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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. 2162

by the Swiss Accident

Investigation Board SAIB

concerning the serious incident
(AIRPROX)

involving the Falcon 2000 aircraft,
registration N994GP

and the Cessna 210 aircraft, registration
N8KR

on 12 March 2011

in the Geneva TMA

General information on this report

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

In accordance with Art 3.1 of the 10th edition, applicable from 18 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 reference version of this report is the original in the French 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 Time (CET) applied as local time (LT) in Switzerland. The relation between LT, CET and UTC is:
 $LT = CET = UTC + 1 \text{ hour}$.

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Final report

Summary

Aircraft 1

Owner Wells Fargo Bank Northwest Na Trustee
Mac U1228-120, Salt Lake City, United States

Operator Elite Air Inc.
100 Second Avenue South, Suite 101-S
St. Petersburg, Florida, United States

Manufacturer Assault Aviation, 78 Quai Marcel Dassault
92552 Saint-Cloud, France

Aircraft type Dassault FALCON 2000EX

Country of registration United States of America

Registration N994GP

Flight rules IFR

Type of operation Commercial

Departure point Moscow Vnukovo, UUWW

Destination point Chambéry Aix-les-Bains, LFLB

Aircraft 2

Owner Aircraft Guaranty Holdings & Trust LLC, Trustee
515N. Sam Houston Parkway East, Suite 305
Houston, Texas 77060, USA

Operator Flieg Kleiner Prinz GbR; c/o F. Dickhaus
Am Alten Weinberg 23, D - 65207 Wiesbaden

Manufacturer Cessna Aircraft Co.
One Cessna Blvd. Wichita, USA

Aircraft type Cessna P210N Silver Eagle

Country of registration United States of America

Registration N8KR

Flight rules VFR, under a category "Z" flight plan

Type of operation Private

Departure point Annecy, LFLP

Destination point Mainz-Finthen, EDFZ

Location Abeam Présilly; waypoint PITOM; N 46°05'41" E
06°06'07"

Date and time 12 March 2011, 14:30 UTC

ATS unit Geneva approach control

Airspace Class C, (TMA LSGG 2)

Minimum prescribed separation Horizontal 3 NM / vertical 1000 ft

Closest convergence

Horizontal 0.3 NM / Vertical 335 ft

Airprox category of the serious
incident

ICAO – Category A – high risk of collision

Investigation

The serious incident occurred on 12 March 2011 at 14:30 UTC. It was notified on Wednesday 16 March 2011 at 11:55 UTC. The federal Aircraft Accident Investigation Bureau (AAIB) opened an investigation on 29 March 2011 at 12:36 UTC.

The AAIB notified the incident to the following authorities:

NTSB-Washington, United States

BEA-Le Bourget, France

BFU-Braunschweig, Germany

The 3 countries designated an accredited representative. The airspace in which the serious incident took place is located in France and is delegated to Switzerland. The French authorities entrusted the investigation to the Swiss Air Accident Investigation Bureau.

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

Synopsis

The serious incident took place in the Geneva TMA on 12 March 2011. It was caused by a loss of separation between a Falcon 2000, registration N994GP, in approach phase at Chambéry airport under IFR rules, and a Cessna 210, registration N8KR, departing from Annecy airport, flying under VFR rules under a "Z" flight plan, which entered the Geneva TMA without authorisation.

The aircraft involved in the conflict were on two different frequencies. The two ATC units issued traffic information to the pilots, who read it back and reported that they had the traffic in sight.

The crossing of the routes took place at 14:30 UTC abeam waypoint PITOM, located geographically over Présilly/F. According to the radar recordings, at the closest point of proximity the aircraft had a lateral separation of 0.3 NM and an vertical difference of 335 ft.

Causes

The serious incident is due to a dangerous convergence between an IFR aircraft established on an arrival route and stable at its flight level, and a VFR aircraft in climbing phase, which entered controlled class C airspace without authorisation.

Factors which played a part in the serious incident:

- Incomplete flight preparation by the crew of the Cessna 210
- Absence of established procedures for category "Z" flights departing from the Chambéry TMA

Safety recommendations

This report has given rise to one safety recommendation.

According to the provisions of Annex 13 of the ICAO, all safety recommendations listed in this report are intended for the supervisory authority of the competent state, which has to decide on the extent to which these recommendations are to be implemented. Nonetheless, any agency, establishment or individual is invited to strive to improve aviation safety in the spirit of the safety recommendations pronounced.

In the Ordinance on the Investigation of Aircraft Accidents and Serious Incidents (OIAASI), the Swiss legislation provides for the following regulation regarding implementation:

“Art. 32 Safety recommendations

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

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

³ DETEC informs the SAIB at least twice a year on the state of implementation by the FOCA.”

1 Factual information

1.1 History of the serious incident

1.1.1 General

The history of the serious incident and the description of the flight facts were drawn up on the basis of the recordings of the radar tracks, the transcriptions of the radiotelephony communications, the telephone coordinations and the statements of the crew members and air traffic controllers.

Aircraft 1 – N994GP

This aircraft was making a ferry flight from Moscow (UUWW) to Chambéry (LFLB) and was operating under instrument flight rules (IFR). The commander was at the controls of the aircraft (pilot flying – PF) whilst the copilot fulfilled the function of pilot not flying (PNF).

Aircraft 2 – N8KR

This aircraft had just left Annecy (LFLP) for Mainz-Finthen (EDFZ) and was operating under visual flight rules (VFR). This single-turbine aircraft type can be operated by a single pilot. However, for the return flight to Germany, two pilots were flying the aircraft. The pilot seated on the left was at the controls of the aircraft (PF). The second fulfilled the function of PNF and was responsible for navigation and radiotelephony communications. According to the statements, it was he who assumed the role of Pilot in Command (PIC). One passenger was seated aft.

ATS units

At the time of the serious incident, the Geneva terminal control region ATS units consisted of the following workstations:

Approach coordinator (APC), presequence radar (PRE), departure radar (DEP), final radar (FIN) and flight information centre (FIC).

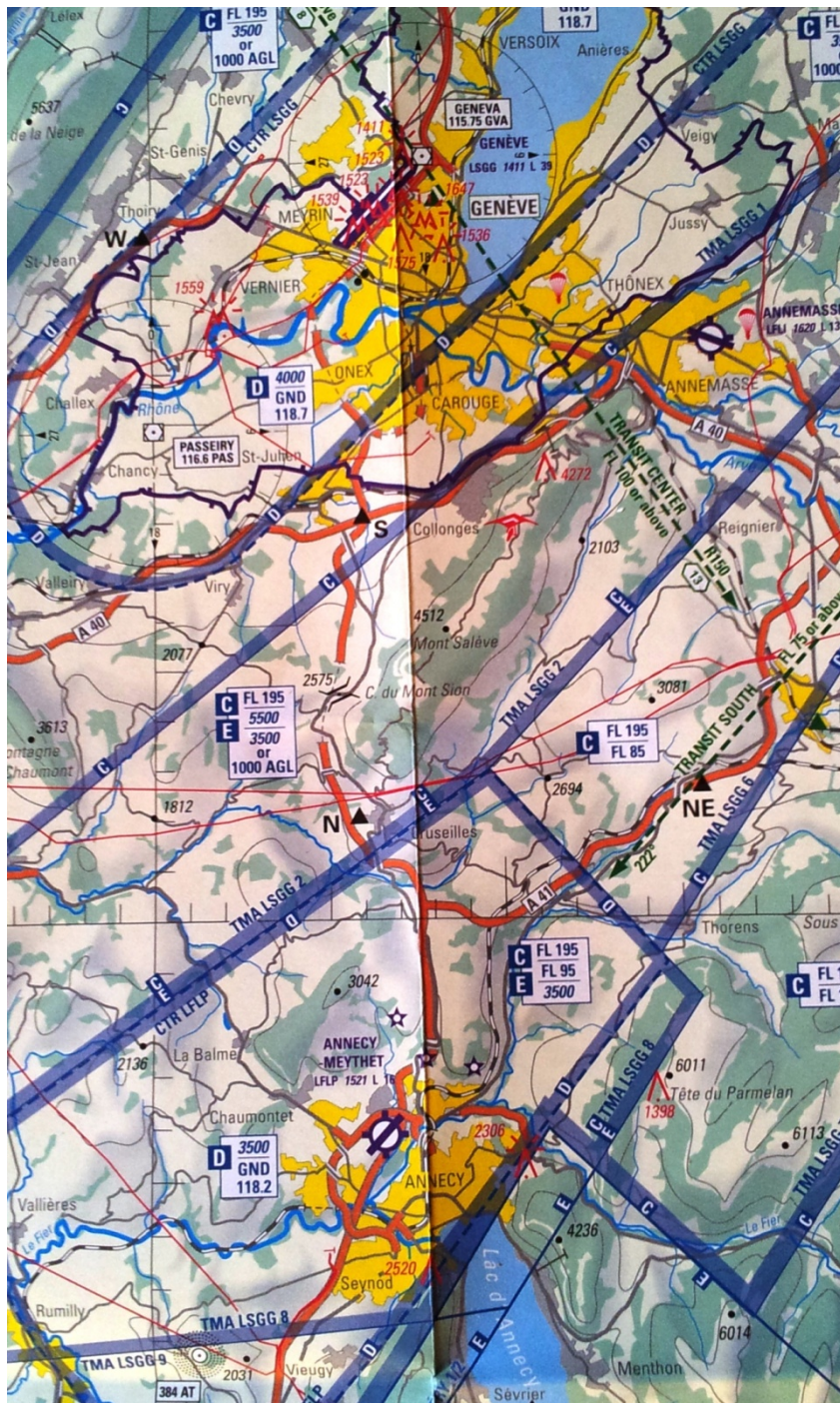
All the workstations were occupied except the FIN position which was closed, and awaiting opening for the peak traffic to come.

The approach coordinator (APC) position was filled by a controller in training, under the supervision of an instructor (OJTI – on the job training instructor).

The Chambéry ATS units consisted of the approach, tower and information service workstations.

The surrounding airspace

The airspace surrounding Annecy airport is class D up to 3500 ft. Above this is the Chambéry TMA, class E, up to flight level FL 95. Adjacent on the north side is the Geneva TMA 2, class E, extending from 3500 ft to 5500 ft, and class C, from 5500 ft to flight level FL 195. The Geneva TMA 6 and 7 extend to the northeast, class C, from flight level FL 85 and FL 105 respectively, up to flight level FL 195.



Chambéry TMA and Geneva airspace

1.1.2 Flight preparations

- Saturday 12 March 2011 was a day of heavy traffic for Geneva and Chambéry. All flights to Geneva were required to obtain an airport slot before filing a flight plan. The pilot of N8KR, who had not obtained the said slot, had initially chosen Annemasse/F as a destination before finally opting for Annecy airport.
- The pilot of N8KR had, accordingly, filed an initial flight plan for Annemasse, then a second one for Annecy, taking care to cancel the first.
- The category Z flight plan (joining) for the return to Mainz-Finthen was filed at 08:53 UTC. It did not specify a joining point. The corrected version was sent by the ATS units at 09:03 UTC and specified waypoint VENAT for the IFR joining point. Confirmation of acceptance of the flight plan was, according to the testimony of the pilot, received on the pilot's mobile telephone.
- When the turbine was running, the crew of N8KR received information from Annecy control tower that the flight plan was cancelled. This action gave rise to a cancellation message sent by the Brussels Flight Plan Centre which 2 minutes later issued a new flight plan Z with an ETD corrected to 14:25 UTC. In the minutes which followed, this enabled Annecy Tower to propose to the crew that they should take off in accordance with the filed "Z" flight plan.

1.1.3 History of the serious incident

On 12 March 2011 at 14:26 UTC, a private aircraft type Cessna 210, registration N8KR, with 2 pilots and one passenger on board, took off from Annecy aerodrome for Mainz-Finthen in Germany. The first part of the flight took place under visual flight rules, the intention being to change to IFR and continue the flight under instrument flight rules.

At 14:25:52 UTC the Falcon 2000EX, registration N994GP, flying from Moscow Vnukovo, was cleared by the Geneva departure sector to descend to flight level FL 80 without any speed restriction on its standard arrival route, destination Chambéry.

At 14:27 UTC the Cessna P210N aircraft, registration N8KR, which had just left Annecy airport, was passing 4000 ft climbing and heading north. Annecy TWR cleared it to leave the frequency without any special instructions. Although the IFR joining point lies to the NE of Annecy, the pilots initially maintain a northerly heading because, on the right, there is the mountainous region of Haute Savoie and cloud cover partially masks the terrain. Navigation, although this was the VFR part of the flight, was carried out using the Jeppesen no. 10-1 IFR chart, Area-Geneva/Switzerland dated 2 July 2010 (Annex 1).

A 14:27:25 UTC, N8KR called Chambéry approach control on the 121.200 MHz frequency assigned to IFR traffic and asked to join IFR "*request IFR pickup*".

At 14:27:49 UTC, according to the radar recordings (see section 2.1), N8KR crossed the boundary of the Geneva TMA.

At 14:27:59 UTC, at the request of Chambéry approach, it confirmed its position as follows: "*Position is 4 NM north of Annecy, passing 5500, N8KR, inbound SALEV*". Noting that N8KR was close to the southern boundary of the Geneva TMA, Chambéry approach transferred it directly to the 126.350 MHz frequency of the Geneva flight information service.

At 14:28:04 UTC, the Geneva departure sector sent N994GP to the 121.200 MHz Chambéry approach frequency. The aircraft maintained flight FL 80 level and it

was passing abeam the GVA VOR. The transfer of control becomes effective as soon as the aircraft is in contact with Chambéry approach (Annex E, Chambéry – Geneva LOA).

At 14:28:37 UTC N8KR called the flight information service. It was passing 6000 ft in a climb with a rate of climb of approximately 1200 ft/min.

At 14:28:50 UTC N8KR confirmed that it was flying according to a category "Z" flight plan (joining) on take-off from Annecy and was about to reach SALEV for an IFR pick-up.

At 14:29:22 UTC the flight information service assigned a transponder code for identification. The pilot confirmed the code and reported that he was turning in the direction of MOLUS.

At 14:29:26 UTC Chambéry approach control noted VFR traffic N8KR passing an altitude of 7300 ft in a climb and warned the crew of N994GP about the conflicting opposing traffic. The latter confirmed they had visual contact with the traffic and reported that they had a traffic advisory (TA) on their TCAS, but no resolution advisory (RA).

At 14:29:31 UTC the flight information centre (FIC) informed the Geneva approach coordinator by telephone of the intrusion of N8KR at SALEV at 7000 ft. The FIC operator, having observed the presence of the opposing traffic N994GP, asked the approach coordinator for instructions to be transmitted to N8KR. The latter instructed it at 14:29:40 UTC to maintain an altitude of 7000 ft, a message which the flight information service transmitted without delay to the pilots of N8KR.

At 14:29:47 UTC N8KR reported that it was passing 7000 ft, but that it had visual contact with the traffic on its left and that it was stabilising at 7500 ft. In response, the flight information service instructed it to descend to 7000 ft and confirmed the presence of the opposing traffic.

At 14:30:01 UTC the two aircraft N8KR and N994GP crossed above Présilly/F. At the closest point of approach the aircraft had a lateral separation, according to the radar recordings, of 0.3 NM and an altitude difference of 335 ft.

1.1.4 Location of the serious incident

Geographical position	Présilly, France
Date and time	14:30:01 UTC
Lighting conditions	Daytime
Coordinates	N 46°05'41" E 06°06'07"
Altitude or flight level	FL 80

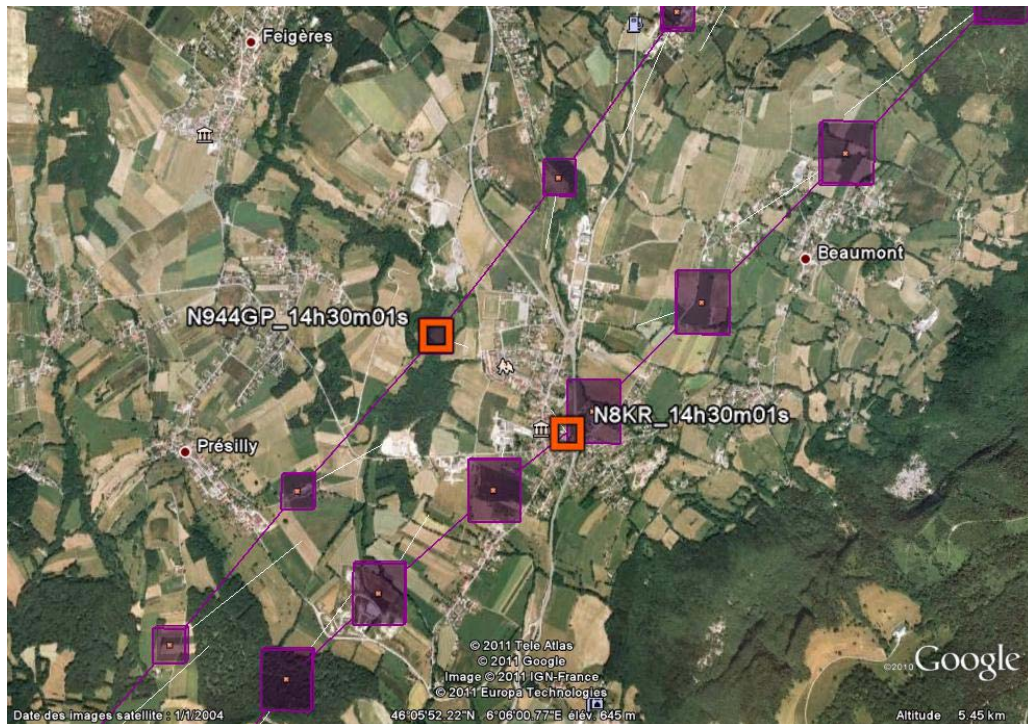


Image of the location of the serious incident above Présilly/F

1.2 Personnel information

1.2.1 Crew of aircraft 1 – N994GP

1.2.1.1 Commander

1.2.1.1.1 Training

Person	American citizen, born 1966
Licence	Airline transport pilot licence (ATPL) according to the Department of Transportation – Federal Aviation Administration, issued by the FAA / USA on 2 May 2007
Ratings class/type	DA-2000/EASY
Last aptitude test	3 April 2010 and 20 October 2010
Medical certificate	Class 1, 15 April 2011
Last medical examination	15 April 2011

1.2.1.1.2 Flying experience

Total hours	6050 hours
on the type involved	2500 hours

1.2.1.2	Copilot (PNF)	
1.2.1.2.1	Training	
	Person	American citizen
	Licence	Not communicated
1.2.1.2.2	Flying experience	
	Total hours	Not communicated
1.2.2	Crew of aircraft 2 – N8KR	
1.2.2.1	Pilot (PF)	
1.2.2.1.1	Training	
	Person	German citizen, born 1958
	Licence	Private pilot licence PPL(A) according to ICAO and JAR-FCL, first issued by the Bundesrepublik Deutschland on 4 September 1992 and valid till 19 October 2014. Commercial pilot according to the FAA, issued by the Federal Aviation Administration, United States of America on 27 May 2010
	Ratings class/type (on German licence)	Class SEP PIC (single engine piston), valid till 19 October 2012 NFQ, night flying NIT(A) English Level 5, valid till 1 November 2018.
	Ratings (on American licence)	Single and multi-engine land; instrument airplane
	Last proficiency check	29 November 2010
	Medical certificates	For German licence: Class 2, VDL (Holder must wear corrective lenses for distant vision) Valid from 2 June 2010 till 24 July 2012 For American licence: Class 3, VDL
	Last medical examination	2 June 2010 (for the 2 certificates)

1.2.2.1.2 Flying experience

Total hours	1738 hours
of which on the type involved	19:48 hours
in the last 90 days	15:42 hours
of which on the type involved	14:36 hours

1.2.2.2 Copilot

1.2.2.2.1 Training

Person	German citizen, born 1950
Licence	PPL (A) (private pilot licence aeroplane) according to the ICAO and JAR-FCL, first issued by Bundesrepublik Deutschland on 27 October 1989 and valid till 9 October 2013. Pilot private PPL (A) (private pilot licence aeroplane) according to the FAA, first issued by the Federal Aviation Administration, United States of America on 15 January 2004 and valid with the German PPL(A) licence
Ratings class/type	Cessna SET PIC (single engine turbine), valid till 15 October 2011. Class SEP (single engine piston), valid till 15 October 2011. English Level 4, valid till 9 May 2014.
Ratings	Class SEP LAND; Instrument Airplane; issued on the basis of, and valid only when accompanied by, German pilot licence, Valid till 15 October 2011. Night flying NIT (A)
Last proficiency check	28 September 2009
Medical certificate	Class 2, VML Valid from 5 March 2012 till 5 March 2012
Last medical examination	5 March 2010

1.2.2.2.2 Flying experience

Total hours	1431:07 hours
of which on the type involved	Approx. 900 hours
in the last 90 days	16:42 hours
of which on the type involved	16:42 hours

1.2.3 Air traffic controllers

1.2.3.1 Air traffic controller 1

Function	Approach coordinator (APC)
Person	Swiss citizen, born 1974
Working days before the day of the incident	Last rest days 8 and 9 March. On 11 March duty began at 14:30 UTC
Start of duty on the day of the incident	09:00 UTC
Licence	Air Traffic Controller Licence, based on European Community Directive 2006/23, first issued by the Federal Office of Civil Aviation (FOCA) on 5 July 2000 and valid till 5 October 2011.
Position qualification	Unit endorsement TWR / APC; Location LSGG Ratings: AeroDrome control Instruments - ADI, Approach control Surveillance - APS; Rating Endorsements: Air Control - AIR, RADar – RAD (ADI+APS, Surveillance Radar Approach – SRA, ToWeR control – TWR, Ground Movement Control - GMC, Ground Movement Surveillance – GMS License endorsement: OJTI, Assessor / EXaMiner – EXM English Level 5, valid until 15 April 2015
Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 5 October 2011; no limitations

1.2.3.2 Trainee air traffic controller

Function	Approach coordinator (APC)
Person	Swiss citizen born 1988
Working days before the day of the incident	On 11 March duty began at 14:30 UTC
Start of duty on the day of the incident	09:00 UTC
Licence	Air Traffic Controller Licence, based on European Community Directive 2006/23, first issued by the Federal Office of Civil Aviation (FOCA) on 31 March 2010 and valid till 8 June 2012.
Position qualification	Trainee Ratings: ADI, APS; Rating Endorsements: none License endorsement: none English Level 4, valid until 25 June 2013
Medical certificate	European Class 3 Medical Certificate for Air Traffic Controllers, valid until 16 June 2012; no limitations

1.2.3.3 Air traffic controller 2

Function	Departure controller (DEP)
Person	Swiss citizen born in 1976
Working days before the day of the incident	Rest days 9, 10 and 11 March.
Start of duty on the day of the incident	13:40 UTC
Licence	Air Traffic Controller Licence, based on European Community directive 2006/23, first issued by the Federal Office of Civil Aviation (FOCA) on 14 September 2001 and valid till 23 December 2011.
Position qualification	Unit endorsement APC; Location LSGG Ratings: APS, ACS; Rating Endorsements: RAD (APS + ACS), 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

1.2.3.4 Flight information service controller (FISC)

Function	FIS operator
Person	Swiss citizen, born 1970
Working days before the day of the incident	Rest days 10 and 11 March.
Start of duty on the day of the incident	11:00 UTC
Licence	Safety Related Task Licence, first issued by the Federal Office of Civil Aviation (FOCA) on 29 July 1998 and valid until 21 July 2011.
Position qualification	Unit endorsement FIS; Location LSAG Ratings: FISC; Rating Endorsements: RAM (Radar Monitoring) License endorsement: OJTI English Level 4, valid until 22 April 2012
Medical certificate	Medical Certificate for Air Navigation Service Employees, class SRT valid until 11 September 2011; no limitations

1.3 Aircraft information

1.3.1 Aircraft 1



Registration	N8KR
Aircraft type	Cessna P210 Silver Eagle
Characteristics	Single turbine, aircraft of metal construction, high wings and retractable landing gear, powered by propeller
Manufacturer	Cessna Aircraft Co. Wichita, USA
Serial no.	P21000709
Owner	Aircraft Guaranty Holdings & Trust LLC, Continent Aircraft Trust No. 672 Houston Texas 77060, USA
Operator	Flieg Kleiner Prinz GbR, D – Wiesbaden
Equipment	Garmin GPS 430 with integrated TCAS; TA only

1.3.2 Aircraft 2



Registration	N994GP
Aircraft type	Dassault Falcon 2000 EX
Characteristics	Twin-jet
Manufacturer	Dassault Aviation, 92552 Saint-Cloud, France
Serial no.	105
Owner	Wells Fargo Bank Northwest Na Trustee, Mac U1228-120, Salt Lake City, USA
Operator	Elite Air Inc. St. Petersburg, Florida, USA
Equipment	ACAS

1.4 Meteorological information

1.4.1 General

The information contained in section 1.4 was provided by MeteoSwiss.

1.4.2 General meteorological information

AIRMET

LSAS AIRMET 3 VALID 121330/121700 LSZH-

LSAS SWITZERLAND FIR MOD TURB FCST ALPS AND N OF ALPS
SFC/FL140 STNR INTSF=

Which means:

Forecast valid 12 March between 13:30 UTC and 17:00 UTC for the Swiss flight information region:

Moderate turbulence forecast in the Alps and to the north of the Alps, extending from the surface to flight level 140, stationary and intensifying.

METAR

LSGG 121420Z VRB01KT 7000 FEW080 OVC130 10/04 Q1008 NOSIG=

Which means:

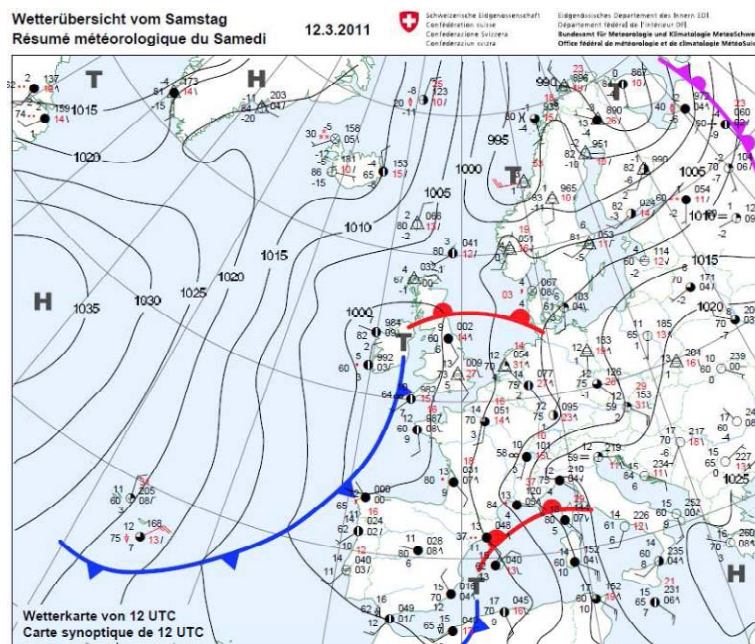
Geneva airport meteorological observation issued on 12 March at 14:20 UTC, wind variable, intensity 1 kt, visibility 7000 metres, 1-2/8 cloud at 8000 ft AAL, 8/8 cloud at 13000ft, temperature +10°C, dew point +04°C, atmospheric pressure 1008 hPa, no significant change for the next two hours.

LFLP 121430Z AUTO 24004KT 200V260 9999 NSC 10/04 Q1008=

Which means:

Annecy airport meteorological observation issued on 12 March at 14:30 UTC, winds 240°, variable between 200° and 260°, speed 4 kt, visibility over 10 km, no significant cloud, temperature + 10 °C, dew point + 04 °C, atmospheric pressure 1008 hPa.

Meteorological synopsis for Saturday



Synoptic chart at 12:00 UTC.

A depression over the Iberian Peninsula was moving towards southern France. In the course of the day the associated perturbation approached Switzerland. In front of it a Föhn wind situation prevailed.

1.4.3 Meteorological situation at the time of the incident

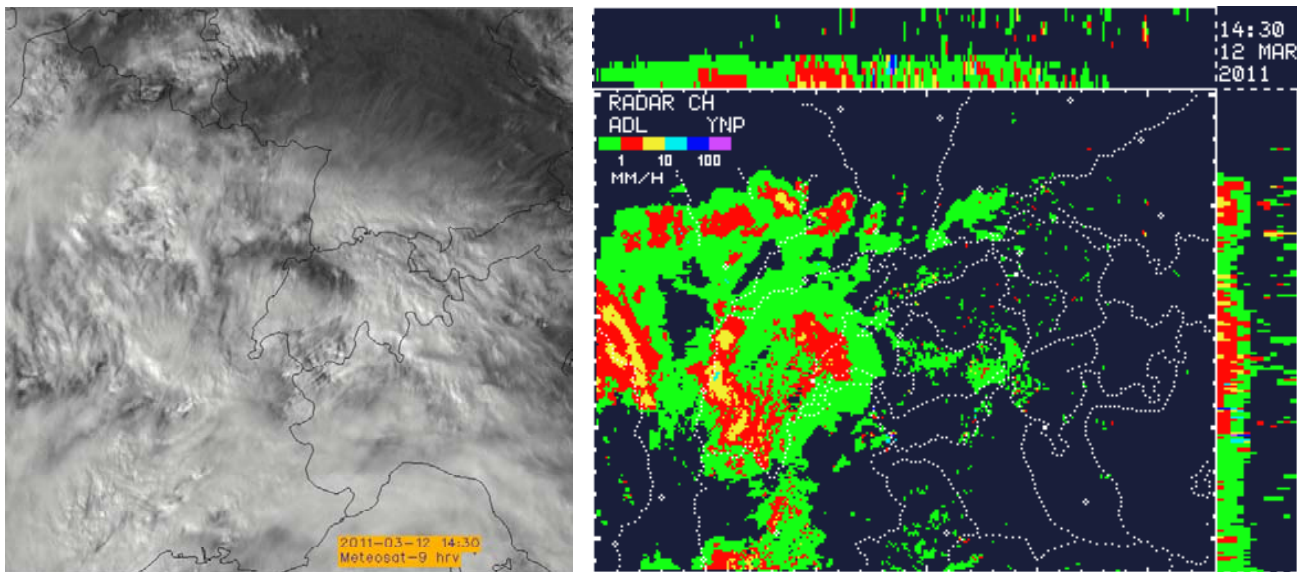
The following information about the meteorological conditions at the time of the incident is based on information from MeteoSwiss.

Weather/cloud 1/8 at 9500 ft AMSL, 8/8 at 14,000 ft

	AMSL
Visibility	No reliable data
Wind:	Wind from south south-west at 20 kt
Temperature / dew point	01°C/ -14°C
Atmospheric pressure	QNH LSGG 1008
Hazards	Moderate turbulence possible

1.4.4 Image taken by satellite and weather radar in the region of the incident

On the satellite image thick cloud cover can be distinguished, and on the radar image echoes of light precipitation are identifiable.



Satellite image

Weather radar image

1.4.5 Forecasts

At the time of the serious incident the following terminal aerodrome forecasts (TAF) were valid:

TAF

```
LSGG 121125Z 1212/1318 05003KT 7000 SCT025 SCT120 TX14/1214Z
      TN05/1306Z TX12/1315Z BECMG 1214/1217 BKN 070 PROB40 TEMPO
      1222/1310 RA BECMG 1310/1312 -RA SCT015 BKN040=
```

In clear text this means:

Geneva Cointrin

On 12 March 2011, at 11:25 UTC the following weather forecasts valid between 12 March at 12:00 UTC and 13 March at 18:00 UTC were issued:

Wind: From 050° at 3 kt

Meteorological visibility	7000 m
Cloud	3 - 4/8 at 2500 ft AAL 3 - 4/8 at 12,000 ft AAL
Temperature	Maximum 14 °C on 12 March at 14:00 UTC Minimum 5 °C on 13 March at 05:00 UTC Maximum 12 °C on 13 March at 15 00 UTC
Conditional forecasts	On 12 March between 14:00 UTC and 17:00 UTC, 5-7/8 at 7000 ft AAL, between 12 March at 22:00 UTC and 13 March at 10:00 UTC, 40% probability of rain, between 10:00 UTC and 12:00 becoming light rain accompanied by 3-5/8 cloud cover at 1500 ft AAL and 5-7/8 at 4000ft AAL.

LFLP 121100Z 1212/1312 VRB02KT 8000 NSC BECMG 1212/1215 06005KT
9999 SCT040 BKN090 TEMPO 1221/1309 16006KT 7000 -RA FEW020
SCT030 OVC080=

In clear text this means:

Annecy

On 12 March 2011 at 11:00 UTC the following weather forecasts valid between 12 March at 12:00 UTC and 13 March at 12:00 UTC were issued:

Wind:	variable at 2 kt
Meteorological visibility	8000 m
Cloud	No significant cloud
Conditional forecasts	On 12 March between 12:00 UTC and 15:00 UTC, wind from 060°, speed 5 kt, visibility over 10 km, cloud cover 2-4/8 at 4000 ft and 5-7/8 at 9000 ft, temporarily between 12 March at 21:00 UTC and 13 March at 09:00 UTC, wind from 060°, speed 6 kt, visibility 7000 m, light rain, 1-2/8 cloud cover at 2000 ft AAL, 3-4/8 at 3000 ft ALA and 8/8 at 8000 ft AAL.

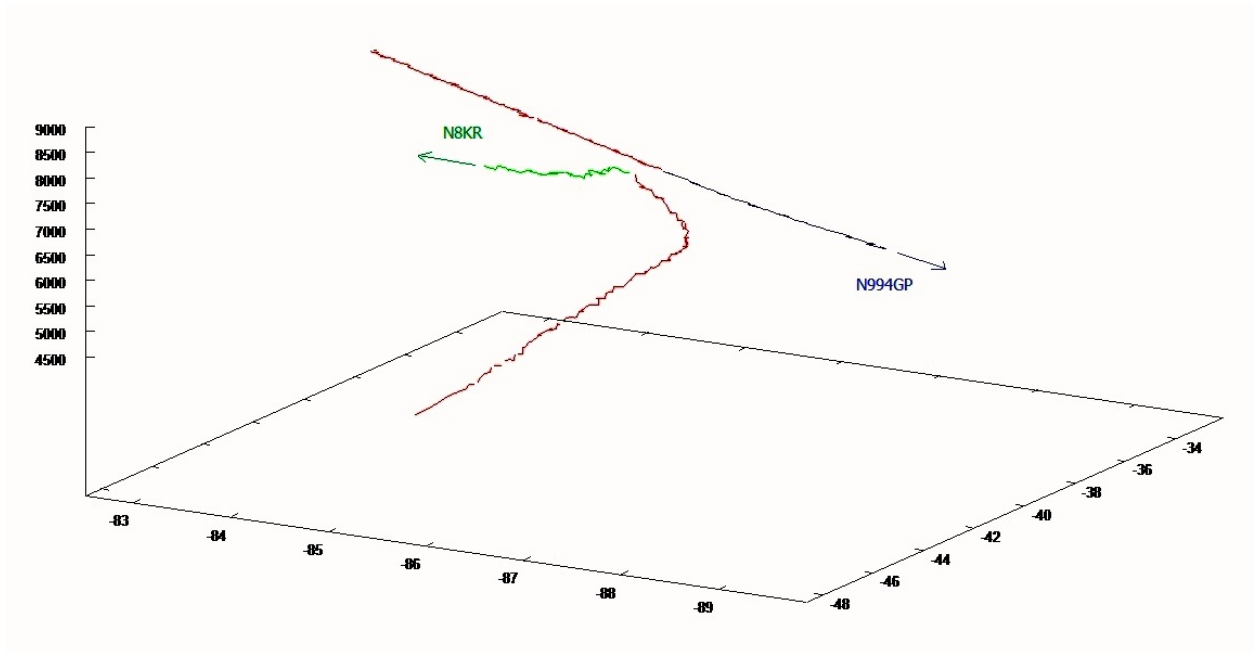
1.5 Communications

Communications between the pilots and ATC units were conducted in English in a normal manner. From take-off from Annecy to the time of the serious incident, during a four-minute period the pilot of N8KR contacted three different ATC units. He passed from Annecy Tower to Chambéry approach control and then to the Geneva flight information centre which, after the crossing, transferred him to Geneva approach sector.

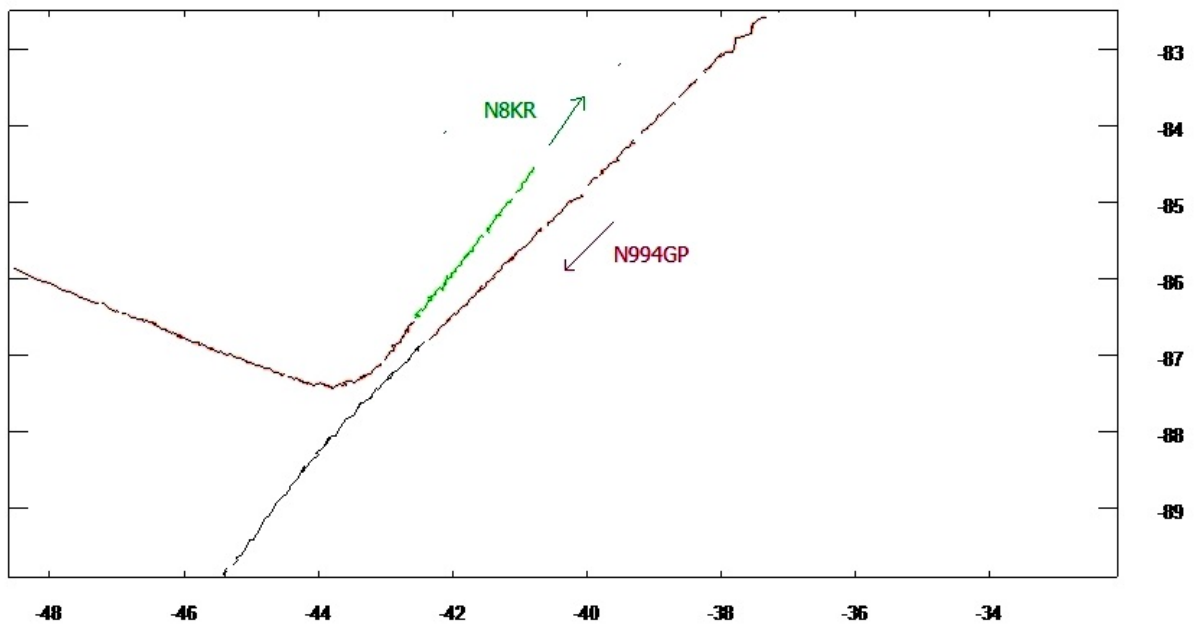
1.6 Tests and research

The preliminary analysis of the trajectories demonstrated that these were diverging and that the conditions necessary for the issue of an RA were not met. The data in the Mode S files confirm that no resolution advisory RA was issued onboard aircraft N994GP (see Annex 3).

3D presentation



Trajectories



X and Y in NM

1.7 Organisational and management information

Several flight plans for N8KR were lodged (see Annex 2) and some were amended by the Integrated Initial Flight Plan Processing System (IFPS) in Brussels. A category “Z” flight plan (joining) without a specified joining point was modified, whereas, according to the pilot's statement, he intended departing directly under IFR from Annecy airport. The update to the ETD in the “Z” flight

plan by the ATS units enabled Annecy Tower to propose to the crew that they should take off in accordance with the "Z" flight plan.

1.8 Additional information

1.8.1 VFR flights in class C airspace – ATC clearances

Extract from the VFR Switzerland Manual, RAC 4-0-3

“Regardless of the fact that a flight plan has been filed, the competent air traffic control authority must be called in good time before entering class C airspace.”

1.8.2 Traffic information / general

Extract from ATMM Switzerland, flight information service, sect. 11-4.1

“Traffic information provided within the scope of FIS includes only aircraft the presence of which is known to you and which might constitute a collision hazard to the aircraft concerned, and will sometimes be incomplete.

Note: ATS cannot assume responsibility for its issuance at all times, nor for its accuracy.”

1.8.3 Traffic information to aircraft operating in controlled airspace

Extract from ATMM Switzerland, flight information service, sect. 11-4.2

“For the issuance of traffic information to aircraft operating in controlled airspace, refer to Section 7 General Air Traffic Control § 4 of this Manual.”

“Issue traffic information as required by the airspace classification in respect of aircraft, the presence of which may constitute a risk of collision for the aircraft receiving the information.

When required by airspace classification, issue traffic information to the aircraft concerned.”

1.8.4 Class C airspace

Extract from AIP Switzerland, ENR 1.4- 2

The provisions of class C airspace are shown below:

	IFR	VFR
Separation provided	IFR from IFR/IFR from VFR	VFR from IFR
Service provided	ATC	ATC for separation from IFR VFR traffic information (and traffic avoidance advice on request)
VMC minima	Not applicable	At and above FL 100: 8 km visibility Distance from cloud: Horizontal 1500 m Vertical 1000 ft Below FL 100: 5 km visibility Distance from cloud: Horizontal 1500 m Vertical 1000 ft
Speed limitation	Exceptionally applicable in Switzerland: 250 kt IAS below FL 100	250 kt IAS below FL 100
Radio communication	Continuous two-way	Continuous two-way
ATC clearance	Required	Required

1.8.5 Use of radar by FIC operators

Extract from ATMM Switzerland, flight information service, sect. 11-9.1)

“You may use radar to provide the services listed on your duty statement as outlined in § 9.3 below.

Perform radar identification by using SSR identification procedures only. If SSR identification is not possible and radar identification is deemed necessary, ask a licensed ATCO to perform identification by a primary radar method.

Under no circumstances shall you use radar for providing:

- *radar separation; or*
- *radar vectoring.”*

1.8.6 Specific tasks and services

Extract from ATMM Switzerland, flight information service, Sect. 11-9.3

“Provide the following services: “...

- *provide traffic information as appropriate;*
- *inform aircraft which appear likely to infringe boundaries of airspace class D or C of their position and request flight crews’ intentions;*
- *inform the respective ATC unit of the position of aircraft which appear likely to infringe airspace class D or C;*

....”

1.8.7 FIC duties

Extract from ATMM TCG FIC, A1

“The FIC provides flight information service, alerting service and other specific duties that fall within its domain of competence.

The FIC provides flight information service and alerting service to flights operating within the limits of Geneva CTA and delegated airspace, with the exception of Geneva TMA and CTR.

Flight information service shall be provided to all aircraft which are likely to be affected by the information and which are:

- Provided with air traffic control services, or*
- Otherwise known to the relevant air traffic services units.”*

1.8.8 Traffic information

Extract from ATMM TCG FIC, E11

“Traffic information shall be issued using the level or the relative position above (or below) in feet of the traffic concerned. In order to avoid confusion with any cleared level and to permit rapid sighting of the traffic, traffic information based on relative position is the recommended option.”

1.8.9 VFR flights / flights from Chambéry approach to Geneva approach

Extract from Letter of Agreement Chambéry approach – Geneva Terminal; Annex D, coordination procedures, paragraph D.5.1

“- Chambéry INFO assigns a transponder code to VFR traffic (see F.1.4).

- Flights likely to concern Geneva are visible on one of these codes.

- When the volume of traffic permits, Chambéry carries out a telephone coordination with Geneva approach before a known VFR enters the Geneva TMA sectors classified in airspace category C, i.e. above 5500 ft QNH. The telephone line used for this purpose is the "Geneva VFR" line.

- If coordination is not possible, the aircraft will be sent to Geneva Information (126,350 MHz) sufficiently early to enable it to request clearance to enter class C airspace.”

1.8.10 Transfer of control

Extract from Chambéry approach – Geneva Terminal Letter of Agreement; Annex E, Transfer of control and transfer of communications

“In the absence of prior agreement between the two approaches, and subject to paras. D.3.1.1 and D.3.2.1, the transfer of control is effective as soon as the aircraft is in contact with the receiving control unit.”

1.8.11 Transfer of communications

Extract from Chambéry approach – Geneva Terminal Letter of Agreement; Annex E, Transfer of control and transfer of communications

"VFR aircraft are invited to contact Geneva Information, or Geneva TWR for flights destination Cointrin."

VFR aircraft which have been accepted by Geneva approach for entry into class C airspace are transferred to Geneva Transit."

1.8.12 Special procedures

Extract from Chambéry approach – Geneva Terminal Letter of Agreement; Annexe D3,

D.3.2.1 Arrivals LFLB

" -aircraft are cleared by Geneva Approach onto the STAR SALEVxR..."

- Silent transfer STAR SALEVxR at FL 80 is to be preferred

- Geneva Approach sends free aircraft towards 6500 ft and left turn..."

D.3.2.2 Arrivals LFLP

" - aircraft are cleared by Geneva Approach onto the STAR SALEVxR..."

D.3.2.3 Special cases: departure LFLB/LFLP simultaneous with an arrival LFLB/LP

"...SID VENAT

- Chambéry clears the departure and climb to FL 090 and transfers it to Geneva as soon as possible.

- Geneva ensures separation and descent of the arrival to FL 080 before the transfer to Chambéry as quickly as possible but at the latest at the limit of the Chambéry TMA1, IAS 220 kt max. ..."

D.3.2.4 Flights LSGG/LFLI to LFLB/LP

"Flights taking off from Geneva and Annemasse towards LFLB/LP shall be reported to Chambéry APP by telephone during the roll."

1.8.13 Radar coordination procedure – A/C 7000

Extract from Chambéry approach – Geneva Terminal Letter of Agreement; Annex F, Radar coordination procedure

"France: operation mandatory only with Mode C for VFR flights in class E and G airspace.

Subject to assignment of another SSR code by an ATS unit."

1.8.14 Emergency separation

Extract from Chambéry approach – Geneva Terminal Letter of Agreement; Annex G, Complementary procedures

"In case of imminent conflict and when coordination can no longer be effected in time, collision avoidance is ensured according to the following rule:

Geneva APP: avoidance in the vertical plane. This procedure must not be contrary to a TCAS avoidance RA.

Chambéry APP: Avoidance in the horizontal plane.”

1.8.15 IFPS manual processing procedures

Requirements

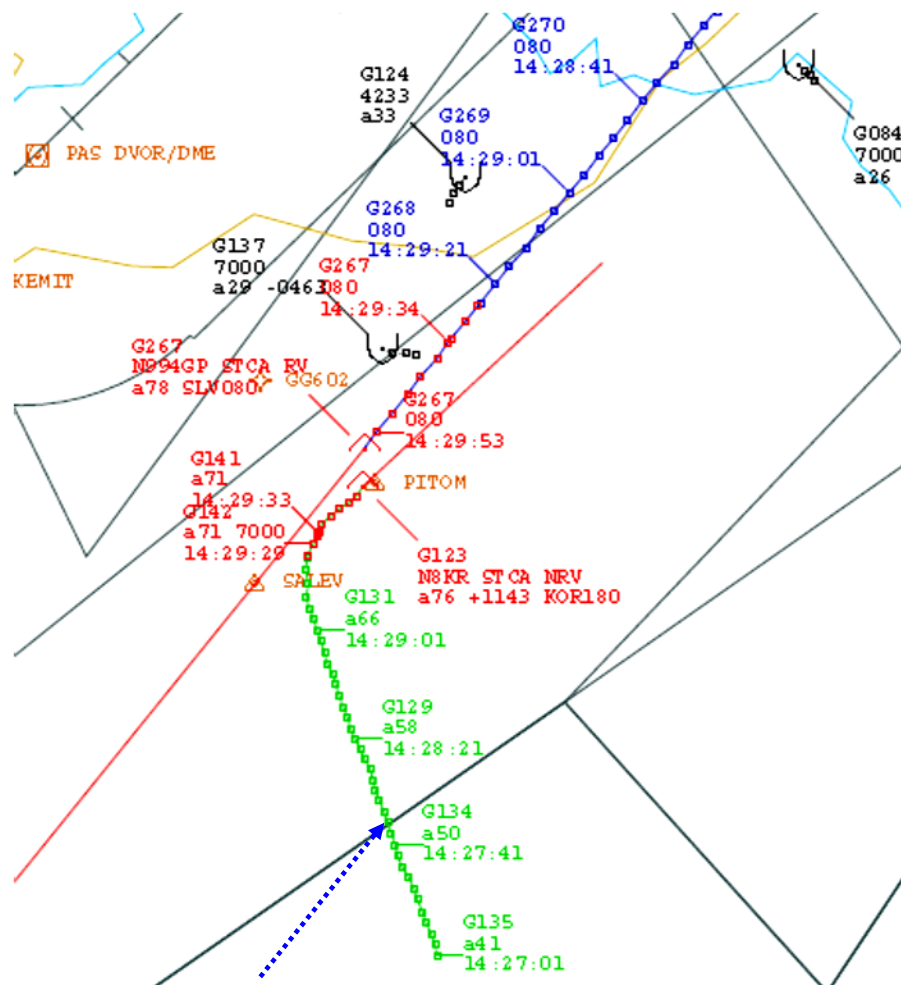
“The IFPS is responsible for the reception, verification and distribution of flight plan data for all IFR/GAT flights within the IFPZ. AOs have a legal responsibility (ref. National AIPs and ICAO Doc. 7030) to ensure that all flight plans and associated messages for IFR/GAT flights or parts thereof intending to operate within the IFPZ shall be submitted to the IFPS for processing.”

2 Analysis

2.1 ATC aspects

Shortly after take-off and in accordance with procedures, Annecy control TWR released the pilot from the obligation to maintain radio contact. Chambéry approach control responded to the initial call from the aircraft and noted that the aircraft was on the northern boundary of its terminal area. As the aircraft was heading towards waypoint SALEV, notwithstanding its request for joining, he transferred it to the Geneva flight information service (FIC), according to the statement of the air traffic controller so that they could "... handle it (routes, intentions)".

Although this transfer takes into account the handover procedure to the Geneva information frequency, it could not meet the condition of a transfer which is sufficiently early to allow the crew to request clearance for entry into Geneva class C airspace, given the position of N8KR (Geneva – Chambéry LoA, Annex D, paragraph 5.1). This transfer results above all from a heavy IFR traffic volume for the control unit which therefore makes it change frequency without any indication to, or restriction on, the crew, i.e. without taking into account the fact that the aircraft was in the VFR phase of a category "Z" flight (joining). Chambéry approach control, according to his own statement, was unable to deal with the VFR traffic.



Time reference of the penetration into the Geneva TMA by N8KR, crossing of the limit of the TMA at 14:27:49 UTC.

By coincidence, following the transfer of the VFR flight, in the same minute Chambéry approach received the call from aircraft IFR N994GP, stable at flight level FL80, without detecting the latent conflict. However, at the moment of the code change for the VFR aircraft (N8KR) initiated by the Geneva FIC, Chambéry approach Control became aware of the conflict and immediately issued essential traffic information to the IFR pilot (N994GP). Chambéry Control did not have time to issue an avoidance instruction in the horizontal plane. (LOA, Annex G, G1 emergency separation).

Less than ninety seconds before crossing, i.e. at 14:28:37 UTC, N8KR called the flight information service (FIC) for the first time. It was passing 6000 ft in a climb at a rate of climb of approximately 1200 ft/min. The pilot entered the new transponder code which Geneva Information had assigned to him and a few seconds later, radar correlation of the aircraft display was established on the radar screens. It was only at this precise moment that the flight information service noticed the conflicting position of this VFR traffic which had entered the Geneva terminal control area (TMA) without authorisation and without having made prior radiotelephone contact.

Geneva Information, before issuing traffic information, immediately informed the radar coordinator by telephone of the unfolding conflict and requested instructions. This delay in the issuing of essential traffic information is the result of applying the rule to not use radar information to ensure separations or radar vectoring, and of the habit of receiving directives from the radar controllers – directives which, in this case, will be retransmitted without delay by the FIC to the pilot.

In parallel, the Geneva approach control DEP position was monitoring the autonomous navigation of the Falcon DA 200EX on its IFR route. After instructing it to descend in stages to flight level FL 80, the lower level for Geneva approach control, he transferred it to the Chambéry approach frequency, approximately 15 NM before it passed the communication transfer point (PINOT) mentioned in the letter of agreement. The intention, according to approach control, was: *"I send them as quickly as possible to make their work easier."* Thus, we find a situation in which the wish to facilitate the work of the adjacent centre should go hand in hand with the concerted management of the IFR and/or VFR volume of traffic.

Handing off IFR traffic as soon as possible is a desire, or even a request, often expressed by controllers in the two centres. In relation to VFR traffic management, the perceived impression is that the problem is often passed on to the adjacent centre. In this specific case, no centre noticed the potential conflict sufficiently early to apply a separation concept or adequate coordination.

At no time did Geneva or Chambéry approach control initiate telephone coordination, since neither perceived the impending potential conflict. The result was that the two aircraft did not find themselves in radiotelephone contact with the same control unit at the same time.

2.2 Crew aspects

Any aircraft intending to enter the Geneva terminal management area (TMA) under VFR must establish radiotelephone contact with control before entering the said area.

The home aerodrome of N8KR at Mainz-Finthen always requires a take-off under VFR and joining IFR ("Z"). The habit of filing "Z" flight plans may explain the fact

that the initial flight plan for the return from LFLP to EDFZ mentions "Z" even though no joining point is mentioned.

Flight preparations were carried out by the copilot the previous evening. Confirmation of the flight plans was received, according to the pilot, on his mobile by SMS. Annecy Tower proposed to the crew that they take off under VFR in accordance with the filed "Z" flight plan. This VFR departure was poorly planned. In addition this was, according to the statement of the pilot at the controls, his first flight out of Annecy.

The proximity of Annecy airport to the boundary of the Geneva TMA and the complexity of the sectorisation of the TMA, was not well understood by the crew, under these conditions. The copilot, in fact, consulted the IFR chart, Jeppesen no. 10 – 1, Area – Geneva / Switzerland.

Shortly after take-off and leaving Annecy CTR, aircraft N8KR was less than 2 NM from the boundary of the Geneva TMA. In the presence of compact cloud cover, a relief covered by sparse cloud and unfamiliar terrain, the crew maintained a northerly heading and continued their climb, thereby causing the unauthorised entry into the Geneva TMA. This incursion was favoured by the fact that the crew were using IFR waypoints for VFR navigation.

The IFR flight of aircraft N994GP took place without any problems. Following the traffic information issued by Chambéry approach, the crew of aircraft N994GP reported to the controller that they had visual contact with the traffic. He also indicated that he had received traffic information from his TCAS (TA), but at no time a resolution advisory (RA). This is confirmed by the Mode S analysis carried out in relation to a TCAS resolution (pt. 1.6). The crew confirmed in their statement that no avoiding action had been necessary and that the flight continued without any problems.

2.3 Technical aspects

The investigation revealed no technical malfunctions which could have contributed to or caused the serious incident.

2.4 Human and operational factors

2.4.1 Crews

It must be stated that the flight preparation of the crew of the Cessna 210 was inadequate in the light of the envisaged flight. Indeed, with regard to the return flight from Annecy to Mainz-Finthen, the crew filed a category "Z" flight plan (joining IFR) without specifying the joining point, which had been notified to them in an SMS by the ATC service. This type of flight plan assumes a VFR departure and, as a result, the use of an ICAO VFR chart. But the crew did not use adequate documentation and merely consulted an IFR chart. In fact, they were unable to study and develop a flight profile complying with the constraints associated with the sectorisation of the airspace.

Moreover, the pilot at the controls of the aircraft did not participate in the flight preparation, which was carried out by the copilot. In addition, inappropriate division of labour in relation to the functions of the two pilots was a source of disorder in the conduct of the flight.

2.4.2 ATC procedure

There is no established procedure for category "Z" flights departing from the LFLB TMA. These flights are treated as VFR flights and no coordination is

initiated by the air traffic unit concerned, regardless of whether this is a take-off from Annecy or Chambéry.

Establishing a specific procedure for departures under a “Z” flight plan which takes into account the complexity of the different TMAs of LFLB and LSGG within this restricted airspace would make it possible to manage most such cases.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects and procedures

- The investigation revealed no technical defect which may have played a part in the incident.
- Aircraft N8KR was authorised for VFR and IFR traffic.
- There is no specific procedure for departures under a category "Z" flight plan departing from Chambéry (LFLB) or Annecy (LFLP) and flying towards the Geneva TMA.

3.1.2 Crews

- The documents provided indicate that the two crews each held a valid licence.
- There is no indication that the pilots' health was affected at the time of the incident.
- The facts indicate that the preparation of the flight of N8KR was undertaken for an IFR flight. The Jeppesen no. 10-1 Area Geneva IFR chart was used for the VFR part of the flight.

3.1.3 Air traffic controllers

- The documents provided indicate that the controllers and the flight information service operator each held an appropriate licence.
- There is no indication that their state of health was affected at the time of the incident.

3.1.4 History of the flight

- At 14:26 UTC, aircraft N8KR took off from Annecy airport under a Z flight plan.
- It called Chambéry approach control at 14:27:25 UTC.
- Shortly before 14:29 UTC the pilot asked the Geneva flight information centre to join IFR and reported that he was approaching waypoint SALEV.
- At 14:29 UTC the pilot entered the transponder code received by the flight information service and reported he was turning in the direction of MOLUS.
- At 14:29:40 UTC the flight information centre instructed N8KR to maintain its altitude of 7000 ft.
- At this time, aircraft N8KR had exceeded the assigned altitude of 7000 ft, and the crew transmitted that they were maintaining an altitude of 7500 ft and had visual contact with the traffic on their left.
- At 14:30:01 UTC, N8KR and N994GP crossed above Présilly/F, with a lateral distance of 0.3 NM and an altitude difference of 335 ft.

3.1.5 Environmental aspects

- At the time of the incident, cloud partially obscured the relief of the Annecy region.

3.2 Causes

The serious incident is due to a dangerous convergence between an IFR aircraft established on an arrival route and stable at its flight level, and a VFR aircraft in climbing phase, which entered controlled class C airspace without authorisation.

Factors which played a part in the serious incident:

- Incomplete flight preparation by the crew of the Cessna 210
- Absence of established procedures for category "Z" flights departing from the Chambéry TMA.

4 Safety recommendations and measures taken since the serious incident

According to the provisions of Annex 13 of the ICAO, all safety recommendations listed in this report are intended for the supervisory authority of the competent state, which has to decide on the extent to which these recommendations are to be implemented. Nonetheless, any agency, establishment or individual is invited to strive to improve aviation safety in the spirit of the safety recommendations pronounced.

In the Ordinance on the Investigation of Aircraft Accidents and Serious Incidents (OIAASI), the Swiss legislation provides for the following regulation regarding implementation:

"Art. 32 Safety recommendations

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

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

³ *DETEC informs the SAIB at least twice a year on the state of implementation by the FOCA."*

4.1 Safety recommendations

4.1.1 Safety deficit

On Saturday 12 March 2011 at 14:26 UTC, aircraft N8KR took off from Annecy airport under a category "Z" flight plan under VFR, bound for Mainz-Finthen in Germany.

Chambéry approach control transferred N8KR, on the boundary of the Geneva TMA, directly to the flight information service frequency. At the same moment, Geneva approach control transferred aircraft N994GP under IFR and stabilised at FL 80 to the Chambéry control frequency, 15 NM before the transfer point.

The flight information service instructed N8KR to descend and reported the presence of the opposing traffic. Chambéry approach issued essential traffic information to aircraft N994 GP, without any other instructions.

The absence of specific IFR joining procedures caused a dangerous convergence, the values of which are 0.3 NM in the horizontal plane and 335 ft in the vertical plane.

4.1.2 Safety recommendation No. 460

The Federal Office of Civil Aviation should complete the letter of agreement between Geneva and Chambéry, particularly with regard to departures under a “Z” flight plan.

4.2 Measures taken since the serious incident

No measures taken to date.

Payerne, 19 November 2012

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, 6 December 2012

Annexe 2 : Flight plans filed for N8KR

```
FF EDDZZPZQ
120853 EDDXZPZZ
(FPL-N8KR-ZG
-01C10T/L-SRGDY/S
-LFLP1200
-N0190F190 VENAT T45 SOSAL N871 DITON Z138 KUDES N851 LBU Z11 KETEG VFR
-EDFZ0135 EDFM
-RMK/CI202509 DOF/110312 EET/MOLUS0010 RMK/IFPS REROUTE ACCEPTED
-E/0300 P/3 R/VE S/ J/ A/+491728906906, WHITE WITH BLUE STRIPES N/B/I
FRANK.DIC
KHAUS:AT:GMX.DE C/DICKHAUS, F/DICKHAUS)
=====
TO : EUCBZMFP EUCHZMFP EDDXYIYR
FROM : EDDZYFYA
DATE : 120903
PRIORITY : FF
SUBJECT : FPL-N8KR-ZG
AD LFMMZFZX LFLLPZPX LFLPZTZX LSGGZTZX EDGGZFZX EDDZZPLP
(FPL-N8KR-ZG
-C10T/L-SDGRY/S
-LFLP1200
-N0190VFR VENAT/N0190F190 IFR T45 SOSAL N871 DITON Z138 KUDES N851
LBU Z11 KETEG VFR
-EDFZ0135 EDFM
-EET/VENAT0010 RMK/CI202509 RMK/IFPS REROUTE ACCEPTED DOF/110312)
=====
FF EDDZYNYS
120903 EUCBZMFP
(FPL-N8KR-ZG
-C10T/L-SDGRY/S
-LFLP1200
-N0190VFR VENAT/N0190F190 IFR T45 SOSAL N871 DITON Z138 KUDES N851
LBU Z11 KETEG VFR
-EDFZ0135 EDFM
-EET/VENAT0010 RMK/CI202509 IFPS REROUTE ACCEPTED DOF/110312
ORGN/EDDZYFYA)
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FF EDDZYFYA
120903 EUCBZMFP
-TITLE ACK -MSGTYP IFPL -FILTIM 120903 -ORIGINDT 1103120903
-BEGIN ADDR
-FAC EDDZYFYA
-END ADDR
-EXTADDR -NUM 006
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110312 -ORGN EDDZYFYA -END MSGSUM
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-LFLP1200
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LBU Z11 KETEG VFR
-EDFZ0135 EDFM
-EET/VENAT0010 RMK/CI202509 IFPS REROUTE ACCEPTED DOF/110312
```

ORGN/EDDZYFYA)
=====

TO : EUCBZMFP EUCHZMFP EDDXYIYR
FROM : EDDZYFYB
DATE : 121131
PRIORITY : FF
SUBJECT : DLA-N8KR-LFLP1400-EDFZ
AD LFMMZFZX LFLLZPZX LFLPZTZX LSGGZTZX EDGGZFZX EDDZZPLP
(DLA-N8KR-LFLP1400-EDFZ)
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FF EDDZYNYS EDDZZPZX
121131 EUCBZMFP
(DLA-N8KR-LFLP1400-EDFZ)
=====

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121131 EUCBZMFP
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110312 -ORGN EDDZYFYB -END MSGSUM
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-LFLP1425
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LBU Z11 KETEG VFR
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-EET/VENAT0010 RMK/CI202509 IFPS REROUTE ACCEPTED DOF/110312
=====

FF EDFZZTZX
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(DEP-N8KR-LFLP1426-EDFZ)
=====

FF EDDZZPZQ
121604 EDFZYYYY
(ARR-N8KR-LFLP-EDFZ1604)
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FROM : EDDZYFYL
DATE : 121607
PRIORITY : FF
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(ARR-N8KR-LFLP1425-EDFZ1604)
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Annex 3: Verification concerning the possible issuing of resolution advisories

Extract from the analysis of the verification concerning the possible issuing of resolution advisories (RA) onboard N994GP

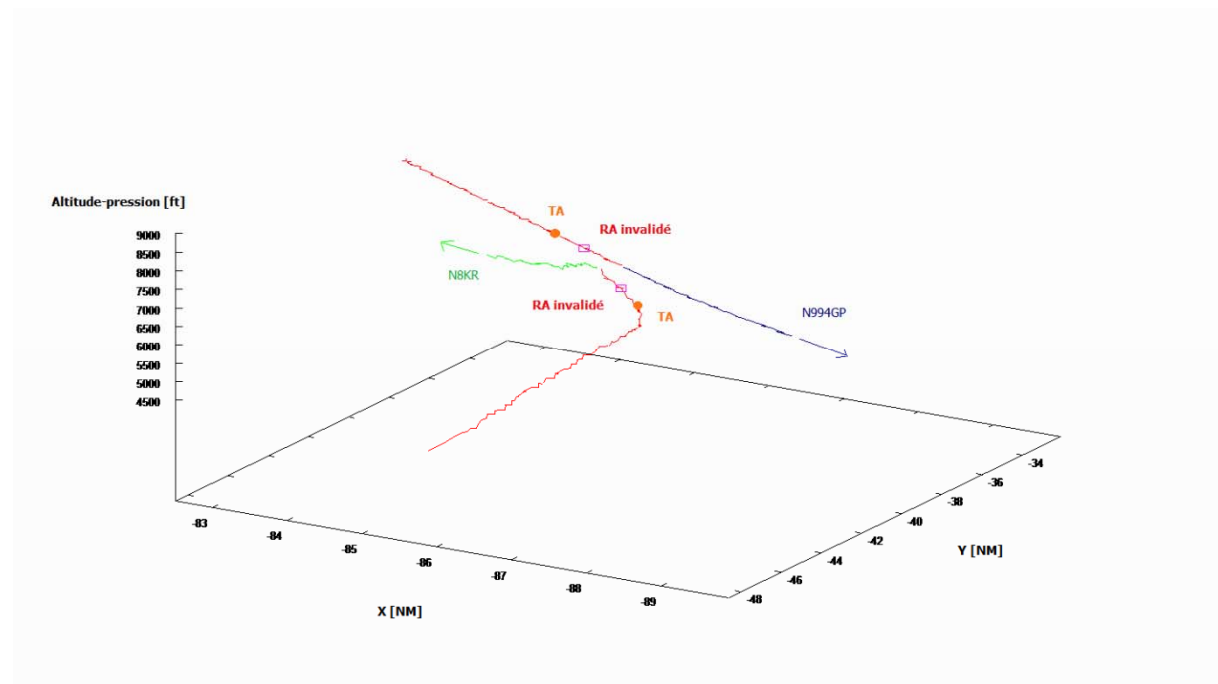
Introduction

The dangerous convergence between the two conflicting aircraft apparently did not generate a resolution advisory onboard N994GP. Its flight crew only reported the issuing of a traffic advisory and the downlink transmissions of the Mode S transponders do not contain any report of resolution advisories.

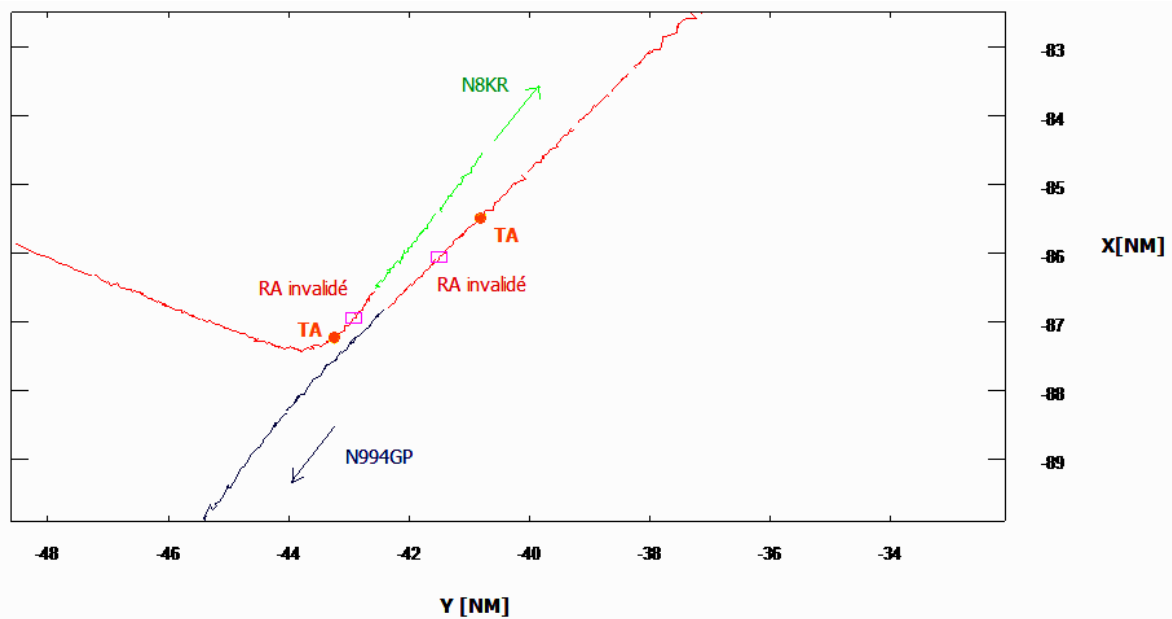
The absence of the generation of this type of alert in the case of convergence of trajectories initially established may raise the question, although highly improbable, of malfunction or incorrect configuration (e.g. "TA only") of the collision avoidance system onboard N994GP.

The verification is carried out with the aid of a theoretical tool consisting of the "TA/RA range tau" and "TA/RA vertical tau" diagrams.

3D view



Plan view of the conflict



The plan view of the conflict indicates that although the trajectories were initially converging at right angles, after the turn by N8KR they were then almost parallel when the traffic advisory was issued.

In terms of the collision avoidance logic, this configuration is identified as a slow horizontal convergence and consequently causes the horizontal miss distance (HMD) filter to intervene. The “TA/RA range tau” and “TA/RA vertical tau” diagrams indicate that for some fifteen seconds (14:29:46 to 14:30:01 UTC) the conditions for the generation of a resolution advisory at the level of the tau tests are met. During this period, the HMD filter perceives a distance between the two aircraft which is initially above the distance modifier (DMOD - 0.55 NM for SL5); when it falls below this value, the rate of convergence then falls much more rapidly than the distance, which indicates that the projected horizontal avoidance distance remains greater than the DMOD and that the HMD filter annuls the two tau tests, thereby invalidating the RA alerts.

For a better visualisation of the dynamics of the encounter, the symbols of the advisories which would have been issued onboard N8KR if it had been fitted with an onboard collision avoidance system are shown on its trajectory.

Conclusion

A true reconstruction of the TCAS advisories which occurred during the conflict could have been carried out if the recording of the data from N994GP’s collision avoidance system had been available. The doubt concerning the possible issuing of a resolution advisory is eliminated indirectly by recourse to the TA/RA diagrams. They reveal that the conditions required for the generation of an RA were met for some fifteen seconds, but that at that moment the geometry of the encounter was that of a slow horizontal convergence, leading to the activation of the HMD filter and invalidating of the alert.