



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Schweizerische Unfalluntersuchungsstelle SUST
Service d'enquête suisse sur les accidents SESA
Servizio d'inchiesta svizzero sugli infortuni SISI
Swiss Accident Investigation Board SAIB

Aviation Division

Final Report No. 2184 of the Swiss Accident Investigation Board SAIB

concerning the serious incident
(AIRPROX)

involving aircraft type A320, registration
SWR 194W

and

aircraft type C56X, registration AUF 331

on 17 August 2011

in the Geneva TMA, 2.9 NM south-west of
the St-Prex (SPR) VOR

General information on this report

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

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.

Unless otherwise indicated, all times in this report are stated in co-ordinated universal time (UTC). At the time of the serious incident, Central European summer time (CEST) applied as local time (LT) in Switzerland. The relationship between LT, CEST, UTC is: $LT = CEST = UTC + 2 \text{ hours}$.

For reasons of data protection and simplification of the text, this report uses exclusively the generic masculine.

Table of contents

Summary	5
Investigation.....	7
Synopsis.....	7
Cause.....	7
Safety recommendation	8
1 Factual information	9
1.1 History of the serious incident	9
1.1.1 General.....	9
1.1.2 Organisation of the sectors	11
1.1.3 History of the serious incident	12
1.1.4 Location of the serious incident.....	15
1.2 Personnel information.....	15
1.2.1 Crew of aircraft HB-IJM/SWR 194W	15
1.2.1.1 Commander	15
1.2.1.1.1 Training.....	15
1.2.1.1.2 Flying experience.....	15
1.2.1.1.3 Duty and rest periods	16
1.2.1.2 Co-pilot	16
1.2.1.2.1 Training.....	16
1.2.1.2.2 Flying experience.....	16
1.2.1.2.3 Duty and rest periods	17
1.2.2 Crew of aircraft D-CTTT/AUF 331.....	17
1.2.2.1 Pilot/commander.....	17
1.2.2.1.1 Training.....	17
1.2.2.1.2 Flying experience.....	17
1.2.2.1.3 Duty and rest periods	18
1.2.2.2 Co-pilot	18
1.2.2.2.1 Training.....	18
1.2.2.2.2 Flying experience.....	18
1.2.2.2.3 Duty and rest periods	19
1.2.3 Trainee air traffic controller.....	19
1.2.3.1 Air traffic controller 1.....	19
1.2.3.2 Air traffic controller 2.....	20
1.2.3.3 Air traffic controller 3.....	20
1.2.3.4 Air traffic controller 4.....	21
1.3 Aircraft information	22
1.3.1 Aircraft 1	22
1.3.2 Aircraft 2	22
1.4 Meteorological information.....	22
1.4.1 General.....	22
1.4.2 General meteorological situation:.....	22
1.4.3 Meteorological situation at the time of the incident at 7000 ft AMSL	23
1.4.4 Astronomical information.....	23
1.4.5 Aerodrome meteorological information	23
1.4.6 Forecasts.....	23
1.4.7 Satellite image.....	24
1.5 Aids to navigation.....	24
1.6 Communications.....	24
1.7 TCAS alerts and Mode S data sets.....	25
1.8 Organisational and management information	25
1.8.1 Workplace ergonomics during double duty on the job training - OJT	25
1.8.2 Management of trajectories on the occasion of a crossing in the vertical plane.....	25

1.8.3	Take-over of control by the instructor.....	25
1.9	Additional information ATMM (air traffic management manual)	26
1.9.1	Allocation of data (ATMM Geneva TWR/APP APP A.8.4.1).....	26
1.9.2	Traffic NORTH – SOUTH (ATMM Geneva TWR/APP APP A.3.2.2).....	26
1.9.3	Traffic between FL090 and FL145 (ATMM Geneva TWR/APP APP A.4.2.3).....	26
1.9.4	Approach Sectorisation (ATMM Geneva TWR/APP APP A.13-2).....	26
1.9.5	APP sectors (ATMM Geneva TWR/APP UTI A.2.4).....	26
1.9.6	STCA - Scope (ATMM Geneva TWR/APP UTI A.4.1).....	27
1.9.7	STCA - Presentation of alerts (ATMM Geneva TWR/APP, UTI A.4.4).....	27
2	Analysis.....	28
2.1	ATC aspects	28
2.2	Technical aspects	28
2.3	Operational and human factors.....	29
2.3.1	Operational factors	29
2.3.2	Human factors	29
2.3.3	Crews	29
3	Conclusions.....	30
3.1	Findings.....	30
3.1.1	Technical aspects.....	30
3.1.2	Operational aspects	30
3.1.3	Air traffic controllers.....	30
3.1.4	Crews	30
3.1.5	Chronology of the serious incident.....	30
3.1.6	Environmental aspect.....	31
3.2	Causes	31
4	Safety recommendations and measures taken since the serious incident	32
4.1	Safety recommendations	32
4.1.1	Safety deficit STCA alerts	32
4.1.2	Safety recommendation 471	32
4.2	Measures taken after the serious incident	33

Final report

Summary

Aircraft 1

Owner	Swiss International Air Lines Ltd Postfach, 4002 Basel, Switzerland
Operator	Swiss International Air Lines Ltd Postfach, 4002 Basel, Switzerland
Manufacturer	Airbus Industries, Toulouse, France
Aircraft type	Airbus A320 – 214
Country of registration	Switzerland
Registration	HB-IJM
Flight number	LX 1914
ATC flight identifier	SWR 194W
Radiotelephone callsign	Swiss one niner four whiskey
Flight rules	IFR
Type of operation	Scheduled flight
Departure point	Barcelona, LEBL
Destination point	Geneva, LSGG

Aircraft 2

Owner	Augusta Air GmbH, Flughafenstrasse 3 86169 Augsburg, Germany
Operator	Augusta Air GmbH, Flughafenstrasse 3 86169 Augsburg, Germany
Manufacturer	Cessna Aircraft Company, Wichita, USA
Type of aircraft	Cessna Citation C56X
Country of registration	Germany
Registration	D-CTTT
Flight number	AUF 331
Radiotelephone callsign	Augusta three three one
Flight rules	IFR
Type of operation	Commercial
Departure point	Augsburg, EDMA
Destination point	Geneva, LSGG
Location	Over Lake Geneva in Swiss territory, 2.9 NM south-west of SPR VOR
Date and time	17 August 2011, 08:31 UTC
ATS unit	Geneva Approach Control (APP)

Airspace	TMA LSGG 1, Class C
Maximum convergence	Horizontal 0.7 NM and vertical 375 ft
Prescribed minimum separation	Horizontal 3 NM and vertical 1000 ft
Airprox category of the serious incident	ICAO – category A – high risk of collision

Investigation

The serious incident occurred on 17 August 2011 at 08:31 UTC. It was notified on 17 August 2011 at 14:15 UTC. The Federal Aircraft Accident Investigation Bureau (AAIB) opened an investigation on 26 August 2011 at 11:50 UTC.

The AAIB notified the incident to the *Bundesstelle für Flugunfalluntersuchung* (BFU) investigation service in Braunschweig, Germany, which nominated an accredited representative. The serious incident occurred in Swiss airspace.

The investigation report is published by the Swiss Accident Investigation Board (SAIB).

Synopsis

On 17 August 2011, a Cessna Citation aircraft type C56X, callsign AUF 331, flying from Augsburg (EDMA) destination Geneva (LSGG) was passing the region of Fribourg. It made contact with the Geneva Approach Sector (PRE) of Geneva area which was under the control of a trainee, supervised by a coach. The trainee lined up AUF 331 using radar vectors on the ILS centre line of runway 23 at Geneva airport.

At the same time, a single-engine type SR20 aircraft, registration D-ELUX, was passing the Geneva region from the north-east to south-west. It was stable at flight level FL 90, on the south-eastern edge of the approach sector.

Meanwhile, an Airbus A320 type aircraft with the callsign SWR194W, flying from Barcelona (LEBL) and bound for Geneva, was passing the Alps in the direction of the Geneva VOR (GVA). It made contact on the PRE frequency of the Geneva Approach sector, which cleared it to descend to an altitude of 7000 ft and to follow a north-easterly heading. This trajectory opposed it to D-ELUX, which was stable at flight level FL 90. Approach control imposed a minimum rate of descent on SWR 194W in order for it to pass below D-ELUX before the two aircraft crossed.

Estimating the safety margin as inadequate for the impending crossing, the coach took over control and instructed SWR 194W to turn left in order to distance it from D-ELUX. Thirty-five seconds later, he issued a second radar heading to SWR 194W to make it cross the approach centre line. Moments later, SWR 194W was in conflict with AUF 331, which was established on the approach line. Becoming aware of the conflict, the coach issued an avoidance heading to SWR 194W. He also issued essential traffic information to AUF 331. SWR 194W reported that it had visual contact with AUF 331 and vice versa.

At 08:31 UTC, at the time of the dangerous convergence, the lateral distance between the two aircraft was 0.7 NM and the vertical distance was 375 ft. The trajectories never crossed.

Cause

The serious incident is due to a dangerous convergence between two aircraft in IFR flight, one in runway 23 ILS acquisition phase, and the other under radar vectors, following the take-over of control by the coach.

Factors which played a part in the serious incident:

- Use by the trainee of a separation concept which the coach deemed inadequate
- Absence of a control position dedicated to coaching and displaying parameters identical to those of his trainee
- No STCA alert in the controllers' headsets

Safety recommendation

The present report gave rise to a safety recommendation.

According to the directives of Annex 13 of the ICAO the safety recommendations formulated in this report are addressed to the supervisory authorities of the State concerned. It is up to its authorities to decide what action to take. However all organisations, companies and individuals are invited, in the sense of the safety recommendation, to improve flight safety.

In the ordinance on the investigation of aircraft accidents and serious incidents, the Swiss legislation prescribes the following directives concerning safety recommendations:

"Art. 32 Recommendations concerning safety

¹ DETEC, on the basis of the safety recommendations in the reports of the SAIB and in the reports of foreign origin, shall address implementation orders or recommendations to the FOCA.

² The FOCA periodically informs DETEC of the implementation of the orders or recommendations issued.

³ DETEC shall inform the SAIB at least twice a year of the status of implementation in the FOCA."

1 Factual information

1.1 History of the serious incident

1.1.1 General

The description of the history of the flight is based on the recordings of the radio communications, radar recordings, data transmitted by Mode S of the transponders and the statements of the crew members and air traffic controllers.

Aircraft 1: HB- IJM / SWR 194W

The commander performed the function of assistant pilot (pilot not flying - PNF). The co-pilot was at the controls of the aircraft (pilot flying - PF). The Airbus A320 type aircraft is an airliner for passenger transportation.

Aircraft 2: D-CTTT / AUF 331

The commander was at the controls of the aircraft (pilot flying - PF). The co-pilot performed the function of assistant pilot (pilot not flying - PNF). The Cessna Citation Excel (C56X) aircraft type is a twin jet-engine business aircraft with between 6 and 8 seats.

The flights of the two aircraft took place under instrument flight rules (IFR).

The Geneva Approach sector ATS units consisted of the following control positions: departure coordinator (DPC), departure radar (DEP), approach coordinator (APC), arrival radar (PRE) and final radar (FIN). With the exception of the FIN and DEP positions, all the control positions were occupied. The arrival radar (PRE) position was occupied by a trainee controller, under the supervision of an instructor (OJTI - on the job training instructor). Both assessed the volume and complexity of traffic as low to moderate. The instructor had occupied the FIN position in order to gain a better view of the arriving traffic, to have a personal radar screen, a microphone and a speaker enabling him to monitor the frequency and to intervene promptly if necessary. He therefore had a complete workstation, without having to monitor the traffic and work over the shoulder of the trainee controller who was seated in the PRE position. He was wearing an instructor's headset enabling him to monitor his trainee's telephone conversations in one ear and to monitor the frequency in the other.

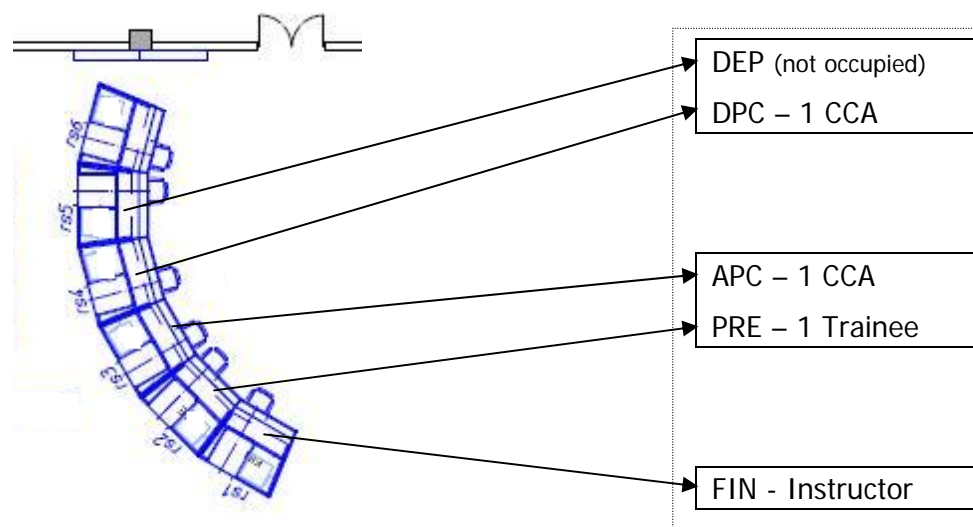


Figure 1: Allocation of control positions

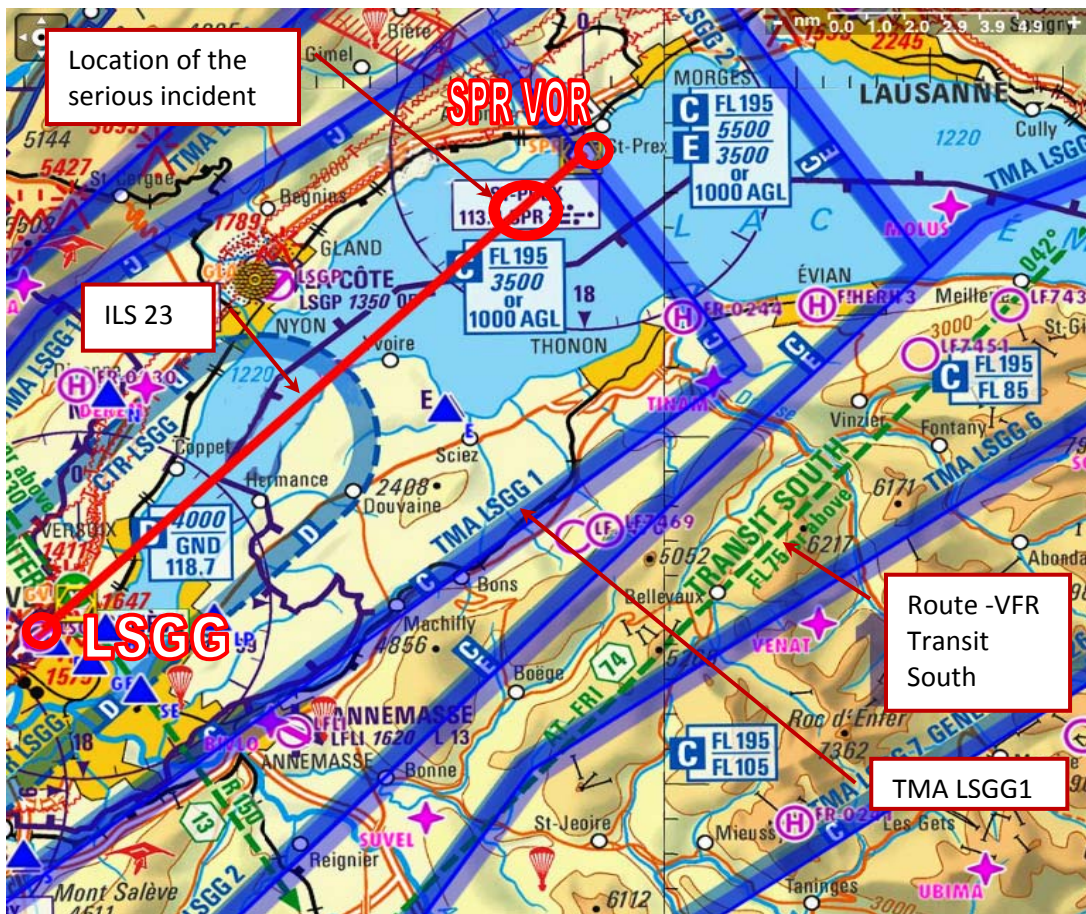


Figure 2: Geneva TMA

The terminal control area (TMA) airspace surrounding Geneva airport is class C and E. The location of the incident is situated in sector TMA 1, class C, between 3500 ft and flight level FL 195.

1.1.2 Organisation of the sectors

At the time of the incident, three positions were being used for control purposes, i.e. DPC, APC and PRE. The FIN position was used by the instructor.

The APC and PRE consoles are coupled, as are DPC and DEP. They technically constitute two sectors which receive flight plan data. The FIN position is similar but receives flight plan data, with among other things the Short Term Conflict Alert - STCA¹, only when AoC² manipulation is performed by a mouse click on the callsign of the aircraft concerned.

At the time of the serious incident, the sectorisation was in the configuration according to code 3A

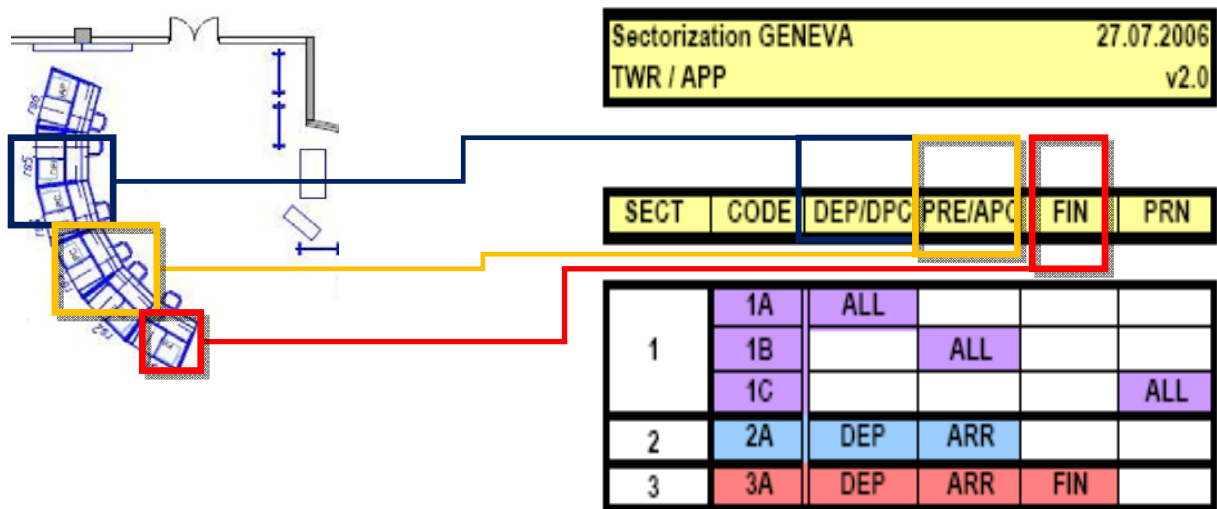


Figure 3: Sectorisation and layout of the workstations

¹ STCA is an automatic alert in the event of loss of separation or predicted loss of the required spacing between two or more aircraft (see 1.9.7 and 1.9.8)

² "ACCEPTance of Control": click Action/B1 on the call sign of the aircraft concerned (see 1.9.2)

1.1.3 History of the serious incident

On 17 August 2011, a Cessna Citation C56X aircraft type, registration D-CTTT, on a commercial IFR flight, with the callsign AUF 331, flying from Augsburg (EDMA) destination Geneva (LSGG), was passing the region of Fribourg.

At 08:18:21 UTC, a single-engine aircraft type SR20 registration D-ELUX, on a private IFR flight, was passing the Geneva region from north-east to south-west and called the departure sector (DEP). It was stable at flight level FL 90.

At 08:21:45 UTC, AUF 331 reported to the PRE controller that it was descending to flight level FL 160. The PRE position was occupied by a trainee supervised by a coach.

At 08:22:36 UTC, SWR 194W, an Airbus A320, registration HB-IJM on a commercial IFR flight from Barcelona (LEBL) to Geneva was passing the Alps in the direction of Geneva. It called the Geneva approach controller and reported that it was passing flight level FL 175 in descent towards flight level FL160 in the direction of GOLEB.

At 08:25:14 UTC, the PRE controller cleared AUF 331 to descend to flight level FL 100 and instructed it to reduce speed to 210 kt. In the same minute he cleared SWR 194W to descend to flight level FL 110.

At 08:25:53 UTC, the DEP controller instructed D-ELUX to turn left onto heading 210° in order to follow the south-east boundary of the approach sector and to free up the runway 23 ILS (instrument landing system) centre line.

To the left of D-ELUX, 500 ft below the TMA and in class E airspace, several VFR flights were in transit on the VFR South route. They were stable at flight level FL85.

At 08:25:58 UTC, the PRE controller instructed AUF 331 to turn right onto heading 260 to extend its route, then cleared it to descend to flight level FL 80.

At 08:27:00 UTC, SWR 194W received from the PRE controller an instruction to turn right onto heading 045° in order to position it on the left-hand downwind leg for the runway 23 ILS approach. This trajectory opposed it to D-ELUX, which was stable at flight level FL 90.

At 08:27:14 UTC, the DEP controller cleared D-ELUX to resume autonomous navigation towards the CBY VOR.

At 08:27:30 UTC, the PRE controller instructed AUF 331 to turn left onto heading 200°, to descend to 7000 ft and cleared it for the runway 23 ILS approach.

At 08:28:00 UTC, the PRE controller instructed SWR 194W to descend to 7000 ft at a minimum rate of descent of 2000 ft/min. The latter was at flight level FL 110, 16 NM from D-ELUX. The closing speed was 415 KT. He imposed this minimum rate of descent in order to allow it to pass below D-ELUX which was at flight FL 90 whilst maintaining the separation minima.

The radar situation at 08:28:51 UTC is reproduced in the image below.

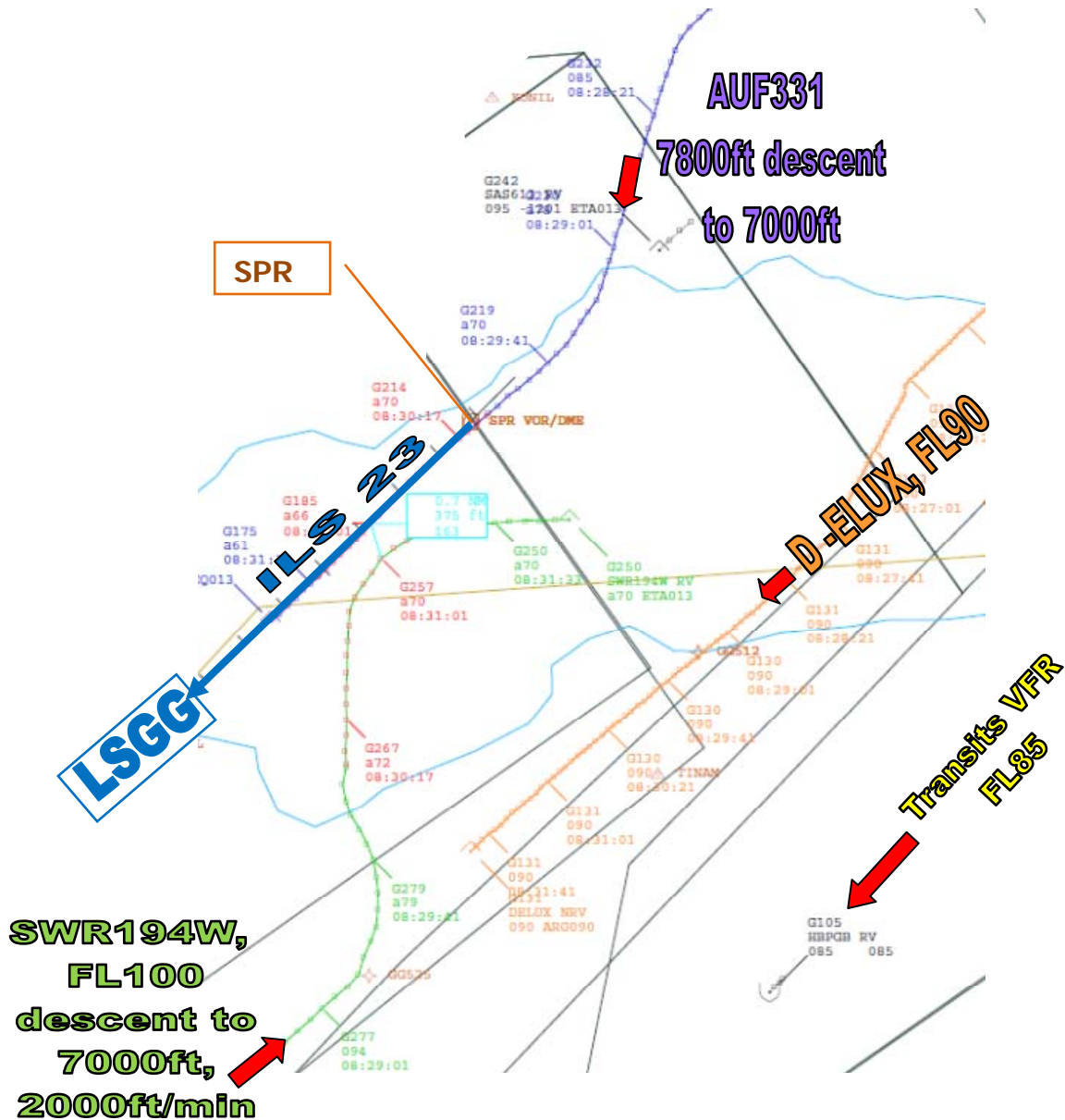


Figure 4: Positions of the aircraft  at 08:28:51 UTC

At 08:28:57 UTC, judging the safety margin to be inadequate for the impending crossing, the instructor took over control from the adjacent FIN position and instructed SWR 194W to turn left onto heading 320° in order to distance it from D-ELUX.

At 08:29:15 UTC the DEP controller informed D-ELUX that opposing traffic at 8 NM was crossing its flight level. The pilot acknowledged the information and confirmed that he had visual contact with the traffic.

At 08:29:30 UTC, SWR 194W requested confirmation of the imposed speed.

At 08:29:35 UTC, the PRE controller asked him to reduce speed to 210 kt and to turn right onto heading 360° for right-hand downwind positioning for runway 23.

At 08:30:00 UTC, AUF 331 acknowledged the instruction received from the PRE controller to reduce its speed to 180 kt in order to facilitate departures.

At 08:30:05 UTC, the STCA alert was triggered, but only at the PRE and APC positions. The instructor did not receive this alert. Then, for the next 25 seconds, he received a simultaneous call from two aircraft and responded to them by giving them instructions; this occupied the frequency and his attention. During the same period, the trainee in the PRE position and the APC controller realised that the coach had not received the STCA alert and informed him of the conflict between SWR 194W and AUF 331.

At 08:30:30 UTC and following the information provided by the two controllers, the coach became aware of the conflict and issued an avoidance heading instruction: "...turn right, immediately right heading east" to SWR 194W. The latter acknowledged the instruction received and reported: "...and we have the traffic in sight." Immediately afterwards, the coach issued essential traffic information to AUF 331 as follows: "Augusta three three one, ess, essential traffic at your twelve o'clock, three miles, seven thousand feet, descend on the ILS." AUF 331 confirmed that it was descending and that they had visual contact with the traffic.

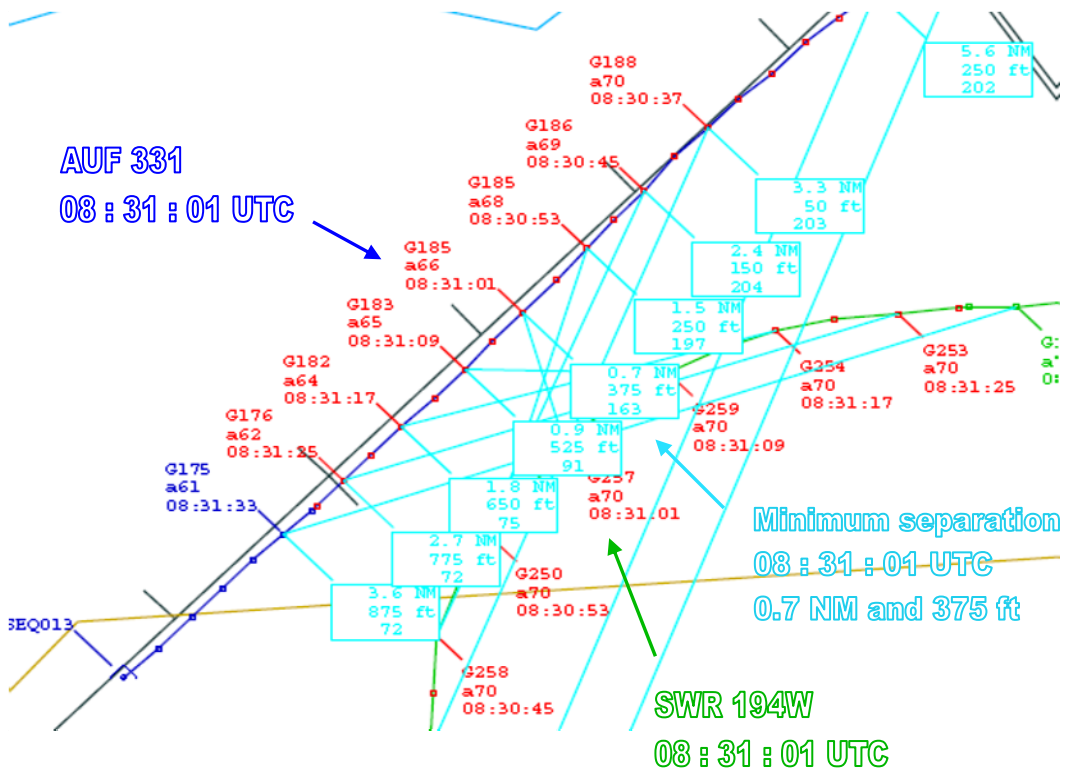


Fig. 5 Details of the dangerous convergence

A 08:31:01 UTC, the distance between the two aircraft was minimal. The trajectories never crossed. The dangerous convergence took place above Lake Geneva, 2.5 NM to the south-west of the SPR VOR. The radar recordings indicate a lateral separation of 0.7 NM and an altitude difference of 375 ft.

1.1.4 Location of the serious incident

Geographical position	2.9 NM south-west of SPR VOR
Date and time	17.08.2011 08:31 UTC
Lighting conditions	Daylight
Coordinates	N 46 23.0 E 006 20.0
Altitude	7000 ft AMSL

1.2 Personnel information

1.2.1 Crew of aircraft HB-IJM/SWR 194W

1.2.1.1 Commander

1.2.1.1.1 Training

Person	Swiss citizen, born 1967
Licence	ATPL(A) (air transport pilot licence aeroplane) according to joint aviation requirements (JAR), first issued by the Federal Office of Civil Aviation (FOCA) on 8 August 1995 and valid till 11 April 2016.
Type rating	A320 (PIC), valid till 8 April 2012
Ratings	Instrument flight (IR), category III approaches, extended on 31 March 2011 and valid till 8 August 2012 English Level 4, valid till 4 March 2014
Last proficiency check	16 March 2011 / LPC (licence proficiency check), OPC (operator proficiency check) 31 March 2011
ACAS training	Included at time of type A320 training; review at the time of LPC/OPC on 31 March 2011
Medical certificate	Class 1 & 2, without restrictions Valid from 14 June 2011 to 22 June 2012 and 22 June 2013 respectively
Last medical examination	14 June 2012

1.2.1.1.2 Flying experience

Total hours	9632 hours
of which on the type involved	1445 hours
In the last 90 days	145:14 hours
of which on the type involved	145:14 hours

1.2.1.1.3 Duty and rest periods

Start of duty in the 48 hours before the serious incident	16 August 2011 04:15 UTC
	17 August 2011 04:10 UTC
End of duty within the 48 hours before the serious incident	16 August 2011 10:37 UTC
Flight duty period within the 48 hours before the serious incident	13:07 hours
Rest period in the 48 hours before the serious incident	34:53 hours
Flight duty time at the time of the serious incident	04:30 hours

1.2.1.2 Co-pilot

1.2.1.2.1 Training

Person	German citizen, born 1987
Licence	ATPL(A) (air transport pilot licence aeroplane) according to joint aviation requirements (JAR), first issued by the Federal Office of Civil Aviation (FOCA) on 23 February 2010 and valid till 20 May 2016.
Type rating	A320 (COPI), valid till 28 May 2012.
Ratings	Instrument flight (IR), category III approaches, extended on 14 May 2011 and valid till 28 May 2012 English Level 4, valid till 19 January 2014
Last proficiency check	Line check 4 August 2010 / LPC (licence proficiency check), OPC (operator proficiency check) 14 May 2011
ACAS training	Included at time of type A320 training; review at the time of LPC/OPC on 14 May 2011
Medical certificate	Class 1 & 2, VDL shall wear corrective lenses Valid from 10 January 2011 to 23 January 2012 and 23 January 2013 respectively
Last medical examination	10 January 2011

1.2.1.2.2 Flying experience

Total hours	981 hours
of which on the type involved	981 hours
In the last 90 days	208:04 hours
of which on the type involved	208:04 hours

1.2.1.2.3 Duty and rest periods

Start of duty in the 48 hours before the serious incident	16 August 2011 04:15 UTC
	17 August 2011 04:10 UTC
End of duty within the 48 hours before the serious incident	15 August 2011 10:30 UTC
	16 August 2011 10:37 UTC
Flight duty period within the 48 hours before the serious incident	14:52 hours
Rest period in the 48 hours before the serious incident	33:08 hours
Flight duty time at the time of the serious incident	04:30 hours

1.2.2 Crew of aircraft D-CTTT/AUF 331

1.2.2.1 Pilot/commander

1.2.2.1.1 Training

Person	German citizen, born 1955
Licence	ATPL(A) (air transport pilot licence aeroplane) according to joint aviation requirements (JAR), first issued by the <i>Luffahrt - Bundesamt</i> on 9 January 1985 and valid till 12 February 2014
Type rating	C560XL/XLS (PIC), valid till 8 December 2011
Ratings	Instrument flight (IR), category I approaches, extended on 16 November 2010 and valid till 8 December 2011
	English Level 4, valid till 29 May 2013
Last proficiency check	OPC (operator proficiency check) 27 April 2011
ACAS training	Included at time of training on type C560XL/XLS; from 24 February to 9 March 2003
Medical certificate	Class 1 & 2, VDL shall wear corrective lenses
	Valid from 10 November 2010 to 8 December 2011 and 8 November 2012 respectively
Last medical examination	10 November 2011

1.2.2.1.2 Flying experience

Total hours	8920 hours
Of which on the type involved	5252 hours
In the last 90 days	206 hours
Of which on the type involved	206 hours

1.2.2.1.3 Duty and rest periods

Start of duty in the 48 hours before the serious incident	15 August 2011 08:00 UTC
	17 August 2011 06:30 UTC
End of duty within the 48 hours before the serious incident	15 August 2011 17:30 UTC
Flight duty period within the 48 hours before the serious incident	15 August 2011 09:30 hours
Rest period in the 48 hours before the serious incident	15-17 August 37:00 hours
Flight duty time at the time of the serious incident	02:00 hours

1.2.2.2 Co-pilot

1.2.2.2.1 Training

Person	German citizen, born 1984
Licence	CPL(A) (commercial pilot licence aeroplane) according to joint aviation requirements (JAR), first issued by the Civil Aviation Authority of Austria on 14 June 2007 and valid till 25 August 2014
Type rating	C560 XL/XLS (COPI), valid till 22 October 2012
Ratings	Instrument flight (IR), category I approaches, extended on 30 September 2011 and valid till 22 October 2012 English Level 4, valid till 25 February 2012
Last proficiency check	OPC (operator proficiency check) 26 September 2011
ACAS training	Included at time of training on type C560XL/XLS; from 24 September to 6 October 2007
Medical certificate	Class 1 / 2, Valid from 2 November 2011 to 29 November 2012 and 22 November 2016 respectively
Last medical examination	2 November 2011 (preceding examination 11 November 2010)

1.2.2.2.2 Flying experience

Total hours	2433 hours
Of which on the type involved	2230 hours
In the last 90 days	171 hours

	Of which on the type involved	171 hours
1.2.2.2.3	Duty and rest periods	
	Start of duty in the 48 hours before the serious incident	15 August 2011 05:40 UTC
		17 August 2011 06:30 UTC
	End of duty within the 48 hours before the serious incident	15 August 2011 13:50 UTC
	Flight duty period within the 48 hours before the serious incident	15 August 08:10 hours
	Rest period in the 48 hours before the serious incident	15-17 August 40:40 hours
	Flight duty time at the time of the serious incident	02:00 hours

1.2.3 Trainee air traffic controller

One of the active controllers at the time of the incident was a trainee, in the middle of phase 2 of the 3 phases for his training. According to the statements of the trainee and the instructor, the evaluations received in the days preceding the serious incident were normal and did not mentioned any shortcomings. This corresponded to a standard evaluation in which the trainee controller had to provide evidence of independence at times of average traffic.

1.2.3.1 Air traffic controller 1

Function	Approach radar (PRE) on the job trainee (OJT)
Person	Swiss citizen, born 1986
Working days before the day of the incident	3 days
Start of duty on the day of the incident	03:40 UTC
Licence	Student Air Traffic Controller Licence on the basis of Directive 2006/23 of the European Community, first issued by the Federal Office of Civil Aviation (FOCA) on 31 March 2010 and valid till 28 June 2012
Professional qualification	Trainee Ratings: AeroDrome control Instruments - ADI, Approach control Surveillance - APS; Rating Endorsements: none License endorsement: none English Level 4, valid till 25 June 2013
Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 15 June 2012; no limitation

1.2.3.2 Air traffic controller 2

Function	Approach radar (PRE) On-the-job training instructor (OJTI)
Person	Swiss citizen, born 1971
Working days before the day of the incident	4 days
Start of duty on the day of the incident	03:40 UTC
Licence	Air Traffic Controller Licence on the basis of Directive 2006/23 of the European Community, first issued by the Federal Office of Civil Aviation (FOCA) on 15 November 1996 and valid till 16 April 2012 Safety Related Task Licence first issued by the Federal Office of Civil Aviation (FOCA) on 29 January 2009 and valid till 16 April 2012.
Professional qualification	Unit endorsement TWR / APC; SPVR Location LSGG Ratings: ADI, APS; SPVR; Rating Endorsements: Air Control - AIR, RADar - RAD (ADI+APS), Surveillance Radar Approach - SRA License endorsement: OJTI, Assessor / EXaMiner – EXM, valid until 16 April 2012 English Level 5, valid until 12 December 2013
Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 16 April 2012; VDL shall wear corrective lenses

1.2.3.3 Air traffic controller 3

Function	Approach coordinator (APC)
Person	Swiss citizen, born 1986
Working days before the day of the incident	2 days
Start of duty on the day of the incident	07:30 UTC
Licence	Air Traffic Controller Licence on the basis of Directive 2006/23 of the European Community, first issued by the Federal Office of Civil Aviation (FOCA) on 3 October 2007 and valid till 11 November 2011

	Professional qualification	Unit endorsement TWR; APC; Location LSGG Ratings: ADI, APS; Rating Endorsements: Air Control - AIR, RADar - RAD (ADI+APS), Surveillance Radar Approach - SRA English Level 4, valid until 12 August 2013
	Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 22 July 2013; no limitations
1.2.3.4	Air traffic controller 4	
	Function	Departure radar (DEP)
	Person	Swiss citizen, born 1976
	Working days before the day of the incident	3 days
	Start of duty on the day of the incident	05:20 UTC
	Licence	Air Traffic Controller Licence on the basis of Directive 2006/23 of the European Community, first issued by the Federal Office of Civil Aviation (FOCA) on 14 September 2001 and valid till 23 December 2011.
	Professional qualification	Unit endorsement APC; Location LSGG Ratings: APS, ACS Rating Endorsements: RADar - RAD (ADI+APS), Surveillance Radar Approach - SRA License endorsement: OJTI English Level 5, valid until 29 April 2015
	Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 7 January 2012; no limitations

1.3 Aircraft information

1.3.1 Aircraft 1

Registration	HB-IJM
Aircraft type	Airbus A320-214
Characteristics	Twin jet-engine, short and medium haul.
Manufacturer	Airbus Industrie, Toulouse, France
Year of manufacture	1996
Serial no.	CN 635
Owner	Swiss International Air Lines Ltd. Postfach, 4002 Basel, Switzerland
Operator	Swiss International Air Lines Ltd. Postfach, 4002 Basel, Switzerland
Equipment	TCAS II



1.3.2 Aircraft 2

Registration	D-CTTT
Aircraft type	Cessna Citation Excel (C56X)
Characteristics	Twin-engine business jet
Manufacturer	Cessna Aircraft Company, Wichita, USA
Year of manufacture	2005
Serial no.	c/n 560-5573
Owner	Augusta Air Luftfahrtunternehmen, Flughafenstrasse 3, 86169 Augsburg, Germany
Operator	Augusta Air Luftfahrtunternehmen, Flughafenstrasse 3, 86169 Augsburg, Germany
Equipment	TCAS II



1.4 Meteorological information

1.4.1 General

The information contained in sections 1.4.2 to 1.4.7 was provided by MeteoSwiss and by a webcam in the Vevey region.

1.4.2 General meteorological situation:

“Die Schweiz lag am Rande eines flachen Hochs mit Kern über dem östlichen Mitteleuropa. In der Höhe erstreckte sich ein Rücken vom westlichen Mittelmeer zu den Alpen”

“Rund um den Genfersee herrschten ein nahezu wolkenloser Himmel und eine ausgezeichnete Sicht”

This means:

Switzerland was on the edge of a stable anticyclone centred over the eastern part of central Europe. A high-altitude ridge extended from the west of the Mediterranean towards the Alps.

The environs of Lake Geneva were virtually cloudless, with excellent visibility.

According to MétéoSuisse:

“Am Flughafen Genève-Cointrin wurde um 06 und 09 UTC eine meteorologische Sicht von mehr als 70 km beobachtet. Die 1-2/8 Bewölkung auf 3500 ft AGL beziehen sich auf einzelne CU entlang des Reliefs. Über dem Genfersee war der Himmel wolkenlos”

This means:

On 17 August 2011 at 06:00 and 09:00 UTC at Geneva – Cointrin airport, visibility of over 70 km was observed. The cloud cover of 1-2/8 at 3500 ft AGL related to a few isolated cumulus clouds on the relief. The sky above Lake Geneva was cloudless.

1.4.3 Meteorological situation at the time of the incident at 7000 ft AMSL

<i>Weather/cloud</i>	<i>1-2/8 ALONG THE RELIEF</i>
<i>Visibility</i>	<i>70 km and over</i>
<i>Wind</i>	<i>225 deg. 15-20 kt</i>
<i>Temperature / dew point</i>	<i>14°C/ -1°C</i>
<i>Atmospheric pressure</i>	<i>1018 hPa</i>

1.4.4 Astronomical information

Natural lighting conditions	Daylight, mid-morning
Position of the sun	Azimuth: 114° Elevation: 39°

1.4.5 Aerodrome meteorological information

The aerodrome observations according to the ATIS (automatic terminal information service) for Geneva airport at 08:20 UTC were as follows:

INFO Tango, Met report LSGG 0820z,

Wind varying between 030 degrees and 110 degrees at 2 kt, CAVOK, temperature +22°C, dewpoint +15°C, QNH 1018, NOSIG

This means:

Information Tango, meteorological observation for Geneva airport at 08:20 UTC, wind variable from 030° to 110°, speed 2 kt, visibility greater than 10 km, no cloud below 5600 ft AMSL, no significant weather nor cumulonimbus or cumulus congestus, temperature +22°C, dew point +15°C, atmospheric pressure adjusted to sea level 1018 hpa, no significant change in the next two hours.

1.4.6 Forecasts

At the time of the incident, the following aerodrome forecasts (terminal aerodrome forecast - TAF) applied:

TAF LSGG

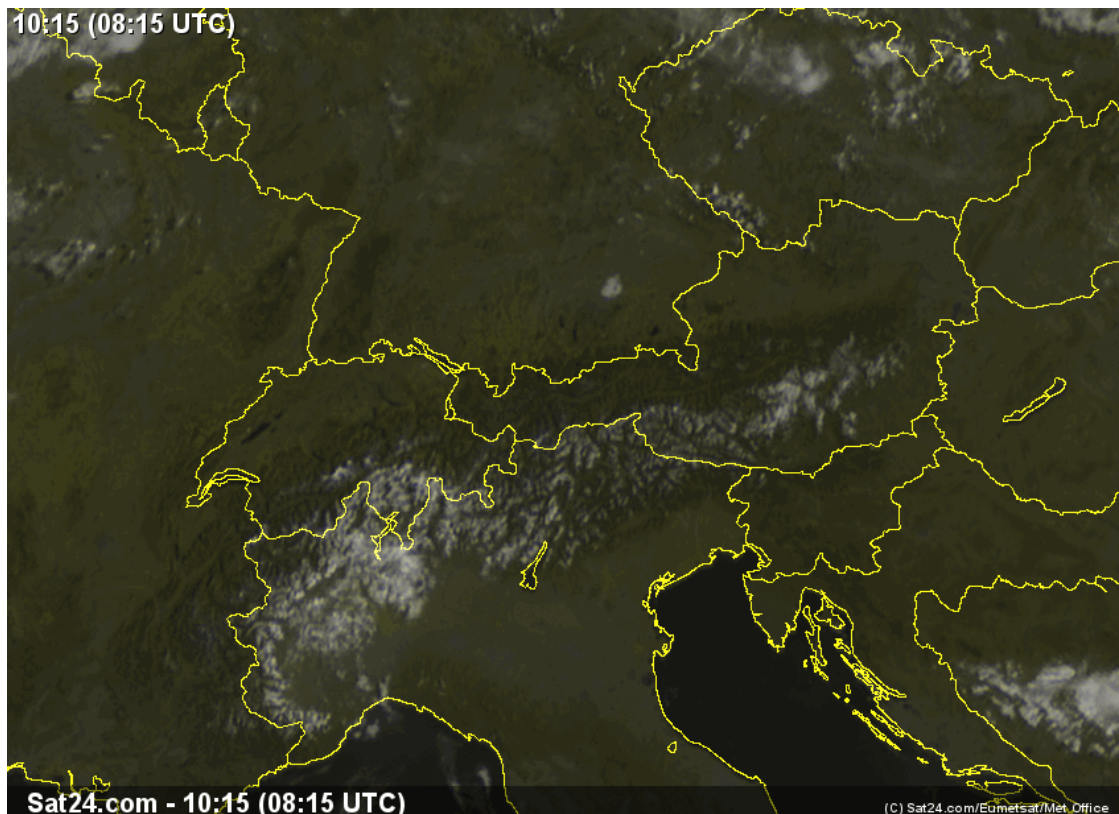
170825Z 1709/1815 08005KT CAVOK TX30/1715Z TN17/1804Z TX32/1815Z
PROB30 TEMPO 1712/1716 24007KT PROB40 TEMPO 1812/1815 24008KT

This means:

On 17 August 2011 at 08:25 UTC the following meteorological forecasts between 09:00 UTC and 18:15 UTC were announced for Geneva airport:

Wind	From 080° at 5 kt
Meteorological visibility	CAVOK
Cloud	3-4/8 at 2500 ft AAL 3-4/8 at 12,000 ft AAL
Temperature	Maximum 30°C at 15:00 UTC Minimum 17°C on 18 August at 05:00 UTC Maximum 32°C on 18 August at 15:00 UTC
Conditional forecasts	On 17 August between 12:00 and 16:00 UTC wind from 240° at 7 kt; on 18 August between 12:00 and 15:00 UTC wind from 240° at 8 kt

1.4.7 Satellite image



Satellite image from 17 August 2011

1.5 Aids to navigation

No influence on the serious incident.

1.6 Communications

Communications took place without any problems on the ATC frequencies. At the time the STCA was triggered, the crews of two aircraft were transmitting simultaneously, thereby partially occupying the PRE frequency. Apart from this, the recordings of the communications reveal good transmission and reception quality.

1.7 TCAS alerts and Mode S data sets

Shortly after passing the SPR VOR, AUF 331, established on localiser 23, received a traffic advisory (TA) followed by a corrective resolution advisory (RA) of the type “*descend, descend*”, ordering a rate of descent. The initiation of the descent of AUF 331 on the slope of the ILS 23 approach axis coincided with the RA’s instruction to descend.

Under radar guidance south of localiser 23, SWR 194W received a TA (traffic advisory) followed, some 3 seconds later, by a preventive RA of the type “*monitor vertical speed*” corresponding in this case to maintaining altitude, i.e. a vertical speed equal to zero.

The captured Mode S data at the time of the serious incident was as follows:

SWR 194W at 08:30:43 UTC, “*only one threat or RA to provide separation in the same direction; RA is preventive*”;

AUF 331 at 08:30:42 UTC “*only one threat or RA intended to provide separation in the same direction; RA is corrective*”.

1.8 Organisational and management information

1.8.1 Workplace ergonomics during double duty on the job training - OJT

When a control position of the Geneva Approach sector (PRE, APC, FIN) is occupied by a trainee and an instructor, the latter is normally seated behind him, as he has no assigned radar position. The instructor is equipped with a headset enabling him to monitor the radiotelephone conversations on the frequency in one ear and the telephone conversations in the other. The audible STCA “*Conflict*” warning is transmitted by the speakers at the control positions concerned, but not in the air traffic controllers’ headsets.

1.8.2 Management of trajectories on the occasion of a crossing in the vertical plane

The method of carrying out a vertical crossing of two opposing aircraft is not defined by a specific procedure. Within the context of approach control, where the vertical space is limited, the two most usual methods are:

- Offsetting the two trajectories by means of radar headings
- Maintaining vertical separation until the crossing has occurred.

The method involving imposing a minimum rate of climb/descent on one or other of the aircraft in order to ensure a crossing before loss of horizontal separation is customary in upper sectors (INI and UAC) where the vertical space is less restricted. This method is frequently taught by instructors with an en-route qualification but is not applied or is rarely applied by instructors who have undergone TWR/APP training.

Throughout his training, the trainee worked with instructors with different basic training: those coming from approach control (TWR/APP) and those from the upper sector (INI/APP). The instructor in charge had received approach controller training (TWR/APP).

1.8.3 Take-over of control by the instructor

Some of the training of trainees takes place in a simulator. During hazardous situations, the exercise is stopped and the radar image is frozen, enabling the trainee to understand and analyse the situation. There is no take-over of control by the instructor.

In a real situation, the timing and method of taking over control are left to the instructor’s discretion.

1.9 **Additional information ATMM (air traffic management manual)**

1.9.1 Allocation of data (ATMM Geneva TWR/APP APP A.8.4.1)

“Correlation data shall always be allocated to the Entry Window of the sector where the aircraft will establish first radio contact (see Section UTI, § A.2.4).

When an aircraft passes from one sector/unit to another, the receiving sector/unit shall take control of the correlation data through the function "ACCEPTance of Control" (click Action/B1 on the call sign of the aircraft concerned) only on first radio contact. This operation allocates the radar track to the accepting sector, instead of the transferring sector.

The function "AoC" shall also be executed by the receiving unit for correlated VFR flights. Nevertheless, when FIC or APP sends an aircraft into radio contact with TWR, TWR does not execute an "AoC" function.”

1.9.2 Traffic NORTH – SOUTH (ATMM Geneva TWR/APP APP A.3.2.2)

“Transit flights below FL155 are transferred by INI to DEP before entering the Approach Sector. DEP shall subsequently transfer them to INS, Lyon or Chambéry, according to their flight level.”

1.9.3 Traffic between FL090 and FL145 (ATMM Geneva TWR/APP APP A.4.2.3)

“Traffic departing LSGG TMA or transiting the APP sector between FL090 and FL145 shall be cleared via MILPA(FL130)/PAS(FL090-110) – ARGIS –DEPUL – LSE and shall be sent into contact with Lyon APP.

NON RNAV traffic destination LFLS shall be cleared via ARGIS –DEPUL – LSE MAX XFL110.”

1.9.4 Approach Sectorisation (ATMM Geneva TWR/APP APP A.13-2)

“The following SKYVISU and EMTEL sectorisations are available for the APP sectors and shall be requested from SMC when opening or closing WPs:

Sectorization GENEVA		27.07.2006
TWR / APP		v2.0

SECT	CODE	DEP/DPC	PRE/APC	FIN	PRN
1	1A	ALL			
	1B		ALL		
	1C				ALL
2	2A	DEP	ARR		
3	3A	DEP	ARR	FIN	

Additionally, when opening APC or DEP control positions for the first time after a sectorisation change, APC or DEP are required to manually de-group the VISTA telephone.”

1.9.5 APP sectors (ATMM Geneva TWR/APP UTI A.2.4)

“The APC and PRE consoles, as well as DPC and DEP, are associated, i.e. they constitute one sector and are fed with flight plans identically.

The logical APP sectors are the following (logical MV addresses)”:

DEP (24)	=	DPC + DEP
ARR (25)	=	APC + PRE
FIN (26)	=	FIN

1.9.6 STCA - Scope (ATMM Geneva TWR/APP UTI A.4.1)

“STCA is an automatic alert in the event of loss of separation or predicted loss of the required spacing between two or more aircraft.

This alerting function is part of the "Safety Nets", a complement to the radar surveillance and separation of traffic provided by the controller. The controller should normally be alerted before the pilot is likely to follow a TCAS Resolution Advisory.”

1.9.7 STCA - Presentation of alerts (ATMM Geneva TWR/APP, UTI A.4.4)

“When a controlled flight is conflicting, or about to enter into imminent conflict, with another flight transmitting Mode C, STCA alerts the controller of the sector(s) concerned:

- the audio alert "conflict" is activated;*
- the window CA (Conflict Alert) opens:*
- the two flights are forced on the screen. They are automatically given a speed vector corresponding to 40 seconds. (This value can be adjusted in the system, but not at a working position).*
- the call signs (or the SSR code in the case of a non-correlated flight) and the "leader" of the label turn a salmon-pink colour.*

The CA window displays the call sign (or the SSR code for non-correlated flights) of the flights conflicting or about to enter into imminent conflict, their vertical movement tendency, their actual distance and the minimum distance forecast.”

2 Analysis

2.1 ATC aspects

At 08:28:00 UTC, the trainee decided to impose a minimum rate of descent on SWR 194W in order to ensure horizontal separation before the crossing of the opposing traffic D-ELUX. This method, which had been applied with other instructors from the upper sectors, appeared inappropriate to his instructor.

Taking into account the rate of convergence, the distance separating the two opposing traffics would have been covered in less than 2 minutes, after taking into account the 3 NM required for separation. Considering the requested value of 2000 ft/min, the time required to implement this instruction and the safety margin required for possible intervention by the instructor, it is understandable that the latter assessed this situation as potentially dangerous.

This motivated his decision to take over the frequency from the FIN position and to rapidly establish lateral separation using radar headings.

The instructor wanted to reposition SWR 194W on the right hand downwind leg and issued a heading of 360° so that it could cross the approach centre line. This placed SWR 194W and AUF 331, which was established on the ILS, in conflict. The instructor was not aware of the imminent conflict.

At 08:30:05 UTC, the STCA alert was triggered at the trainee's PRE position and at the position of the APC coordinator. Without an AoC manipulation by the instructor, no alert would appear on the FIN screen, because the STCA parameters of the two aircraft remained assigned to the PRE/APC positions.

In addition, at the moment the STCA was triggered, the instructor's attention was diverted to the simultaneous radio call from two other aircraft occupying the frequency for 25 seconds.

It was the verbal intervention of the trainee and the coordinator which enabled the instructor to become aware of the conflict.

He immediately issued an avoidance heading instruction to SWR 194W and an instruction to descend to AUF 331, and issued essential traffic information to the two crews. These actions were quick and adequate.

2.2 Technical aspects

The investigation did not reveal any technical malfunction which could have contributed to or caused the serious incident. It revealed that the instructor could not hear the STCA alert at the FIN position because he had not carried out an AoC manipulation.

The FIN position was open but was not occupied and its use for monitoring purposes was possible. Coupling the FIN position to the PRE/APC positions would allow simultaneous distribution of alerts to the three positions.

This would have the benefit of providing the both the STCA alert and flight plan data and would avoid the need to carry out AoC manipulations.

The investigation revealed the downside of not having an audible STCA alert in the controllers' headsets. Such an audible alert would probably have facilitated awareness of the triggering of the STCA.

2.3 Operational and human factors

2.3.1 Operational factors

There was no radar console assigned to the instructor to enable monitoring of the trainee in the APP sector.

When the volume of traffic is high the FIN position is open and occupied. Then the instructor can monitor the trainee only over the latter's shoulders. This can be a handicap for the instructor, both visually and in the event of a take-over of control requiring his direct presence in the PRE position.

The use of the FIN position can be advantageous for monitoring a trainee in the PRE position. However, a take-over of control by the instructor from the FIN position does not provide all the flight plan information or an STCA alert (Conflict Alert window) from the PRE/APC position.

This fact demonstrates that a take-over of control from the FIN position imposes additional constraints on the instructor.

2.3.2 Human factors

During his training a trainee was supported for periods of a few days at a time by all the instructors in the unit. In this way he benefited from the experience and technique of each instructor.

The use of a method of separation deemed inappropriate by the instructor motivated the latter to intervene rapidly. This caused significant stress as he concentrated on the resolution of the initial conflict.

Because of a tunnel effect, he did not become aware of the impending new conflict even though the two aircraft were on the same frequency.

The tunnel effect may be due to stress and may cause a momentary loss of peripheral vision.

2.3.3 Crews

The reactions of the crews were in accordance with the procedures in force.

The good weather conditions allowed crews to observe their reciprocal positions at the time of the serious incident.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- Aircraft HB-IJM and D-CTTT were authorised for IFR traffic.
- The investigation did not reveal any technical malfunction which could have contributed to or caused the incident.
- The APC and PRE radar consoles were coupled and technically constituted one sector which received the flight plan data.
- The FIN position was open but did not receive the flight plan data. Consequently the STCA alert was not available without manipulation.
- The audible STCA alert cannot be transmitted to the headsets used by the controllers.

3.1.2 Operational aspects

- There was no radar console assigned to monitoring of the trainee in the APP sector.
- The instructor used the FIN position to monitor his trainee working at the PRE position.
- The instructor took over control from the FIN position.
- The time and method of taking over control is left to the discretion of the instructor.

3.1.3 Air traffic controllers

- The documents provided indicated that the controllers were in possession of an adequate licence.
- There is no indication that their state of health was affected at the time of the incident.
- The trainee had been trained by specialist instructors from approach control (TWR/APP) and instructors specialising in the control of upper sectors (INI/APP).
- The instructor in charge had received a TWR/APP controller training.

3.1.4 Crews

- The documents provided indicated that the pilots were in possession of an adequate licence.
- The reactions of the crews were in accordance with the procedures in force.

3.1.5 Chronology of the serious incident

- At 08:28:00 UTC, the PRE controller instructed SWR 194W to descend to 7000 ft at a minimum rate of descent of 2000 ft/min.
- At 08:28:57 UTC, judging the safety margin to be inadequate for the impending crossing, the instructor took over control from the adjacent FIN position and instructed SWR 194W to turn left onto heading 320° in order to distance it from D-ELUX.

- At 08:30:05 UTC. the STCA alert was triggered, but only at the PRE and APC positions. The instructor did not receive this alert. The trainee in the PRE position and the APC controller realised that the coach had not received the STCA alert and informed him of the conflict between SWR 194W and AUF 331.
- At 08:30:30 UTC and following the information provided by the two controllers, the coach became aware of the conflict and ordered an avoidance heading.
- The minimum distance between the two aircraft occurred at 08:31:01 UTC: 0.7 NM horizontally and 375 ft vertically.

3.1.6 Environmental aspect

- The weather conditions played no direct part in the incident.

3.2 Causes

The serious incident is due to a dangerous convergence between two aircraft in IFR flight, one in runway 23 ILS acquisition phase under radar vectors, and the other under radar vectors, following the take-over of control by the coach.

Factors which played a part in the serious incident:

- Use by the trainee of a separation concept deemed inappropriate by the coach.
- Absence of a control position dedicated to coaching and displaying parameters identical to those of his trainee.
- No STCA alert in the controllers' headsets.

4 Safety recommendations and measures taken since the serious incident

According to the directives of Annex 13 of the ICAO the safety recommendations formulated in this report are addressed to the supervisory authorities of the State concerned. It is up to its authorities to decide what action to take. However all organisations, companies and individuals are invited, in the sense of the safety recommendation, to improve flight safety.

In the ordinance on the investigation of aircraft accidents and serious incidents, the Swiss legislation prescribes the following directives concerning safety recommendations:

"Art. 32 Recommendations concerning safety

¹ *DETEC, on the basis of the safety recommendations in the reports of the SAIB and in the reports of foreign origin, shall address implementation orders or recommendations to the FOCA.*

² *The FOCA periodically informs DETEC of the implementation of the orders or recommendations issued.*

³ *DETEC shall inform the SAIB at least twice a year of the status of implementation in the FOCA."*

4.1 Safety recommendations

4.1.1 Safety deficit STCA alerts

The FIN position was open but was not occupied and its use for monitoring purposes was possible. The instructor took over control from this position

At 08:30:05 UTC, the visual STCA alert was triggered only on the consoles of the positions to which aircraft were assigned, i.e. PRE and APC. The audible STCA "conflict" alert was emitted only by the speakers located at the PRE and APC positions. It was not transmitted to any of the headsets at the control positions.

The trainee at the PRE position and the APC controller realised that the coach had not received an STCA alert, either visual or audible. It was they who informed him of the conflict between SWR 194W and AUF 331.

Associating the FIN position with the PRE/APC positions would allow simultaneous dissemination of alerts to the three positions.

The investigation came to the conclusion that one of the contributing factors is:

"Absence of a control position dedicated to coaching and displaying parameters identical to those of his trainee"

4.1.2 Safety recommendation 471

The Federal Office of Civil Aviation should call for technical adaptations which would make it possible to have available STCA alerts originating from other control positions.

4.2 Measures taken after the serious incident

4.2.1 Publication

On June 11th, 2012, *skyguide* published a Safety Letter, number 2012-04, addressed to the TWR/APP controller. The publication reminds certain limitations of display and STCA alerts at the FIN position.

Payerne, 29 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, 18 July 2013