic control officer undergoing on-the-job training and the coach who was supervising her. Both were working with a headset. The RP M5/M6 position was occupied by another ATCO.

According to the statements of the ATCOs who were asked, up to the time of the serious incident they did not notice any technical limitations or potential sources of disruption in their workstation environment. Both the coach and the trainee

classified the volume of traffic as low and the state of training of the trainee as adequate.

According to the information from the two crews, their flights up to the time of the serious incident were uneventful.

1.1.3 History of the serious incident

At the time of the serious incident, among other aircraft, three aircraft were at or climbing to flight level (FL) 370 under the control of sector M5/M6 of the Zurich Area Control Centre (Zurich ACC). Two of them, QTR 020 and IJM 539, were flying eastward at FL 370. The third aircraft, with the ATC call sign CFG 366, was climbing from FL 350 to FL 370 in a westerly direction. The control sector M5/M6 air traffic control officer had planned its flight path between the other two with a distance close to the required minimum separation.

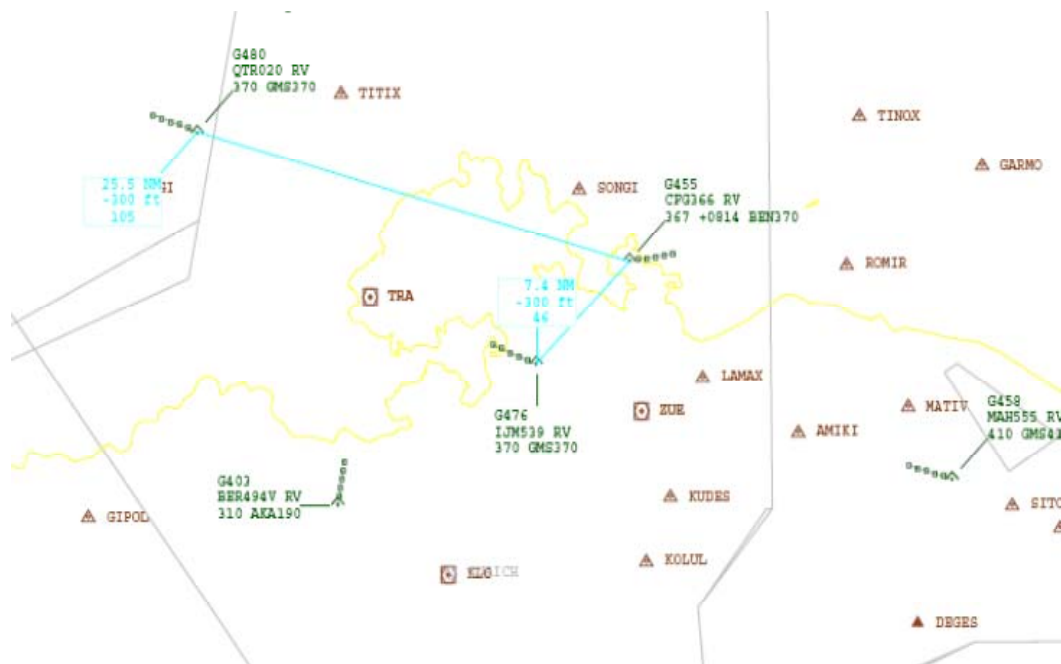


Figure 2: Recording of the radar data display shortly before the serious incident.

For this purpose, the trainee instructed the crews of CFG 366 and the IJM 539 to continue on the heading they had adopted; in addition, she cleared QTR 020 directly to waypoint MADEB. By means of these instructions the air traffic control officer intended to ensure the prescribed separation between these three aircraft.

At 17:40:45 UTC the TCAS¹ in the CFG 366 triggered a traffic advisory (TA).

At 17:40:55 UTC the crew of CFG 366 stopped their climb at FL 367. At 17:41:05 UTC, the crew of CFG 366 reported to the air traffic control as follows: "We are climbing at level three seven zero, present heading, we are turning right now, ten degrees, we have traffic ahead, over us at three hundred feet on TCAS".

At 17:41:19 UTC the air traffic control's short term conflict alert system (STCA) triggered an alarm.

Immediately, at 17:41:21 UTC, the trainee instructed CFG 366 to turn 25 degrees left: "Condor three six six, turn left, I say again, left by two five degrees". The crew of CFG 366 had visual contact to an aircraft but was already in a right turn

¹ TCAS -Traffic Alert and Collision Avoidance System. For details cf. section 1.7.2 respectively 1.7.2.3

and answered at 17:41:27 UTC: *"Now, we are turning right, we have a traffic"*. The trainee then issued CFG 366 at 17:41:31 UTC a traffic information concerning QTR 020 and again instructed them to make a left turn: *"Condor three six six, negative, traffic at your one o'clock position on your right, turn left!"* This was the first traffic information transmitted by the air traffic control. A few seconds later, at 17:41:37 UTC, the crew of CFG 366 reported: *"OK, would like that to descend?"* At about the same time, they stopped their right turn and started to turn to the left.

Shortly afterwards, at 17:41:40 UTC, the supervising coach decided to take over traffic control and to conduct radio communications using his headset. He informed his trainee of this and attempted for some 70 seconds to give various instructions; among other things he instructed CFG 366 to descend to FL 360. On the radiotelephony recording, these instructions from the coach cannot be heard; only the radio communications of other crews and a crackling noise are audible during the coach's transmissions.

At 17:41:55 UTC, when the aircraft was at FL 368, the crew of CFG 366 initiated a descent to FL 365.

The two aircraft involved closed to a lateral separation of 3.1 NM and an altitude difference of 500 ft.

In the transcription of radio traffic at this time the expression "blocked mike" is mentioned several times. When the coach was asked, he stated that he had the impression that the crew of CFG 366 were blocking the frequency with their microphone. He had the impression that his instructions were not being sent or were not being received. That's why he used his hand-held microphone thereafter. Doing so he immediately was able to establish contact again with the aircraft involved. The data that could be downloaded from the flight data monitoring recorder of the CS-TQK show that the crew activated the push-to-talk-button only during short periods of time. The longest time period was twelve seconds. CFG 366 did not block the frequency. The reason for the coach's impression was a malfunction of his headset.

The ATCO subsequently wrote a safety improvement report (SIR), in which he described the problem to the competent technical department and expressed his concerns. According to information from Skyguide, the problem was subsequently resolved.

Both flight crews indicated that they had received a traffic advisory (TA) from their TCAS and at no time an instruction to resolve the conflict (resolution advisory - RA). Both aircraft continued their flights to their scheduled destinations after the serious incident.

1.1.4 Location of the serious incident

Geographical position	3 NM north-east of DVOR Trasadingen TRA
Date and time	25 October 2010, 17:43 UTC
Lighting conditions	Night
Height above sea level or flight level	FL 370

1.2 Personnel information

1.2.1 Crew of CFG 366

1.2.1.1 Commander

Person	Portuguese citizen, born 1954
Licence	Airline transport pilot licence aeroplane – ATPL(A) according to joint aviation requirements (JAR), first issued by the Portuguese Civil Aviation Authority on 2 October 1984
Ratings	Type rating Airbus A320 as commander, valid till 30 November 2011 International radiotelephony for flights according to visual and instrument flight rules RTI (VFR/IFR) Language proficiency English level 5, valid till 31 October 2016
Instrument flying rating	Instrument flight multi-engine, valid till 30 November 2011
Training on TCAS	Initial training at Flight Safety, Paris Le Bourget, during a conversion within Portugalia Airlines, 6 March 2001 Recurrent training at White Airways, 19 May 2010
Medical fitness certificate	Medical Class 1, VDL restriction (shall wear corrective lenses and carry a spare set of spectacles). Issued on 7 January 2010, valid till 23 January 2011

1.2.1.1.1 Flying experience

Total	18 220:15 hours
on the type involved in the incident	1427:52 hours
during the last 90 days	178:32 hours
of which on the type involved in the incident	178:32 hours

1.2.1.1.2 Duty times

Start of duty in the 48 hours before the serious incident	23 October 2010: 01:45 UTC 24 October 2010: 07:00 UTC 25 October 2010: 16:00 UTC
End of duty in the 48 hours before the serious incident	23 October 2010: 08:54 UTC 24 October 2010: 15:31 UTC
Flight duty times in the 48 hours before the serious incident	23 October 2010: 7:09 hours 24 October 2010: 8:31 hours
Rest times in the 48 hours before the serious incident	23/24 October 2010: 22:06 hours 24/25 October 2010: 24:29 hours

	Flight duty time at the time of the serious incident	1:43 hours
1.2.1.2	Copilot	
	Person	Portuguese citizen, born 1964
	Licence	Airline transport pilot licence aeroplane – ATPL(A) according to joint aviation requirements (JAR), first issued by the Portuguese Civil Aviation Authority on 20 November 2007
	Ratings	Type rating Airbus A320 as copilot, valid till 31 July 2011 International radiotelephony for flights according to visual and instrument flight rules RTI (VFR/IFR) Language proficiency English level 5, valid till 30 June 2016
	Instrument flying rating	Instrument flight, multi-engine aeroplane valid till 31 July 2011
	Training on ACAS	Initial training during training to acquire L-1011 type rating, acquired through Air Luxor in Bournemouth, UK, 29 August 2003 Recurrent training during training to acquire A320 type ratings, by Omni Aviation Training Center, 17 July 2010
	Medical fitness certificate	Class 1, VNL restriction (shall have available corrective spectacles), issued on 24 May 2010, valid till 23 June 2011
1.2.1.2.1	Flying experience	
	Total	3423:10 hours
	on the type involved in the incident	236:50 hours
	during the last 90 days	167:39 hours
	of which on the type involved in the incident	167:39 hours
1.2.1.2.2	Duty times	
	Start of duty in the 48 hours before the serious incident	23 October 2010: 01:45 UTC 24 October 2010: 07:00 UTC 25 October 2010: 16:00 UTC
	End of duty in the 48 hours before the serious incident	23 October 2010: 08:54 UTC 24 October 2010: 15:31 UTC
	Flight duty times in the 48 hours before the serious incident	23 October 2010: 7:09 hours 24 October 2010: 8:31 hours
	Rest times in the 48 hours before the serious incident	23/24 October 2010: 22:06 hours 24/25 October 2010: 24:29 hours

	Flight duty time at the time of the serious incident	1:43 hours
1.2.2	Crew of QTR 020	
1.2.2.1	Commander	
	Person	Iranian citizen, born 1955
	Licence	Air transport pilot licence aeroplane (ATPL(A)), issued by the Qatar Civil Aviation Authority on 21 May 2008
	Ratings	Type rating Airbus A340 as commander International radiotelephony for flights according to instrument flight rules RTI (IFR) as part of licence Language proficiency English level 5
	Instrument flying rating	Instrument flying aeroplane
	Training on TCAS	Basic training 31 October 2005 Last recurrent training: 20 June 2009
	Medical fitness certificate	Class 1, VNL restriction (shall have available corrective spectacles), issued on 4 July 2010, valid till 31 July 2011
1.2.2.1.1	Flying experience	
	Total	17 000 hours
	on the type involved in the incident	2349 hours
	during the last 90 days	221:11 hours
	of which on the type involved in the incident	221:11 hours
1.2.2.1.2	Duty times	
	Start of duty in the 48 hours before the serious incident	23 October 2010: 22:55 UTC 25 October 2010: 16:05 UTC
	End of duty in the 48 hours before the serious incident	24 October 2010: 05:57 UTC
	Flight duty times in the 48 hours before the serious incident	23/24 October 2010: 7:02 hours
	Rest times in the 48 hours before the serious incident	36:48 hours
	Flight duty time at the time of the serious incident	0:48 hours

1.2.2.2	Copilot	
	Person	Argentinean citizen, born 1963
	Licence	Air transport pilot licence aeroplane (ATPL(A)), issued by the Qatar Civil Aviation Authority on 28 May 2009
	Ratings	Type rating Airbus A340 as copilot International radiotelephony for flights according to instrument flight rules RTI (IFR) as part of licence Language proficiency English level 5
	Instrument flying rating	Instrument flight aeroplane
	Training on ACAS	Basic training 1994, Bombardier, Learjet initial course, last recurrent training on 3 September 2010
	Medical fitness certificate	Class 1, VDL restriction (shall wear corrective lenses and carry a spare set of spectacles), issued on 23 November 2009, valid till 30 November 2010
1.2.2.2.1	Flying experience	
	Total	11 251:09 hours
	on the type involved in the incident	3000 hours
	during the last 90 days	200 hours
	of which on the type involved in the incident	200 hours
1.2.2.2.2	Duty times	
	Start of duty in the 48 hours before the serious incident	23 October 2010: 22:55 UTC 25 October 2010: 16:05 UTC
	End of duty in the 48 hours before the serious incident	24 October 2010: 05:57 UTC
	Flight duty times in the 48 hours before the serious incident	23/24 October 2010: 7:02 hours
	Rest times in the 48 hours before the serious incident	36:48 hours
	Flight duty time at the time of the serious incident	0:48 hours

1.2.3	Air traffic control personnel	
1.2.3.1	Air traffic control officer 1	
	Function	RE M5/M6 coach
	Person	Swiss citizen, born 1977
	Duty days before the day of the incident	24 October 2010 off duty
	Start of duty on the day of the incident	14:50 UTC
	Licence	Licence for air traffic control officer, based on European Community Directive 2006/23; first issued by the Federal Office of Civil Aviation (FOCA) on 27 January 1999, valid till 10 March 2011
	Relevant ratings	Air traffic control with radar in ACC Zurich (upper and lower sectors) valid till 10 March 2011. Supplementary rating for: on the job training instructor (OJTI), examiner/assessor (examiner – EXM) valid till 10 March 2011
	Medical fitness certificate	Class 3, VDL restriction (shall wear corrective lenses and carry a spare set of spectacles), issued on 26 February 2010, valid till 10 March 2011
1.2.3.2	Air traffic control officer 2	
	Function	RE M5/M6 trainee
	Person	Swiss citizen, born 1988
	Duty days before the day of the incident	24 October 2010 off duty
	Start of duty on the day of the incident	14:50 UTC
	Licence	Licence for air traffic control officer in training, based on European Community Directive 2006/23; first issued by the Federal Office of Civil Aviation (FOCA) on 17 July 2009, valid till 17 September 2011
	Relevant ratings	Air traffic control under supervision with radar in ACC Zurich (upper sectors) valid till 17 September 2011
	Medical fitness certificate	Class 3, VDL restriction (shall wear corrective lenses and carry a spare set of spectacles) issued on 1 September 2009, valid till 1 September 2011

1.3 Aircraft information

1.3.1	CFG 366	
	Registration	CS-TQK
	Aircraft type	A320-232
	Characteristics	Twin-jet short-haul and medium-haul aircraft
	Manufacturer	Airbus S.A. S., Toulouse, France
	Owner	Wells Fargo Bank Northwest, National Association, Salt Lake City, Utah, USA
	Operator	White Airways S.A., 2740-303 Porto Salvo, Portugal
	ACAS equipment	TCAS: Manufacturer: Honeywell (Serial no.: 066-50000-2220); software installed: 20/5

1.3.2 QTR 020

	Registration	A7-AGB
	Aircraft type	A340-642
	Characteristics	Four-jet long-haul aircraft
	Manufacturer	Airbus S.A. S., Toulouse, France
	Owner	Mukeinis Leasing Limited, Qatar
	Operator	Qatar Airways, Doha, Qatar
	ACAS equipment	TCAS: Manufacturer: Thales; software installed: TDB040W

1.4 Meteorological information

1.4.1 General

The information in sections 1.4.2 – 1.4.6 was provided by MeteoSwiss and are translated from German.

1.4.2 General meteorological situation

At low altitudes, a pronounced depression over the Gulf of Genoa and an area of high pressure over southern England resulted in a 'Bise' northerly airflow. With an upper low pressure zone over southern France, light winds from a northerly direction prevailed in the area in which the serious incident occurred.

1.4.3 Weather at the time of the serious incident

The following information on the weather at the time of the serious incident is based on a spatial and chronological interpolation of the observations of different weather stations.

On the basis of the listed information, it is possible to conclude that the weather conditions at the time and in the area of the serious incident were as follows:

Cloud	Clear of cloud
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Visibility	Over 20 km
Wind	South-westerly wind at 30 kt
Temperature/dewpoint	-52 °C / -75 °C
Atmospheric pressure	Not relevant
Hazards	None detectable

1.4.4 Astronomical information

Position of the sun	Below the horizon
Lighting conditions	Night

1.4.5 Significant weather chart

The significant weather chart (FL 100 - FL 450) issued by WAFC London indicates moderate icing and moderate turbulence between FL 150 and below FL 100. On wind chart FL 390, northerly winds at 40 kt and a temperature of minus 54 °C were forecast for this region; on wind chart FL 340 the forecast was also for northerly winds at 40 kt and minus 54 °C.

1.4.6 Weather according to the flight crews

According to the statements of both flight crews the aircraft were outside of cloud in visual flight conditions.

1.5 Communications

Radio communications between the crews and the air traffic control centre concerned took place normally and without difficulties up to the time of the serious incident. In the radio communications recording, from the time the supervising M5/M6 ATCO assumed air traffic control his radio messages using the headset are only perceptible as a crackling noise on the frequency for a period of approximately 70 seconds. Only after he switched to the hand-held microphone were his instructions loud and clearly audible.

1.6 Airspace information

The serious incident occurred in class C airspace of the Zurich Area Control Centre (ACC Zurich). The required minimum separations in this section of the airspace are 5 NM laterally or 1000 ft vertically.

A schematic representation of the breakdown of the upper airspace in ACC Zurich as well as a radar recording of the flight paths of the aircraft involved are provided in figures 1 (chapter 1.1.1) and 2 (chapter 1.1.3).

1.7 Additional information

1.7.1 General points on safety nets

In class C airspace, air traffic control ensures that the required lateral and vertical separations are ensured between aircraft which are flying under instrument flight rules. For this purpose, air traffic control can assign flight paths, flight levels and airspeed instructions and assign rates of climb and descent.

If the instructions of air traffic control, the behaviour of pilots or other factors cause the minimum separations to be violated, air traffic control is equipped with

a collision warning system (short term conflict alert - STCA). This alerts air traffic control officers and usually requires immediate intervention.

The final safety net is the airborne collision avoidance system (ACAS) installed on aircraft, which works solely on the basis of the data exchanged between the aircraft and therefore works independently of the ground.

1.7.2 Airborne collision avoidance system II

1.7.2.1 General

Since 1 January 2000 it has been mandatory in Europe for commercial flights by turbine engine powered aircraft with a maximum permitted take-off mass in excess of 15 000 kg or with more than 30 seats to carry a collision avoidance system conforming to the ACAS II standard.

Since 1 January 2005 it has been also mandatory for aircraft with a maximum permitted take-off mass in excess of 5700 kg or with more than 19 seats to carry a collision avoidance system conforming to the ACAS II standard.

1.7.2.2 Definitions

- a) An airborne collision avoidance system is a system permanently installed in the aircraft which is based on secondary radar transponder signals and which works independently of ground-based systems. It issues advisories and avoidance commands to the pilot, in order to avoid possible conflicts with other aircraft which are also equipped with secondary radar transponders.
- b) ACAS II is an airborne collision avoidance system which in addition to traffic advisories also issues vertical avoidance commands (resolution advisories).
- c) A resolution advisory (RA) is an instruction to the crew to climb or descend with the purpose of establishing adequate separation from aircraft which are dangerously close or to carry out a climb, descent or level flight so that existing vertical separation is maintained.
- d) A traffic advisory (TA) is a notification which informs the crew that an aircraft in the vicinity could represent a possible danger.

1.7.2.3 Technical implementation

The standards of ACAS II are usually implemented by a traffic alert and collision avoidance system (TCAS).

Like a secondary radar, the TCAS emits signals and on the basis of ATC transponder signals of other aircraft determines their position and movement vector; it then uses its own position and direction of motion to calculate a closest point of approach (CPA). In the event of convergence of another aircraft, a traffic advisory (TA) is issued acoustically and optically; in the event of continued, dangerous convergence, an acoustic and optical avoidance instruction (a resolution advisory - RA) is issued.

The acoustic traffic advisory (TA) "*traffic, traffic*" sounds when aircraft are approximately 40 seconds from the CPA.

The acoustic and optical resolution advisory (RA) is issued as a function of the flight altitude and is activated when aircraft are approximately 25 seconds from the CPA. There are two types of resolution advisories: corrective RAs, which demand a change in vertical speed, and preventive RAs, which demand not to change vertical speed.

1.7.2.4 Principles

1.7.2.4.1 Excerpt from ICAO PANS-OPS Document 8168

"3.1.1 Airborne collision avoidance system (ACAS) indications shall be used by pilots in the avoidance of potential collisions, the enhancement of situational awareness, and the active search for, and visual acquisition of, conflicting traffic

3.1.2 Nothing in the procedures specified in 3.2, 'Use of ACAS indicators', shall prevent pilots-in-command from exercising their best judgement and full authority in the choice of the best course of action to resolve a traffic conflict or avert a potential collision.

Note 1.- The ability of ACAS to fulfill its role of assisting pilots in avoidance of potential collisions is dependent on the correct and timely response by pilots to ACAS indications. Operational experience has shown that the correct response by pilots is dependent on the effectiveness of the initial and recurrent training in ACAS procedures.

3.2 Pilots shall not manoeuvre their aircraft in response to traffic advisories (TA) only.

Note 1: TA's are intended to alert pilots to the possibility of a resolution advisory (RA), to enhance situational awareness, and to assist in visual acquisition of conflicting traffic. However, visually acquired traffic may not be the same traffic causing a TA. Visual perception of an encounter may be misleading, particularly at night.

Note 2: The above restriction in the use of TA's is due to the limited bearing accuracy and to the difficulty in interpreting altitude rate from displayed traffic information."

1.7.2.4.2 Excerpt from ICAO Document "ACAS-Training Guidelines for Pilots, Attachment Part III, Section III, Chapter III"

"ACAS Limitations

Objective: to verify that the pilot is aware of the limitations of ACAS

Criteria: the pilot must demonstrate a knowledge and understanding of the ACAS limitations including:

- e) Because of design limitations, the bearing displayed by ACAS is not sufficiently accurate to support the initiation of horizontal manoeuvres based solely on the traffic display"*

1.7.2.4.3 Excerpts from the Eurocontrol's ACAS bulletin no. 6

Eurocontrol, the European organisation for flight safety in air navigation, has published a series of so-called ACAS bulletins for training purposes. Bulletin no. 6, entitled '*Incorrect use of the traffic display*', relates several cases in which flight crews themselves changed course on the basis of the display of aircraft on the TCAS display. In these bulletins the following gists are defined:

"The TCAS traffic display is not a radar display"

"The TCAS traffic display must not be used for self-separation"

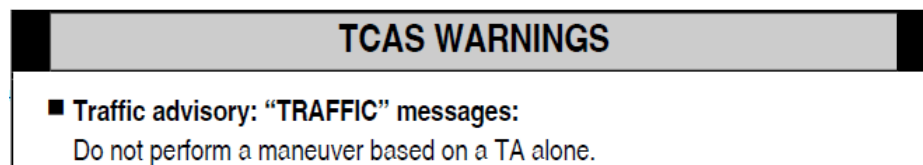
1.8 Crew behaviour

1.8.1 Crew of CFG 366

On the basis of the air traffic control officer's separation concept, CFG 366 would have passed IJM 539 with a lateral separation of about 6 nautical miles and would have reached FL370 approximately at this time. The essential minimum lateral separation was 5 NM.

The crew of CFG 366 detected an aircraft on their NAV display. Furthermore they recognized an aircraft visually. This was IJM 539, which was flying south of their flight path on an approximately opposing heading. The crew of CFG 366 got the impression that their actual flight path would lead to a conflict with the aircraft they had visually recognized. As they crossed, the TCAS of CFG 366 triggered a traffic advisory (TA), on the basis of which the crew of CFG 366 decided to carry out an avoidance manoeuvre in the form of a right turn. This turn led to the conflict with QTR 020. The TCAS of both aircraft triggered a traffic advisory (TA).

The aircraft manufacturer Airbus describes in the Quick Reference Handbook (QRH) the procedure which must be applied as the result of a traffic advisory:



A vertical avoidance manoeuvre commanded by the TCAS would have been necessary only on the basis of a resolution advisory (RA).

1.8.2 Crew of QTR 020

The crew of QTR 020 realised on the radio that a conflict had occurred between two other aircraft on the frequency. The crew mentioned in their statement concerning the serious incident that they identified the aircraft turning towards them on their NAV display and that this had triggered a traffic advisory in their aircraft. They maintained their flight path, assigned by the air traffic control, "*direct to MADEB*". On the radio the crew of QTR 020 mentioned that the distance to the crossing aircraft was "*a little bit too close*". The crew of QTR 020 had no visual contact to the CFG 366.

1.8.3 TCAS Training

All the pilots involved in the serious incident provided information on initial TCAS training, some of which had been more than 10 years in the past. Information is also available on TCAS recurrent training of the crews involved for all pilots.

According to Appendix 2 of JAR-FCL 1.240 an "ACAS event" must be trained for on the occasion of each periodic licence proficiency check. A licence proficiency check is valid for 12 months and is required for the extension of the type rating.

2 Analysis

2.1 Technical aspects

For the aircraft involved there are no indications of any pre-existing technical defects which might have caused or influenced the serious incident.

The fact that the instructions given via the supervising coach's headset were only perceptible as a crackling noise for some 70 seconds after the air traffic control take-over indicates a technical fault. According to information from the coach, this fault was in the plug-in connection of the workstation headset. For this reason, the coach wrote a safety improvement report (SIR) for the attention of the competent technical department.

The technical faults in the supervising air traffic control officer's headset demonstrate a basically risk because it hampered his intervention. It especially prevented an immediate answer by the coach to the CFG 366 crew's shortly before asked question whether they should start a descend. In the present case the supervising air traffic control officer could only interfere at the time where the minimum separation was already undershoot. It cannot be said with certainty whether there had been enough time left to mitigate the serious incident without these technical faults. However it is a fact that the supervising air traffic control officer could only communicate with the crew involved after the closest convergence of the two aircraft.

2.2 Human and operational aspects

2.2.1 Air traffic control

The air traffic control officer in training in sector M5/M6 had informed the coach that three aircraft which were all at FL 370 in principle had sufficiently safe separation. CFG 366 in particular, which was flying westward, had sufficient distance but only little above the minimum required separation from IJM 539 which was flying towards it from the opposite direction. To ensure this, she gave both aircraft an instruction to maintain their present heading. At the same time she cleared QTR 020 to fly direct to waypoint MADEB, which would have meant a flight path slightly north of the TRA beacon and which would therefore have resulted in an slightly greater lateral distance from CFG 366.

These instructions would have meant that these three aircraft would have crossed with a lateral separation of 6 - 8 NM. This type of separation concept is frequently used to guarantee the necessary minimum separation between aircraft. The supervising coach agreed with the suggested solution and allowed the trainee to continue to work.

In the course of the crossing, distances and approaching speeds arose, which led the TCAS of CFG 366 to trigger a traffic advisory (TA).

Such a traffic advisory can be triggered even if the minimum required separation is still granted as it was in the present case. Air traffic control is not committed to give traffic information in such cases but can help that crews involved get an increased situational awareness and are able to understand the air traffic control's separation concept. Even if the separation concept used and the lack of traffic information did not cause the serious incident directly, the SAIB categorizes these two factors as an increase in risk and therefore in the sense of flight safety as improvable.

The trainee reacted immediately to the message from CFG 366 to change its allocated heading and to execute a ten degree right turn because of a traffic advisory.

sory from its on-board TCAS. She realised immediately that a conflict with the opposing QTR 020 would arise and therefore instructed the aircraft not to turn right but to make a 25 degree left turn. These instructions were appropriate to the situation and would have mitigated the situation. But at this time the CFG 366 was already in a right turn initiated on its own authority. Since it takes some time on high altitudes until the aircraft does change from a turn to one side to a turn to the other side, this instruction could not mitigate the situation anymore.

The supervising coach also identified the impending conflict immediately and therefore decided to take over traffic control in sector M5/M6. The decision to carry out traffic control himself and to replace the trainee was safety-conscious and was implemented in good time. However, for the technical reasons described in section 2.1, the coach's instructions could make no contribution to mitigate the serious incident.

2.2.2 Crews

2.2.2.1 CFG 366

The crew of CFG 366, on the basis of a traffic advisory of their traffic alert and collision avoidance system, carried out a lateral and vertical avoidance manoeuvre on their own initiative, which led to the convergence with QTR 020. Despite active intervention by the trainee, the crew of CFG 366 could not be dissuaded from their intention and insisted on resolving themselves the convergence supposedly identified by them.

The behaviour of the CFG 366 crew, being alerted by a traffic advisory and which had visual contact to an aircraft can partially comprehend to in the aspect that they tried to avoid a possible resolution advisory that had possibly led to an abrupt change from climb into descend after the cabin crew has already started the on-board service. On the other hand it must be stated that initiating an avoidance manoeuvre on its own initiative, laterally or vertically, without coordination with air traffic control shows an insufficient understanding of the principles, which are the basis of the air traffic control work. A crew can never be sure that a visual recognized aircraft is identical with the one that is visible on their TCAS display. This is also true vice versa. To recognize an aircraft during night, to reckon his direction of motion in relation to the own direction of motion and to initiate an avoidance manoeuvre based on the visual impression is very difficult or even hardly possible, even for pilots which are especially trained for that task.

The crew's acting on its own authority allowed the serious incident to arise and led to a grave threat.

2.2.2.2 QTR 020

The crew of QTR 020 did not deviate either vertically or laterally from their flight path in response to the traffic advisory (TA) issued by the TCAS; this corresponded to the procedure prescribed for a TA.

3 Conclusions

3.1 Findings

Technical aspects

- Both aircraft were licensed for IFR traffic.
- The investigation produced no indications of any pre-existing technical faults on either aircraft which might have caused or influenced the serious incident.
- A technical fault prevented radio instructions from being given over the headset of the supervising air traffic control officer.

3.1.1 Crews

- The pilots were in possession of the necessary licences for the flight.
- There are no indications of any of the pilots suffering health problems during the flight involved in the serious incident.

3.1.2 Air traffic control personnel

- The air traffic control officers were in possession of the licences necessary to exercise their activities.
- There are no indications of any of the air traffic controllers suffering health problems at the time of the serious incident.

3.1.3 History of the serious incident

- CFG 366 and QTR 020 were flying under instrument flight rules and at the time of the serious incident were in radio contact with ACC Zurich sector M5/M6 on the 132.835 MHz frequency.
- For purposes of separation, CFG 366 was instructed to maintain the present heading.
- QTR 020 was at FL 370 flying in a south-easterly direction and for purposes of separation received clearance to fly direct to waypoint MADEB.
- The crew of CFG 366 reported and stated that they would turn ten degrees to the right because of an aircraft ahead and 300 ft above them.
- At 17:41:19 UTC, the air traffic control's short term conflict alert system (STCA) triggered an alarm on the radar screens of sector M5/M6.
- The trainee intervened immediately and instructed CFG 366 to turn 25 degrees to the left.
- Immediately afterwards, the crew of CFG 366 reported: *"Now, we are turning right, we have a traffic"*.
- At 17:41:31 UTC the trainee issued the crew of CFG 366 the following traffic information and instructed them again to initiate a left turn: *"Condor three six six, negative, traffic at your one o'clock position on your right, turn left!"*
- At 17:41:37 UTC the crew of CFG 366 reported the following: *"Ok, would like that to descend?"* At about the same time, they stopped their right turn and started to turn to the left.

- At 17:41:40 UTC, the supervising ATCO assumed traffic control in sector M5/M6 and attempted to give various instructions for approximately 70 seconds using his headset.
- The coach's instructions during this period are audible on the recording of the radio communication only as a crackling noise.
- After the coach had changed to the hand-held microphone his radio messages were loud and clearly audible.
- At 17:41:55 UTC, when CFG 366 was at FL 368, the crew stopped their climb to FL 370 and initiated a descent to FL 365.
- According to the statements of both crews, traffic advisories (TA) were generated by their TCAS; however at no time were instructions to resolve the conflict (resolution advisory - RA) generated.
- The two aircraft involved closed to a lateral separation of 3.1 NM and an altitude difference of 500 ft.

3.1.4 General conditions

- The serious incident took place at night.
- According to the statements of the two flight crews, the two aircraft involved were in visual flight conditions.
- The crew of CFG 366 recognized an aircraft visually from which they assumed that without an avoiding manoeuvre it could lead to a conflict.
- The crew of QTR 020 could not establish visual contact to CFG 366.
- According to the statements of the air traffic control officers involved, at the time of the serious incident there was a low volume of traffic of low complexity.
- The two air traffic control officers, the coach and the trainee, were wearing headsets.
- The air traffic control issued for the first time a traffic information after the CFG 366 had turned to the right towards the QTR 020.
- The separation concept used, planned crossings with lateral distances close to the minimum separation and led to a traffic advisory triggering.

3.2 Causes

The serious incident is attributable to the fact that the crew of an aircraft, during night and based on visual contact to another aircraft plus a traffic advisory from their traffic alert and collision avoidance system, initiated on its own authority a lateral and vertical avoidance manoeuvre. The result was that an inadvertent convergence of this aircraft and another occurred, involving a high risk of collision.

The fact that the supervising air traffic controller was unable to interfere because of a technical fault may possibly have contributed to the serious incident.

The following factors did not directly cause the serious incident but have, in the context of the investigation, been identified as a factor to risk:

- The air traffic control did not provide a traffic information to the crew of the involved aircraft although they had chosen a separation concept that led to distances close to the minimum separation and resulted in a triggering of a traffic alert in the traffic alert and collision avoidance system.

4 Safety recommendations and measures taken since the serious incident

4.1 Safety recommendations

None

4.2 Measures taken since the serious incident

None

Payerne, 17 July 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, 20.08.2013