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Aircraft Accident Investigation Bureau AAIB

Final Report No. 2033

by the

Aircraft Accident Investigation Bureau

concerning the serious incident (near collision/AIRPROX)
between the Airbus A340-300 aircraft, registration CC-CQC
operated by LAN Airlines S.A. under flight number LAN 704
and the Airbus A321-100 aircraft, registration OE-LBA
operated by Austrian Airlines AG under flight number AUA 415W
on 10 May 2007
Zurich, 9 NM east of DVOR TRA

Aeropole 1, CH-1530 Payerne

General information on this report

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with art. 3.1 of the 9th edition of Annex 13, valid from 1 November 2001, of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

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

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

All times in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Time (CET) applied as local time (LT) in Switzerland. The relation between LT, CET and UTC is: $LT = CET = UTC + 2 \text{ h}$.

Final Report

Aircraft

LAN 704, registration CC-CQC, Airbus A340-300
Holder/operator: LAN Airlines S.A.
Scheduled flight from Madrid-Barajas (LEMD)
to Frankfurt-Main (EDDF)

Type of operation: IFR

AUA 415W, registration OE-LBA, Airbus A321-100
Holder/operator: Austrian Airlines, Österreichische Luftverkehrs AG
Scheduled flight from Vienna-Schwechat (LOWW)
to Paris Charles-de-Gaulle (LFPG)

Type of operation: IFR

Crews

LAN 704
CMDR: Chilean citizen, born 1959
FO: Spanish citizen, born 1970

AUA 415W
CMDR: Austrian citizen, born 1959
FO: German citizen, born 1974

Location

Zurich, 9 NM east of DVOR TRA

Date and time

10 May 2007, 15:06 UTC

ATS unit

Swiss Radar, Upper Area Control Centre East (UAC-E)

Air traffic controllers

Radar Executive Upper M4 (RE-M4 Coach)
German citizen, born 1965

Radar Executive Upper M4 (RE-M4 Trainee)
Swiss citizen, born 1982

Radar Planner Upper M4 (RP-M4)
Swedish citizen, born 1973

Radar Executive Upper M3 (RE-M3)
Danish citizen, born 1966

Radar Planner Upper M3 (RP-M3)
Swiss citizen, born 1982

Airspace

C

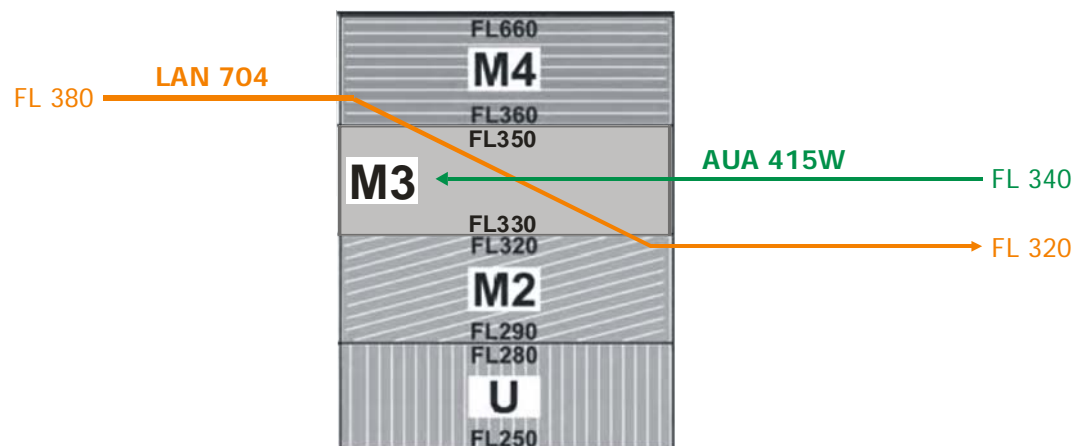
1 Factual information

1.1 Flight preparation and history of the flight

On Thursday 10 May 2007, the LAN Airlines S.A. Airbus A340-300, flight number LAN 704 and radio callsign LAN Chile 704, was on a scheduled flight from Madrid-Barajas to Frankfurt-Main. The first contact by the crew was at 14:53:00 on the 133.405 MHz frequency with air traffic control Swiss Radar, UAC East, Zurich Sector Upper M4.

The Radar Executive Sector Upper M4 (RE-M4) air traffic controller (ATCO), a trainee in the initial phase of practical training at the radar workstation (on-the-job training – OJT) and under the supervision of a coach, cleared them to fly at FL 380 via waypoints DITON-KUDES-LADOL-NELLI. At the Sector M4 workstation, the coach did not have his own radar console and was therefore obliged to perform his supervisory role with the trainee's radar image setting.

At the same time, an Austrian Airlines Airbus A321-100 with the flight number and callsign AUA 415W was en route on a scheduled flight from Vienna to Paris Charles de Gaulle. The crew were in contact with Zurich Sector Upper M3 on the 134.605 MHz frequency. AUA 415W was at FL 340 and flying from the east in the direction of beacon Trasadingen – DVOR TRA.



Comment to the diagram:

The diagram shows the entry of LAN 704 at FL 380 into the area of responsibility of Sector M4 of the UAC E. According Letter of Agreement, the leaving from the area of responsibility of the UAC E and the transfer to Rhine Control had to take place at FL 320. This required a descent through Sector M3 into Sector M2.

A few minutes before the serious incident, the RE-M4 gave a descent clearance to FL 330 to an aircraft with the radio callsign SPAR 91. This instruction was simultaneously acknowledged by a different aircraft with the callsign AFR 1591 and executed. The two confirmations of the descent clearance were overlaid and were therefore not comprehensible for the RE-M4. The ATCO then repeated the descent clearance to SPAR 91. AFR 1591 then also descended, unnoticed by Sec-

tor M4, to FL 340 into Sector M3 airspace. The area of responsibility of Sector M3 extended from FL326 to FL 355. The coach himself then took over air traffic control, because he was of the opinion that the trainee was over-extended and the traffic situation had become too complex for him.

At 15:02:43 UTC the RE-M4 instructed LAN 704 to turn left direct to waypoint NELLI and to descend to FL 360. This was acknowledged correctly by the crew.

At 15:04:08 UTC, there followed a further instruction from the RE-M4 to LAN 704 to continue their descent to FL 320; this was confirmed correctly by the first officer (FO). At this time, the Radar Planner Upper Sector M4 (RP-M4), who had not heard the clearance given by his RE, was coordinating the continuation of the descent of LAN 704 with the RP-M3 by telephone. When asked about this, the RP-M4 gave the following information: *"Shortly afterwards I agreed with the RP-M3 to allow LAN 704 to descend to FL 350, as after a prior quicklook down I recognised AUA 415W at FL 340. The RP-M3 authorised FL 350 for me, taking into account AFR 1591"*. By means of the "quicklook down" function, the aircraft located in the Sector M3 area of responsibility could be displayed on the RP-M4's radar screen.

The RP-M4 continued: *"I heard my RE give an instruction on the radio. At the end of this radio conversation, I informed him that he could allow LAN 704 to descend to FL 350. Since he was very busy, he just answered briefly saying 'good' and then continued to talk on the radio"*.

At 15:04:33 UTC, at the time the RP-M4 was ending the coordination with the RP-M3, the RE-M4 asked LAN 704 to make radio contact with Rhine UAC (Upper Area Control). The crew complied with this request after they had twice enquired about the cleared altitude with the words *"confirm for LAN 704 descending to FL 320?"*. The RE-M4 confirmed FL 320. The altitude of LAN 704 at the time of the frequency change was FL 361 and descending.

At the time when LAN 704 was carrying out the frequency change to Rhine UAC, AUA 415W was at FL 340 approximately 8.5 NM before the point of intersection with LAN 704. Minimum separation between the two aircraft was violated 75 seconds later.

The RP-M4 noticed that Sector M3 had not yet taken over the flight plan data for LAN 704 on his radar screen and therefore asked his RE about the cleared altitude of LAN 704. The latter replied: *"FL 320"*. The RP-M4 stated: *"I immediately informed him that he only had FL 350 available for LAN 704. He replied that he had received FL 320 from me. I again explicitly mentioned that I had only given him FL 350."*

The RE-M4 then twice tried, at 15:05:48 UTC, to contact LAN 704 on his frequency to stop its descent at FL 350. However, since the aircraft was already on the Rhine UAC frequency, this request went unanswered. The subsequent coordination by the RP-M3 with Rhine UAC was not able to prevent the serious incident as the two aircraft had already passed each other.

At 15:06:16 UTC, after they had crossed, a short term conflict alert (STCA) was triggered. At the time, the lateral separation between LAN 704 and AUA 415W was 1.1 NM and the altitude difference was 900 ft.

Both crews stated that their Traffic Alert and Collision Avoidance System (TCAS) had generated neither a traffic advisory (TA) nor a resolution advisory (RA).

On the Rhine UAC frequency, LAN 704, which was under visual meteorological conditions (VMC), identified the aircraft crossing it below as an Austrian Airlines aircraft.

1.2 Sector capacity

The maximum permitted capacity (100%) of Sector M4 was 38 flight movements per hour during military flying times and 41 flight movements per hour outside these times. The maximum sector capacity on this day was reduced by 10%, due to the introduction of a new air traffic control flight plan data processing system.

The recordings of the flow management position (FMP) confirmed a traffic volume between 14:20 UTC and 16:00 UTC of 35 to 37 flight movements per hour.

1.3 Meteorological information

Weather according to MeteoSwiss

General meteorological situation

A ridge of high pressure moving from Spain to central Europe determined the weather in Switzerland.

On the basis of the available information, it is possible to conclude that the following weather conditions prevailed at the time and location of the incident:

The information below relates to FL 340.

<i>Cloud:</i>	<i>no cloud</i>
<i>Weather:</i>	<i>-</i>
<i>Visibility:</i>	<i>over 30 km</i>
<i>Wind:</i>	<i>approx. 270 degrees at 60 kt</i>
<i>Temp./dewpoint:</i>	<i>-52°C / -60°C</i>
<i>Atmospheric pressure:</i>	<i>not relevant</i>
<i>Position of the sun:</i>	<i>not relevant</i>
<i>Hazards:</i>	<i>none detectable</i>

2 Analysis

2.1 Air traffic control

Despite the reduced sector capacity, a high volume of traffic with a high degree of complexity prevailed during the incident. Consequently, the workload for the trainee in the initial phase of his on-the-job training (OJT) was too high.

Shortly before the serious incident, AFR 1591 descended without clearance into Sector M3. This event, combined with the high traffic load and the conviction that his trainee was overextended, caused the coach to take over traffic control in Sector M4.

The subsequent events show that the coach should have intervened even earlier. After clearing SPAR 91 to descend to FL 330, the RE-M4 did not receive a clearly comprehensible confirmation. Instead of this confirmation, only an incomprehensible transmission was audible, indicating that two crews were making a radio-telephone transmission simultaneously. This should have caused the coach to repeat the descent clearance to SPAR 91 and to ensure that no other aircraft would also initiate a descent on the basis of this instruction.

The confusion which occurred in the two sectors M3 and M4 and the fact that various other control problems were also accumulating increased the pressure on the coach. Additional difficulty arose because he was obliged to work with the radar image setting of his trainee. The coach subsequently had to conduct numerous radio conversations in order to ease the traffic situation.

On the control strip which was available to the ATCO, FL 320 had been coordinated for the transfer of LAN 704 to Rhine UAC. This altitude had to be reached at the line of responsibility (LoR) at the latest. The RE-M4 issued LAN 704 an initial clearance to descend to FL 360. This altitude also constituted the lowest possible flight level which he was allowed to assign without additional coordination with Sector M3 directly below.

Until the next descent clearance, when the RE-M4 assigned FL 320 to LAN 704, 68 seconds elapsed, during which 15 radio conversations took place, constituting a high workload.

FL 320 was part of M2 Sector airspace. The descent clearance for LAN 704 to FL 320 should have been coordinated beforehand with Sectors M3 and M2. Such a coordination may also take place between the radar planners (RPs).

In the present case, the relevant telephone conversation was made by the RP-M4 to the RP-M3. However, the RP-M3 only authorised LAN 704 to FL 350, because a lower altitude would have meant a conflict with the approaching AUA 415W which was converging from the east at FL 340. According to the RP-M4's statement, he then informed his RE of the coordinated altitude, FL 350, which the latter, according to his statement, understood as FL 320 and according to the RP confirmed with "*good*". At this time, however, the RE had already cleared the descent to FL 320 without agreement with the sectors concerned and was in the process of transferring the aircraft to the Rhine UAC frequency.

The fact that the coach, in his capacity as RE-M4, cleared an altitude for LAN 704 which was outside his area of responsibility and was not coordinated with the sectors concerned, was commented by himself, that he could not explain this. This indicates that in this phase he was working at the limits of his capability.

The coordination conversation between the sector M4 RP and the RE was unclear and misleading. In this case, a confirmation by the RE with callsign and flight level would have provided clarity. Since this did not take place, the RP should have insisted.

2.2 TCAS aspects

Even though neither of the TCAS systems on the two aircraft involved generated a traffic advisory or a resolution advisory, it can be assumed that the TCAS on both aircraft were operating in accordance with system requirements. The TCAS is the final safety net capable of preventing a dangerous convergence or a collision. According to TCAS logic, in the altitude band from 20,000 ft to 42,000 ft in which the incident occurred, a minimum altitude difference of 600 ft (vertical miss distance – ALIM) must be established at the closest point of approach (CPA) by means of a vertical manoeuvre (RA). In this case, the TCAS systems' extrapolation of the flight paths concluded that the aircraft would cross with a larger separation. This was the reason why no warnings were generated.

3 Conclusions

3.1 Findings

- LAN 704 was flying according to instrument flight rules and was within the area of responsibility of Zurich Sector Upper M3. At the time of the serious incident, the crew were in radio contact with Rhine Upper UAC on the 132.405 MHz frequency.
- AUA 415W was flying according to instrument flight rules at FL 340 and was in contact with Zurich Sector Upper M3 on the 134.605 MHz frequency.
- The crews of the two aircraft involved in the incident and the air traffic controllers were in possession of the licences necessary to exercise their activities.
- In Zurich Sector Upper M4, there was a high volume of traffic of high complexity.
- Various events led the coach to intervene and take over traffic control in Sector M4 himself.
- The RP-M4 stated that he had not heard the RE-M4's clearance to LAN 704 to descend to FL 320, as he was busy with telephone coordination.
- The coordination conversation between the sector M4 RP and the RE was unclear and misleading.
- When asked why he cleared LAN 704 for an altitude which was outside his area of responsibility and which was not coordinated with the sectors involved, the RE-M4 answered, that he could not explain this.

- Both crews stated that their Traffic Alert and Collision Avoidance System (TCAS) had generated neither a traffic advisory (TA) nor a resolution advisory (RA).
- The generation of a short term conflict alert (STCA) in Sectors M4 and M3 only occurred shortly after the two aircraft involved had crossed. At the time, the lateral separation was 1.1 NM and the altitude difference was 900 ft.
- The crew of LAN 704 identified the aircraft flying crossing below them as an Austrian Airlines aircraft.
- At the time of the serious incident, visual meteorological conditions (VMC) applied.

3.2 Cause

The serious incident is attributable to the fact that ATC, in a phase of very high workload, cleared an aircraft to descend to an altitude which was outside its own area of responsibility without prior coordination.

Unclear and misleading coordination within the sector contributed to this.

Payerne, 15 June 2009

Aircraft Accident Investigation Bureau

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

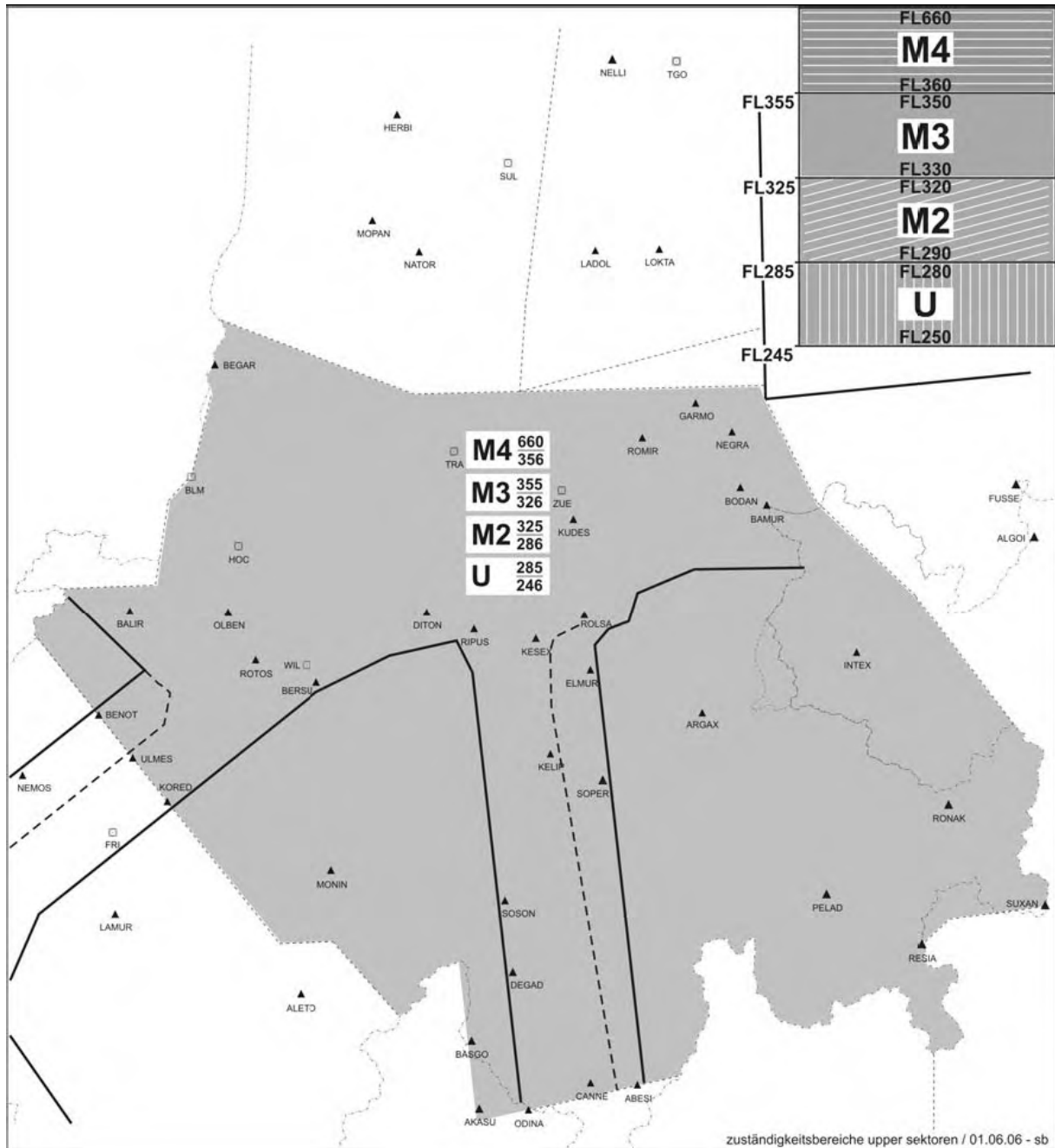
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Annex 1

Map showing Areas of Responsibility - ACC Upper Sectors

FL245 - FL660



Annex 2: Chronological sequence of: radio conversations / tel. coordinations / significant events

TIME UTC	FROM	TO	CONTENT / EVENT	COMMENT
14:53:00	LAN 704	RE-M4	<i>"Swiss Radar er... bonjour LAN Chile seven zero four climb level three eight zero DITON"</i>	First radio contact
14:53:06	RE-M4	LAN 704	<i>"LAN Chile seven zero four identified cleared DITON KUDES LADOL flight level three eight zero"</i>	
14:58:40	RE-M4	SPAR 91	<i>"Spar niner one descend to flight level three three zero"</i>	
14:58:44	???	RE-M4	<i>"????? niner one"</i>	Overlapping answer from 2 stations
14:58:50	RE-M4	???	<i>"Two stations, station calling say again"</i>	
15:00:17	RE-M4	SPAR 91	<i>"Spar niner one descend to flight level three three zero"</i>	
15:00:21	SPAR 91	RE-M4	<i>"Descend flight level three three zero Spar nine one"</i>	
15:01:00			Coach intervenes and takes over traffic control himself	
15:01:01	RE-M4	AFR 1591	<i>"Air France one five niner one?"</i>	
15:01:04	AFR 1591	RE-M4	<i>"Air France one five niner one go ahead"</i>	
15:01:05	RE-M4	AFR 1591	<i>"I see you in the descent you're cleared level three six zero and see you now at three four zero what are you doing?"</i>	
15:01:11	AFR 1591	RE-M4	<i>"Okay I read back three three zero and there is no answer from ATC for Air France one five niner one"</i>	
15:01:18	RE-M4	AFR 1591	<i>"Air France one five niner one stop descent immediately"</i>	
15:01:22	AFR 1591	RE-M4	<i>"Okay"</i>	
15:01:33	AFR 1591	RE-M4	<i>"So we're now level at flight level three four zero Air France one five niner one"</i>	
15:01:37	RE-M4	AFR 1591	<i>"Roger"</i>	
15:02:43	RE-M4	LAN 704	<i>"LAN Chile seven zero four turn left inbound to NELLI and descend to flight level three six zero"</i>	
15:02:51	LAN 704	RE-M4	<i>"XXXXX seven zero four? "</i>	incomprehensible

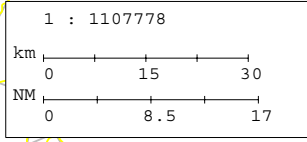
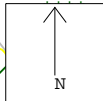
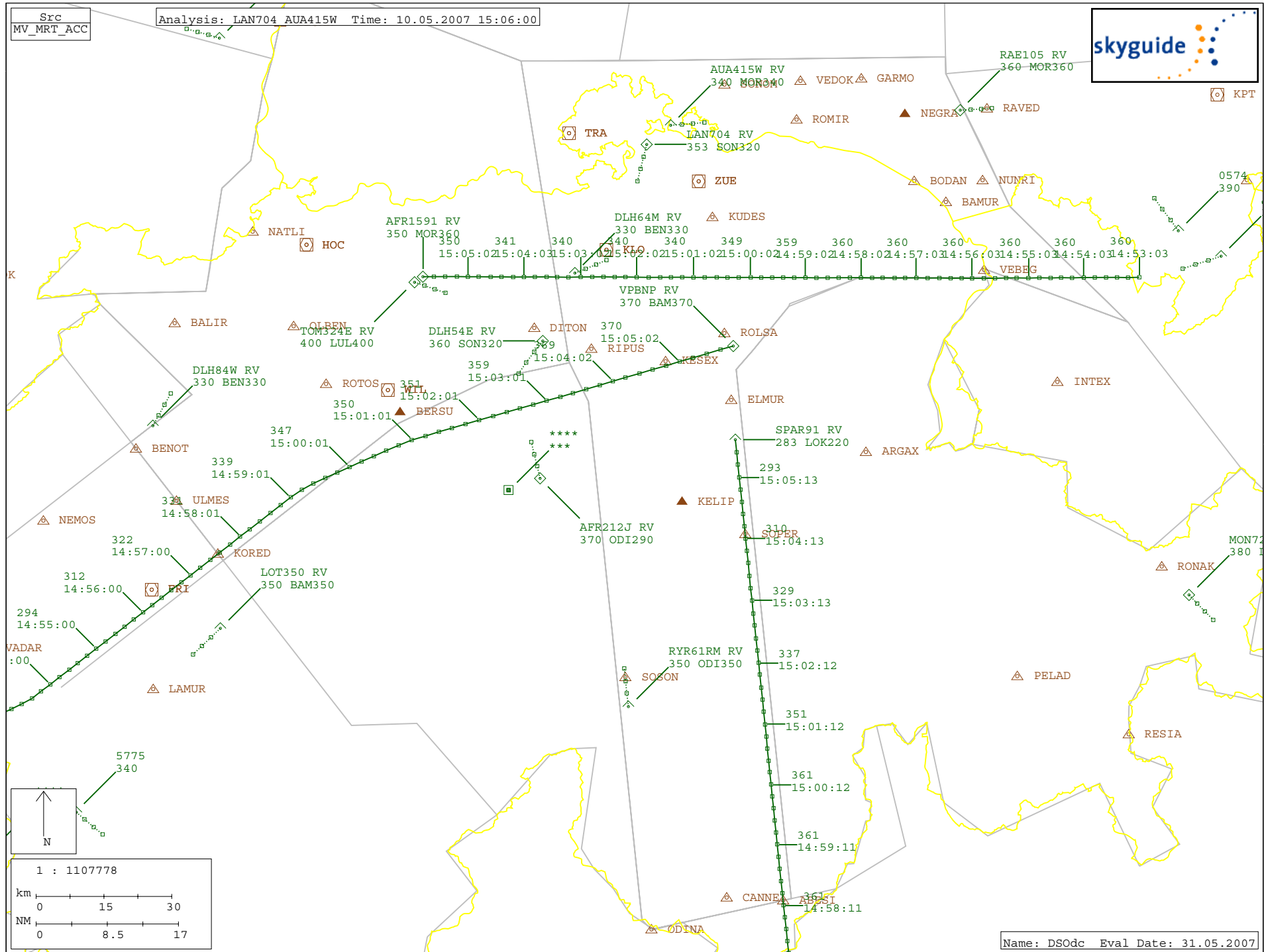
TIME UTC	FROM	TO	CONTENT / EVENT	COMMENT
15:02:53	RE-M4	LAN 704	<i>"Turn left inbound to NELLI descend flight level three six zero"</i>	
15:02:56	LAN 704	RE-M4	<i>"Left to NELLI and three six zero LAN Chile seven zero four"</i>	
15:04:08	RE-M4	LAN 704	<i>"LAN Chile seven-o-four descend level three two zero"</i>	Descent clearance without coordination with M3 and M2
15:04:13	LAN 704	RE-M4	<i>"Descending XXXXX three two zero LAN Chile seven zero four"</i>	
15:04:13	RP-M3	RP-M4	Yes?	Coordination concerning AFR 1591
15:04:14	RP-M4	RP-M3	Yes, now he's staying at three-forty for a short while then we climb again...if...	
15:04:20	RP-M3	RP-M4	Er...yes, it's good we...no we have nothing there	
15:04:23	RP-M4	RP-M3	Er...and then LAN Chile seven four zero do you have anything lower for him?	
15:04:29	RP-M3	RP-M4	Yes reference Air France three-fifty	Reason for FL 350 was AUA 415W at FL 340
15:04:31	RP-M4	RP-M3	Reference Air France three-fifty	
15:04:33	RP-M3	RP-M4	Yes	
15:04:33	RP-M4	RP-M3	Okay thanks	
15:04:33	RE-M4	LAN 704	<i>"LAN Chile seven zero four contact Rhine on one three two four zero five"</i>	
15:04:37	LAN 704	RE-M4	<i>"One three two four zero five and confirm descend to flight level three two zero"</i>	
15:04:44	LAN 704	RE-M4	<i>"Confirm for LAN Chile seven zero four continue descending three two zero?"</i>	2 nd query confirmation
15:04:54	RE-M4	LAN 704	<i>"LAN Chile seven zero four that's correct three two zero"</i>	
15:04:57	LAN 704	RE-M4	<i>"We're correct three two zero thank you"</i>	

TIME UTC	FROM	TO	CONTENT / EVENT	COMMENT
15:05:00	LAN 704	TGOLE	<i>"Rhein Control, er good morning, Lanchile 704 er crossing 3.6.0. descending to 3.2.0. inbound to NELLI"</i>	Start of radio communication between LAN 704 and Rhine RADAR (TGOLE)
15:05:07	TGOLE	LAN 704	<i>"Lanchile 704, good afternoon, identified"</i>	
15:05:11	LAN 704	TGOLE	<i>"Thank you"</i>	
15:05:48	RE-M4	LAN 704	<i>"LAN Chile seven-o-four stop de... descent level three five zero"</i>	1 st attempt by RE-M4 to stop descent of LAN 704
15:05:59	RE-M4	LAN 704	<i>"LAN Chile seven zero four stop descent level three five zero"</i>	2nd attempt by RE-M4 to stop descent of LAN 704
15:06:01	LAN 704	TGOLE	<i>"...chile 704 we have crossing er traffic thousand feet below us"</i>	Continuation of radio communication between LAN 704 and Rhine RADAR
15:06:05	TGOLE	LAN 704	<i>"Who was just ca – asking?"</i>	
15:06:07	LAN 704	TGOLE	<i>"Er we have the traffic in sight, Lanchile 704"</i>	
15:06:14	TGOLE	LAN 704	<i>"Er Lanchile 704 confirm you ´re descending level 3.2.0.?"</i>	
15:06:16			STCA alarm in Sectors M4 and M3	Aircraft have already crossed
15:06:18	LAN 704	TGOLE	<i>"That ´s affirmative"</i>	
15:06:58	TGOLE	LAN 704	<i>"Lanchile 704 from Rhein?"</i>	
15:07:01	LAN 704	TGOLE	<i>"Yes for Lanchile 704?"</i>	
15:07:03	TGOLE	LAN 704	<i>"Er did you receive a TCAS resolution advisory?"</i>	
15:07:06	LAN 704	TGOLE	<i>"Er negative, negative, we have only traffic ah thousand feet we cross and we have the traffic in sight it was like er Austrian"</i>	
15:07:13	TGOLE	LAN 704	<i>"Roger, thank you"</i>	

TIME UTC	FROM	TO	CONTENT / EVENT	COMMENT
15:07:34 to	RP-M3	TGOLP	Yes?	Tel. coordination between Rhine UAC (TGOLP) & RP-M3
.....	TGOLP	RP-M3	The Austrian, did he have a TCAS... or not?	
.....	RP-M3	TGOLP	Erm, I don't know, he didn't say anything...	
.....	TGOLP	RP-M3	He didn't say anything...	
.....	RP-M3	TGOLP	Did Lanchile say anything?	
.....	TGOLP	RP-M3	Lanchile said he had crossing traffic, he saw it was an Austrian but didn't have an RA	
.....	RP-M3	TGOLP	Okay...	

Src
MV_MRT_ACC

Analysis: LAN704 AUA415W Time: 10.05.2007 15:06:00



Name: DSOdc Eval Date: 31.05.2007

Src
MV_MRT_ACC

Analysis: LAN704/AUA415W of may 10, 2007 Time: 10.05.2007 15:06:29



△ SONOM

LAN704 RV
347 SON320

3.3 NM
-700 ft
221

AUA415W RV
340 MOR5406:16

1.1 NM
-900 ft
209

340
15:06:16

1.3 NM
-1100 ft
62

351
15:06:04

340
15:05:52

3.7 NM
-1300 ft
51

353
15:05:51

355
15:05:39

357
15:05:27

359
15:05:15

361
15:05:03

363
15:04:51

365
15:04:39

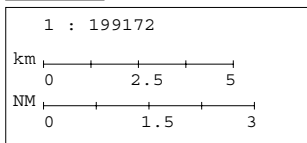
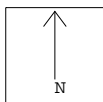
367
15:04:27

340 340 340 340 340 340 340 340 340 340
15:09:40 15:05:28 15:05:16 15:05:03 15:04:52 15:04:40 15:04:28 15:04:15 15:04:04

⊙ TRA

⊙ ZUE

△ KUDES



Name: Nicky Scherrer DSOsn DSOec Eval Date: 11.05.2007