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Aircraft Accident Investigation Bureau AAIB

Final Report No. 1998 by the Aircraft Accident Investigation Bureau

concerning the serious incident (AIRPROX)
between flight AFR 563B, operated by the Régional company,
Embraer E145, registration F-GRGL
and
flight OHY 2451, operated by Onur Air
A321-231, registration TC-OAE
on 30 June 2005
at MEDAM, 71 NM south-west of Geneva

Palais fédéral Nord, CH-3003 Berne

General remarks concerning this report

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

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability. The legal assessment of accident/incident causes and circumstances is no concern of the incident investigation (art. 24 of the Air Navigation Law).

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 French language

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

For reasons of protection of privacy, the masculine form is used in this report for all natural persons, regardless of their gender.

Final Report

Aircraft

AFR 563B, a flight operated by the Régional company
Embraer E145, registration F-GRGL

Venice (LIPZ) – Lyon St-Exupéry (LFLL)

Commercial flight, IFR

OHY 2451, a flight operated by Onur Air
A321-231, registration TC-OAE

Konya (LTAN) – Lyon St-Exupéry (LFLL)

Commercial flight, IFR

Crews

AFR 563B CMDR

FO

OHY 2451 CMDR

FO

Location

MEDAM (71 NM south-west of Geneva)

Date and time

30 June 2005, 17:18 UTC

ATS unit

Geneva UAC En Route Control, Sectors K2/L2

Geneva TCG Terminal Control, Sector MA/MS

Controllers

Radar controller: Swiss citizen
Year of birth: 1978

Radar coordinator: Swiss citizen
Year of birth: 1951

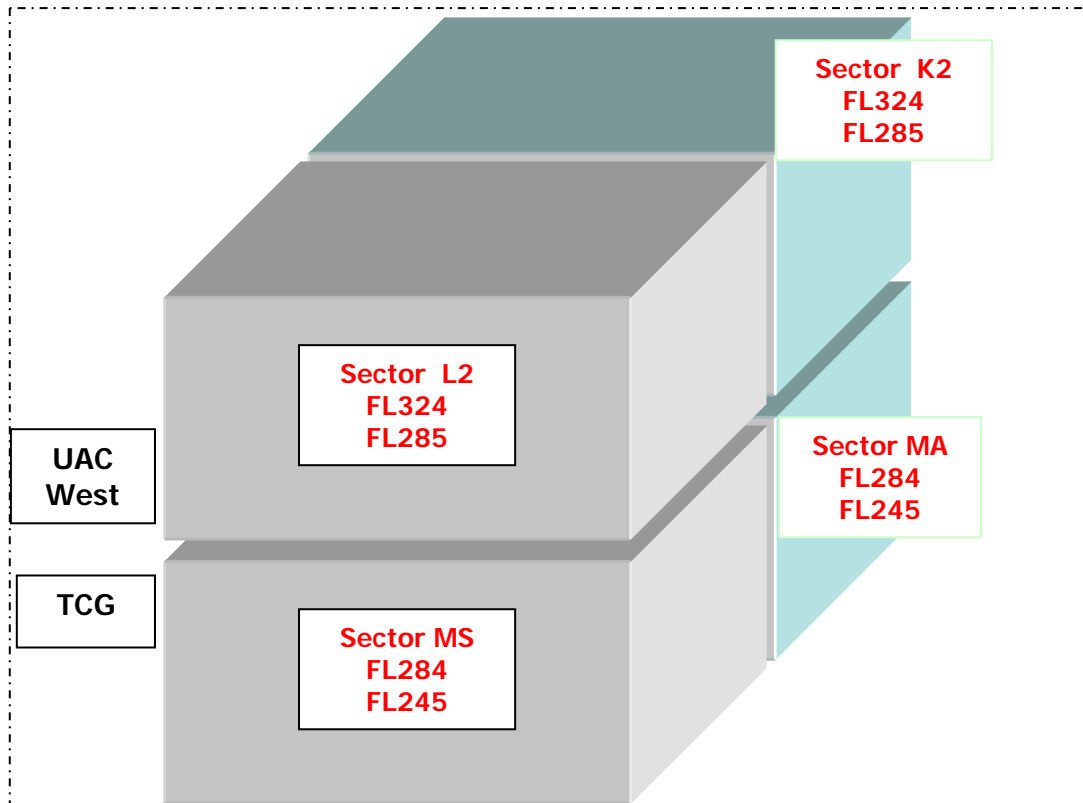
Airspace

Class A

1 Factual information

1.1 Sectorisation of the Geneva Control Centre at the time of the incident

Sectors K2 and L2 and sectors MA and MS were coupled.



In the vertical plane, sectors MA and MS are delimited from level FL 245 to level FL 284, within the Geneva CTA control region. The managed traffic consists of aircraft in transit, arrivals at and departures from Geneva and aircraft leaving or entering the Reims FIR and the adjacent TMAs (ref. ATM GE ACC). Essentially, therefore, these sectors handle traffic moving in the vertical plane.

1.2 Preliminary remarks

The terms and abbreviations specific to air traffic control and the onboard collision avoidance system are specified in the definitions provided at the end of the report.

The information used to produce this report originates from data provided by:

- the flight crews of the aircraft involved
- air traffic controllers
- recordings of radar plots
- the transcriptions of radiotelephony and telephone conversations relating to the incident
- the CFMU and FMP management bodies

On 30 June 2004, Skyguide initiated the "UAC-CH" programme of unification of control of the Swiss upper airspace, involving combining the Zurich and Geneva upper sectors into a control centre managed in Geneva.

Throughout this transition phase, new means of control, working tools and procedures were introduced to implement this programme.

Among other things, a new radar label on the radar screens intended to replace the traditional paper flight progress strips was created to monitor aircraft.

At the time of the incident, controllers were working with these new radar labels and in parallel had to update the flight progress strips.

1.3 History of the incident

On Thursday 30 June 2005, at about 17:11 UTC, an Onur Air Airbus A321 was making a scheduled flight, OHY 2451, from Konya to Lyon St-Exupéry and made contact with the coupled K2/L2 Geneva control sector. The aircraft was maintaining flight level FL 300 and was 10 NM east of VOR TOP.

Since this aircraft was coming from Italian airspace which does not belong to the same ORCAM region as that controlled by Switzerland, a new transponder code had to be assigned to it. The radar controller assigned it transponder code 5772, identified it and cleared it to follow route KINES-GIGUS-AMVAR.

At about 17:13 UTC, a Régional Embraer E145 on scheduled flight AFR 563B from Venice to Lyon St-Exupéry called the coupled MA/MS Geneva control sector on the 134.85 MHz frequency. This sector is directly below sector K2/L2.

The aircraft was 4 NM north-west of TOP/VOR and was maintaining flight level FL 280. It appeared on the sector radar screen in the form of a radar label pre-correlated with the secondary radar code SSR 0225 assigned by Milan. According to its flight plan, its scheduled route was KINES-GIGUS-AMVAR, i.e. the same as that of flight OHY 2451.

The radar controller asked the pilot of aircraft AFR 563B to select transponder code 5730. This instruction was read back correctly. The recording of the radar plots

indicates that the radar label of AFR 563B remained in pre-correlation until 17:13:38 UTC, when the aircraft was 8 NM north-west of TOP; any radar track of this aircraft then disappeared until 17:18:50 UTC, i.e. for 5 minutes and 12 seconds.

The Embraer E145 aircraft on flight AFR 563B was equipped with a Honeywell Primus RCZ-83X transponder. This transponder model switches to standby mode when the pilot takes more than five seconds to make a change of the SSR code.

The flight crew of AFR 563B stated that the pilot who made contact with the MA/MS sector was at that time simultaneously in charge of flying the aircraft as well as radiotelephony conversations, his colleague being busy listening to the ATIS weather information for the Lyon terminal region.

No radiotelephony exchange took place between the MA/MS control sector and the flight crew of AFR 563B in the five-minute duration of the disappearance of the position symbol from the radar screens. The controllers of this sector stated that they did not realise at the time that the correlation of AFR 563B had not taken place normally following the assignment of the new SSR code.

However, the radar controller stated that he was aware of an unidentified aircraft in his sector but that he had not had the time to look into "*this additional problem*". The coordinator noted that his colleague had asked him where "Air France" was before the latter's flight crew requested a descent.

At 17:16:12 UTC, the K2/L2 sector controller cleared flight OHY 2451 to descend to flight level FL 290 and, after the readback by the pilot, he transferred it to the MA/MS sector frequency.

On initial radiotelephony contact by the crew with the new sector, flight OHY 2451 was cleared to continue its descent to flight level FL 280. This flight level was occupied by the Embraer AFR 563B, whose radar label was no longer appearing on the screens. Extrapolation of the radar plots shows that at that moment, flight AFR 563B was maintaining flight level FL 280 at a distance of approximately 1 NM behind and below aircraft OHY 2451.

At 17:18 UTC, the flight crew of AFR 563B reported to control that they wished to start their descent. The controller, not having radar contact with this aircraft at this time, asked them to indicate their position and received the following reply: "*Er...yes, we are arriving four nautical from MEDAM at level two eighty*". Since this information still did not enable the controller to locate the traffic, the controller asked them to confirm the transponder code. After the pilot's reply "*Fifty-seven thirty*", the controller instructed him to recycle the transponder and informed him that he did not have radar contact.

As soon as the transponder reset became effective, the onboard TCAS collision avoidance system on aircraft AFR 563B issued a corrective upward resolution advisory (RA); the flight crew obeyed and informed control in these terms: "*XXXXX Bravo, TCAS climb*".

The pilot then reported that he "*had traffic at the same level, two eight zero*"; the controller replied, telling him to follow his TCAS. At the end of this avoiding action, the pilot reported: "*We'll stabilise at 290, 563B*".

The radar coordinator immediately called his colleague at upper sector K2/L2 by telephone to inform him of the intrusion of an aircraft in a TCAS climb into his sector.

The recording of the radar plots indicated that flight level FL 290 was reached at 17:19:26 UTC and that separation between the two aircraft had been re-established by then. It also revealed that OHY 2451 had reached flight level FL 280 at the time the conflict was detected by the Embraer AFR 563B's onboard collision avoidance system. Aircraft OHY 2451 then maintained this level throughout the duration of the incident, despite the issue of a TCAS alarm in respect of which the crew responded with the words "*Affirmative, we had TCAS*", following the controller's questions.

According to the statements of the pilots of flight OHY 2451, a corrective "downward" resolution advisory (RA) ("*Descend, descend*") was issued and at the instant they were going to obey it "*everything returned to normal.*" The fact that there was no prior traffic advisory was also reported. The position of the threat, flight AFR 563B, was specified: "*1 NM behind and 100 ft above*".

For the two MA/MS sector controllers, the appearance of the AFR 563B radar label caused them to become aware of the conflict eleven seconds after notification of the "*TCAS climb*" by the crew. At this moment, the radar recording indicated that the two aircraft had a lateral distance of 1.1 NM, with the Embraer at flight level FL 284 and the Airbus at flight level FL 280. The STCA alert was triggered on the control sector radar screens at the same time as the symbol of flight AFR 563B appeared on the screens.

As soon as the situation was back under control, the radar controller informed the crew of aircraft AFR 563B that he had "*lost you from radar*" and asked if the transponder had not been de-activated. The pilot replied that the unit must have switched to standby mode without him being aware of it during the code change manipulation.

At the time of greatest proximity of the aircraft, the lateral separation and altitude difference determined by extrapolation of the radar plots was 1.1 NM and 0 ft.

The air traffic controllers stated that at the time of the incident the volume of traffic in the MA/MS sector was not particularly heavy, but that it was characterised by high complexity and by the heavy workload it generated: this was such that the radar coordinator stated that he had no longer been able "*to monitor the traffic*" or "*to monitor the frequency*"; for the same reason, the radar controller stated that he had not had time to look into the "*additional problem*" posed by the AFR 563B correlation fault.

Moreover, one of the two controllers was aware that the Embraer E145 aircraft type had transponder problems, as this aircraft type was on a Skyguide service order list. However, according to the flight progress strip in the controllers' possession, the aircraft on flight AFR 563B had to be an Embraer E135, which was not on this list.

1.4 Operational and technical context

The following factors played a part in this incident:

- the incorrect flight plan data of the type of aircraft AFR 563B
- the transponder model fitted to the Embraer AFR 563B
- the transitional phase associated with the "UAC-CH" programme to unify control of Swiss upper airspace
- the lack of a radar system alarm in the event of transponder failures and loss of transponder response

1.4.1 Transponder model Honeywell Primus RCZ-83X

This model is one of a series of RCZ transponders which switch to standby mode when the pilot takes more than five seconds to make an SSR code change; the aircraft then disappears from air traffic control radar screens and consequently the STCA safety net can no longer take it into account when generating a proximity warning. The same applies to the onboard TCAS collision avoidance system, operation of which is dependent on a transponder in active mode.

In its "Report on Skyguide radar systems" dated 26.06.2002, the AAIB indicated that aircraft equipped with the Honeywell RCZ833 transponder frequently disappeared from radar screens. The transponder failure problem was therefore known to Skyguide.

The defect on Honeywell Primus RCZ-83X transponders was known to Skyguide and the supervisory authority and the aircraft types equipped with it had been identified. On 9 December 2004, the Honeywell company issued Technical Newsletter A23-1146-004 – Suggested Temporary Operational Workaround - in which this fault is described; a measure to correct the problem is stated and in the meantime it was recommended that flight crews on aircraft equipped with these transponders carry out a mode check following any code change.

The Régional company operates, among others, Embraer E145 aircraft equipped, like the aircraft type involved in the incident, with a Honeywell Primus RCZ-83X transponder. On 13 December it brought the fault in this type of transponder to the attention of its pilots and requested them to "*check that the transponder is in mode 1 (or 2) TA / RA after any change of ATC code*" (Temporary Revision RT B02 – 04-03).

On 6 January 2005 the Skyguide air navigation services company published an internal directive on this subject (Service Order Operations 2005-07E) which outlines the problems and instructs controllers to:

- pay attention when a code change is transmitted to an aircraft type likely to be fitted with a defective transponder;
- advise the flight crew to re-activate the transponder if the radar track disappears from the radar screen following an SSR code change.

The aircraft types identified to date as being equipped with defective Honeywell Primus RCZ-83X transponders are listed in this service order. The Embraer E145 involved in this incident is included in the list, but not the E135 model relating to the flight plan. The verification procedure described in the Skyguide directive was therefore not applicable.

In the six months preceding this incident, Skyguide had already noted two similar events involving aircraft equipped with the same transponder: On 5 December 2004, following an SSR code change, an aircraft had disappeared from radar screens for 28 minutes; on 13 June 2005 another Embraer E145 had disappeared for 2 minutes and 24 seconds. They gave rise to an important exchange of correspondence between Skyguide, the Swiss Federal Office of Civil Aviation and Eurocontrol. The latter, as well as the English CAA and the European Advisory Safety Agency have published directives on this topic which are similar to Skyguide's.

1.4.2 Paper flight progress strips

Paper flight progress strips constitute an important working medium for an air traffic controller.

These paper flight progress strips are slid onto a support. They show flight plan data, such as information on the aircraft, its destination, its route, the time it flies over the entry beacon, etc.

Each flight is represented by a paper flight progress strip.

Updating paper flight progress strips is essential in order to represent the current traffic situation.

1.4.3 Transitional phase associated with the "UAC-CH" programme

On 30 June 2004, Skyguide initiated the "UAC-CH" programme of unification of control of the Swiss upper airspace in the Geneva Control Centre. Implementation of this transition was scheduled in several stages.

Throughout this transition phase, new means of control, working tools and procedures were introduced to implement the programme.

Among other things, there was migration to the so-called "stripless" working method, involving the replacement of the paper flight progress strip by a new radar label.

At the time of the incident, the "stripless" working method was being introduced and the paper flight progress strips had to be kept up to date.

Updating is carried out by the coordinator, whilst the radar controller acts directly on the new radar labels, in accordance with the "stripless" working method.

The instructions issued for this transition phase stipulate: *"During high controller workload, the executive shall relieve him of updating the strips. When busy, if required, the coordinator may ask the executive to manage the stripboard."* (Extract from Service Order G 2005 – 027 E).

At the time of the incident, this was the only means of detecting systematically the unexpected and unnoticed disappearance of a traffic from the radar screens.

No annotation is shown on the control strip for aircraft AFR 563B or for OHY 2451.

At the end of the transition programme, paper flight progress strips are to be eliminated.

Copy of the paper flight progress strips.

AFR563B	280	300		
5730 0725				
E135 430			KIN	
LIPZ LFLL		280 GIG		TOP 1709
OHY2451	300	320		
5772 3724				
A321 450			KIN	
LTAN LFLL	M01	210 GTG		TOP 1712

1.4.4 Lack of a radar system alarm in the event of transponder failures and loss of transponder response

At the time of the incident, no alarm system in the radar system indicating transponder failures and loss of transponder response was available.

1.5 Volume of traffic and workload

The volume of traffic and sectorisation are based on the information provided by the CFMU and FMP management bodies.

During the "stripless" transition phase, the capacities of the sectors concerned were reduced during the transition phase by 15%, corresponding to 34 movements per hour for the combined MA/MS sector. In the case in question, their joint capacity was close to saturation due to the cumulation of working methods.

Between 17:00 and 18:00 UTC, 33 aircraft were in sector MA/MS, the declared hourly capacity of which was set at 34 movements.

More precisely, between 17:00 and 17:20 UTC, fifteen aircraft were moving within the sector and ten of them were on the frequency, resulting in 71 radiotelephony exchanges between the first call from flight AFR 563B (17:12:55 UTC) and the report of its TCAS climb (17:18:39 UTC).

ACC supervision considered that since the declared capacity of sector MA/MS had not been reached, it was not necessary to decouple it.

1.6 Trajectory of the Embraer AFR 563B just before its reappearance on the radar screens

The transition to standby mode of the AFR 563B transponder caused the disappearance of the label, and therefore of the aircraft, from the air traffic control radar screens and therefore also from the radar plot recordings. Shortly before its reappearance, within the framework of the investigation it was possible to reverse-extrapolate the trajectory of the Embraer up to flight level FL 280, using the radar plots relating to the TCAS avoiding action.

1.7 Radar identification procedures

The identification procedure to be carried out following the assignment of a transponder code to an aircraft is as follows:

Extracts from ATMM Switzerland:

- 1.2 *Identification procedures*
- 1.2.1 *SSR procedure*

When a discrete code has been assigned to an aircraft, a check shall be made at the earliest opportunity to ensure that the code set by the flight crew is identical to that assigned for the flight. Only after this check has been made shall the discrete code be used as a basis for identification.

1.8 Meteorological conditions

According to MétéoSuisse:

Upper winds – QAO - A1: 15Z-21Z FL240 250/40 FL300 240/60

2 Analysis

2.1 History of the incident

The incident took place in two phases: the first followed the unnoticed disappearance of any radar trace of the Embraer aircraft, even though the radar controller was aware of unidentified traffic in his sector. This resulted in a loss of separation between AFR 563B and OHY 2451 lasting more than one minute which was not shown on the radar screens.

For more than five minutes, the disappearance of the radar label for this traffic was not noticed by the MA/MS sector controllers; moreover, the flight crew of flight AFR 563B did not realise that their transponder had switched to standby mode.

The second phase, which lasted for about thirty seconds, is characterised by the major loss of separation between the two aircraft. When the pilot of flight AFR 563B asked to start his descent and the controller did not see him on his radar screen, the latter asked him to recycle his transponder. As soon as the radar label reappeared, the TCAS and STCA alerts were immediately triggered. The controller and crews then became aware of the conflict.

2.2 Flight management aspects

2.2.1 Flight AFR 563B

The pilot of aircraft AFR 563B entered the new SSR code 5730 assigned by the Geneva radar controller without checking the transponder mode in accordance with his company's directives.

This operation was probably not completed within the five second limit beyond which Honeywell Primus RCZ-83X transponders switch to standby mode.

This transponder malfunction was not noticed either when the pilot, previously busy listening to the ATIS, returned to the aircraft control loop.

Furthermore, after some time – one or two minutes – without news from the controller, the pilots might have suspected an anomaly in their equipment and checked the mode of operation.

Analysis of the radar plot recordings shows that by the time the transponder of AFR 563B was successfully recycled, the Embraer was approximately one nautical mile behind OHY 2451. The latter was reaching flight level FL 280 on the same route and at practically the same ground speed of 400 knots.

The onboard collision avoidance systems recognise this particular configuration as a convergence of two aircraft at relatively low speed. They indicate this by a traffic advisory TA when the horizontal separation falls below 1.3 NM and by a resolution advisory RA when it falls below 1.1 NM.

It is also surprising to authorise the use of a transponder with such a systematic defect in an environment in which only secondary radars are able to detect the presence of conflicting traffic.

2.2.2 Flight OHY 2451

The radar plot recordings show that OHY 2451 had reached flight level FL 280 and remained there despite the TCAS descend advisory.

The particular configuration of the conflict probably caused the pilots concern, thereby delaying their reaction to the alarm: in the first place, the lack of a traffic advisory did not allow the flight crew to acclimatise themselves and prepare for probable avoiding action.

Then, AFR 563B constituted a disconcerting threat, first because of the suddenness of its appearance and then because it was situated behind the Onur Air Airbus and therefore in the opposite direction to that in which the aircraft was flying.

Finally, the "downward" sense of the corrective resolution advisory was contrary to the sense of the aircraft at this time, when it had just carried out its level acquisition phase.

2.3 Air traffic control aspects

2.3.1 Complexity and control workload in sector MA/MS

Management of sector MA/MS was complex primarily because of the conjunction of the following factors:

- The two controllers on duty were in the phase of adaptation to the new “stripless” working method, so their attention had to be more sustained than usual.
- At the time of the incident, the two sector MA/MS controllers considered that the workload was average but that the situation was nevertheless complex. Traffic management demanded serious concentration, given the numerous radiocommunications, telephone coordinations and updates to the paper flight progress strips. Clearly, they no longer had the time necessary to update the latter.

Thus it was found that no strip marking was shown on the strip for AFR 563B or for OHY 2451; this fact proves that monitoring of the paper flight progress strips was not being carried out.

If the controllers had carried out this task in parallel, the disappearance of AFR 563B from the radar screens would have been detected at the time of the first call by aircraft OHY 2451 to sector MA/MS at the latest. The time at which it passed the TOP/VOR beacon was estimated as 17:12 UTC. The strips for the Embraer which was expected three minutes earlier at the same beacon, following the same route, would probably have attracted the attention of the radar controller.

The measures taken to control traffic did not make it possible to avoid a momentary overload.

2.3.2 Lack of a radar system alarm in the event of transponder failures and loss of transponder response

The “stripless” system is designed around the secondary surveillance radar (SSR), the basic principle of which is the interrogation of the transponders of controlled aircraft, by means of transmitters/receivers.

As soon as an aircraft's transponder is in standby mode, following selection of the user or because of a defect in the unit, it no longer responds to radar signals. This causes stoppage of the correlation mechanism and the subsequent disappearance of any radar trace which the latter was generating.

In the phase of the “UAC-CH” programme in question, automatic signalling of the loss of a label existed exclusively for correlated flights.

This is why it is difficult to understand why the new stripless system, which is supposed to lighten the load on air traffic controllers, does not alleviate a serious problem known to Skyguide since 26 June 2002, the date of publication of the AAIB report on Skyguide radar systems. Furthermore, on 6 January 2005 Skyguide published a service order concerning the defective Honeywell transponders. Above all, if Skyguide wishes to replace paper strips with the stripless system, it is imperative that the system copes with the disappearance of traffic, given that the

ATCO loses all the information concerning the aircraft he is supposed to be controlling.

The problems encountered with Honeywell transponders are not the only known problems. A modern ATC system must detect all cases of transponder failure.

When this problem of unintentional transition to standby mode with Honeywell Primus transponders became evident, Skyguide thought it could work around this shortcoming by asking controllers to exercise increased vigilance when transmitting SSR code changes to pilots.

To this end, Skyguide published a service order (*SO O 2005-07E*). The procedure indicated therein, however, was still inadequate, as the list which included aircraft types identified up to that point as being equipped with defective transponders was incomplete.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- Flight AFR 563B was being operated with an Embraer E145 aircraft and not an E135 as indicated in the flight plan.
- The Embraer E145 AFR 563B was equipped with a defective Honeywell Primus RCZ-83X transponder which switches to standby mode when the pilot takes more than five seconds to make a change of the SSR code.
- This defect has been known since September 2004 and the aircraft types equipped with it have been identified since November of the same year.
- On 9 December 2004, the Honeywell company issued Technical Newsletter A23-1146-004 – Suggested Temporary Operational Workaround - in which this fault is described and a measure to correct the problem is announced. In the meantime, flight crews on aircraft equipped with these transponders were advised to carry out a check on their mode following any code change.
- On 13 December 2004, the Régional company brought the fault in the transponders fitted to Embraer E135/E145 aircraft to the attention of its pilots and requested them to "check that the transponder is in mode 1 (or 2) TA/RA after any change in ATC code" (Temporary Revision RT B02 – B02).
- On 6 January 2005 the Skyguide company published a service order concerning the defective transponders fitted to Embraer E145 aircraft, among others (*SO O 2005-07E*); in it, it outlines the problem and requests controllers to be especially vigilant with regard to the aircraft types equipped with such equipment and listed in this document. Aircraft type E135 is not included in this list.
- In the six months preceding this incident, Skyguide noted two similar events involving aircraft equipped with the same transponder.
- In the phase of the "UAC-CH" programme relating to the time of the incident, the protection system against transponder failures did not exist for pre-correlated flights.

3.1.2 Air traffic controllers

- The radar controller as well as the radar coordinator were each in possession of an appropriate licence. The radar controller has held a licence since March 2004 and the radar controller since 1980.
- The air traffic controllers stated that at the time of the incident air traffic in the MA/MS sector was not particularly heavy in terms of numbers but was on the other hand characterised by high complexity and the heavy workload it generated; it was such that the radar coordinator stated that he was no longer able to “follow the traffic” or “follow the frequency”; for the same reason, the radar controller indicated that he had not had time to deal with the “additional problem” constituted by the AFR 563B correlation fault.

3.1.3 History of the incident

- The radar plot recording indicates that all tracks of flight AFR 563B disappeared from the radar screens from 17:13:38 to 17:18:50 UTC.
- The flight crew of AFR 563B obeyed an “upward” resolution advisory and reported this action to control at 17:18:39 UTC.
- The flight crew of OHY 2451 stated that they had had a “downward” corrective resolution advisory; the radar plot recording shows that their aircraft remained stable at its flight level FL 280.
- The minimum distances, calculated by extrapolation, between aircraft AFR 563B and OHY 2451 were a lateral separation of 1.1 NM and an altitude difference of 0 ft.

3.1.4 General framework

- The incident took place close to waypoint MEDAM, 71 NM south-west of Geneva, in Class A delegated French airspace.
- At the time of the incident, control sectors MA (133.690 MHz) and MS (134.85 MHz) were coupled.
- At the time of the incident, flights OHY 2451 and AFR 563B were in contact with and under radar control of sector MA/MS.
- At the time of the incident, the control centre was in a transitional phase of the “UAC-CH” programme to unify control of Swiss upper airspace.

3.2 Cause

The incident was caused by the failure to integrate an aircraft equipped with a defective transponder, the radar plot of which had disappeared from the ATC screen after establishment of initial radiotelephony contact by air traffic controllers.

Factors playing a part in development of the incident:

- Lack of attention by the flight crew of aircraft AFR 563B.
- The absence of a system to protect air traffic control from an unexpected transponder failure in the transition phase of the “UAC-CH” programme;

- Overload and complexity of the control work in the transition phase associated with the "UAC-CH"

4 Safety recommendations and measures taken since the serious incident

4.1 Safety recommendations

In its report on "Skyguide radar systems" published on 26 June 2002, the AAIB recommended, among other things, the following points:

The following aircraft must also be shown in the air situation displayed at ATC:

- those with a disrupted transponder.
- those equipped with a transponder which does not comply with the specifications.
- those originating from a neighbouring ORCAM zone and entering Swiss airspace.
- those with a defective transponder.
- and those flying with their transponder switched off.

4.2 Measures taken since the serious incident

- For aircraft coming from a neighbouring ORCAM zone and entering Swiss airspace: pre-correlation is effective and visible for air traffic controllers (implemented in a successive UAC batch). Furthermore, if an aircraft were to disappear, the "lost on" system (a function implemented shortly after the incident) would enable visualisation of the label and radar symbol of the aircraft on the controller's screen, in red.
- Aircraft with a disrupted transponder or aircraft equipped with a transponder which is not in conformity with the specifications: the "lost on" system lessens the impact of any disappearance of the label and radar symbol.

Berne, 11 September 2008

Aircraft Accident Investigation Bureau

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DEFINITIONS

ACAS – Airborne Collision Avoidance System. Also called **TCAS** - Traffic Alert and Collision Avoidance System. An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders.

ACC – Area Control Centre. A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

ATC – Air Traffic Control.

ATFM – Air Traffic Flow Management. A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilized to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.

ATIS – Automatic Terminal Information Service. The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof.

ATM – Air Traffic Management. ATM-GE Air traffic management Geneva. The aggregation of the airborne functions and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations.

ATMM – Air Traffic Management Manual.

ATS – Air Traffic Service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

Capacity. Ability of the ATC system or any of its sub-systems or an operating position to provide service to aircraft during normal activities. It is expressed in numbers of aircraft entering a specified portion of the airspace in a given period of time. The maximum peak capacity which may be achieved for short periods may be appreciably higher than the sustainable value.

Declared capacity. A measure of the ability of the ATC system or any of its sub-systems or operating positions to provide service to aircraft during normal activities. It is expressed as the number of aircraft entering a specified portion of airspace in a given period of time, taking due account of weather, ATC unit configuration, staff and equipment available, and any other factors which may affect the workload of the controller responsible for the airspace.

CFMU - Central Flow Management Unit (Eurocontrol)

Correlation. Mechanism of the control system which established a biunique link between a radar track and a flight plan.

CTA – Control Area. A controlled airspace extending upwards from a specified limit above the earth.

FL – Flight Level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1,013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals.

FIR - Flight Information Region. An airspace of defined dimensions within which flight information and alerting services are provided.

FMP – Air Traffic Flow Management Position. Working position established within an ACC to ensure the necessary interface with the CEU on matters concerning the provision of the ATFM service.

Threat. An intruder deserving special attention either because of its close proximity to own aircraft or because successive range and altitude measurements indicate that it could be on a collision or near-collision course with own aircraft. The warning time provided against a threat is sufficiently small that an RA is justified.

ORCAM - Originating Region Code Assignment Method. The objective of the ORCAM User Group (OUG) is to administer the allocation of SSR codes and monitor their use on behalf of the ICAO European and North Atlantic Regional Office.

Radar track. “Unique” information created by software using complex mathematical algorithms on the basis of plots originating from multiple radar stations.

Flight Plan - PLN. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

Radar blip. A generic term for the visual indication, in non-symbolic form, on a radar display of the position of an aircraft obtained by primary or secondary radar.

RA – Resolution Advisory. An indication given to the flight crew recommending:

- a) a manoeuvre intended to provide separation from all threats; or
- b) a manoeuvre restriction intended to maintain existing separation.

Corrective RA. A resolution advisory that advises the pilot to deviate from the current flight path.

Positive RA. A resolution advisory that advises the pilot either to climb or to descend .

Preventive RA. A resolution advisory that advises the pilot to avoid certain deviations from the current flight path but does not require any change in the current flight path.

Descend RA. A positive RA recommending a descent but not an increased descent.

Climb RA. A positive RA recommending a climb but not an increased climb.

Primary radar. A radar system which uses reflected radio signals.

CTA - control area. A controlled airspace extending upwards from a specified limit above the earth.

TMA - terminal control area. A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

SSR response. The visual indication, in non-symbolic form, on a radar display, of a response from an SSR transponder in reply to an interrogation.

RPS – Radar Position Symbol. The visual indication, in symbolic form, on a radar display, of the position of an aircraft obtained after automatic processing of positional data derived from primary and/or secondary surveillance radar.

RA sense. The sense of an ACAS II RA is "upward" if it requires climb or limitation of descent rate and "downward" if it requires descent or limitation of climb rate. It can be both upward and downward simultaneously if it requires limitation of the vertical rate to a specified range.

STCA - Short Term Conflict Alert. The generation of short term conflict alerts is a function of an ATC radar data processing system. The objective of the STCA function is to assist the controller in maintaining separation between controlled flights by generating, in a timely manner, an alert of a potential infringement of separation minima.

SSR – Secondary Surveillance Radar. A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

Strip. Paper flight progress strip, i.e. the physical representation of the flight plan elements of an aircraft on a strip of paper.

TA – Traffic Advisory. An indication given to the flight crew that a certain intruder is a potential threat.

TCAS. See ACAS

TCG. Terminal Control Geneva.

TMA. Terminal Control Area. A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

UAC-CH. Upper Area Control Center Switzerland.

UTC – Coordinated Universal Time (Z). The relation between LT, CET and UTC is: $LT = CET = UTC + 2 \text{ hours}$.

VOR - VHF omnidirectional radio range; very high frequency omnidirectional radio range.

**TRANSCRIPT OF TELEPHONY
OR RADIOTELEPHONY COMMUNICATION TAPE-RECORDINGS**

Investigation into the **incident** that occurred on **30 June 2005**

- Subject of transcript: **AFR563B / OHY2451**
- Centre concerned: Swiss Radar Area West
- Designation of unit: Terminal Control Geneva, coupled sectors
K2/L2 & MA/MS
- Frequency / Channel: 126.05/132.315 MHz & 134.85/133.690 MHz
- Date and period (UTC) covered by attached extract: 30 June 2005
17:10 - 17:22 UTC
- Date of transcript: 08 July 2005
- Name of official in charge of transcription:

- Certificate by official in charge of transcription:

I hereby certify:

- That the accompanying transcript of the telephony or radiotelephony communication tape-recordings, retained at the present time in the premises of the Analysis Department, has been made, examined and checked by me.
- That no changes have been made to the entries in columns 2, 3 and 4, which contain only clearly understood indications in their original form.

Geneva, 08 July 2005

Abbreviations

<u>Sector</u>	<u>Designation of sector</u>
L2	- Swiss Radar Area West, Upper Area Control, coupled sector K2/L2
MS	- Swiss Radar Area West, Terminal Control Geneva, coupled sector MA/MS

<u>Aircraft</u>	-	<u>Callsign</u>	<u>Type of acft</u>	<u>Flight rules</u>	<u>ADEP</u>	-	<u>ADES</u>
2451	-	Onurair 2451	A321	IFR	LTAN	-	LFLL
563	-	Air France 563B	E135	IFR	LIPZ	-	LFLL
8659	-	Air Nostrum 8659	CRJ2	IFR	LEBL	-	LEMD
2015	-	Air France 2015	A319	IFR	LIMC	-	LFPG
8934	-	Air Nostrum 8934	CRJ2	IFR	LEBL	-	LSGG
2129	-	Air France 2129	F100	IFR	LIPE	-	LFPG
09L	-	Alitalia 09L	E145	IFR	LEBB	-	LIMC
844	-	Britair 844	CRJ1	IFR	LIMJ	-	LFPG
261	-	Alitalia 261	MD82	IFR	EGCC	-	LIMC
5996	-	Aliexpress 5996	MD82	IFR	LIML	-	LFPG

DMO / 08 July 2005

TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005



To Col.1	From Col.2	Time Col.3	Communications Col.4	Observations Col.5
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Coupled Frequency / Channel: 126.05 & 132.315: sectors K2/L2

L2	2451	17:10:44	Swiss Control, good evening, Onurair two four five one, maintain three zero zero.	
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2451	L2	51	Onurair two four five one, good day, squawk five seven seven two.	
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L2	2451	54	Five seven seven two coming down, ... two four five one.	
----	------	----	--	--

Sector in contact with:
- AZA261
- CRL902

2451	L2	17:12:44	Onurair two four five one, identified, cleared KINES – GIGUS then AMVAR, maintain level three hundred.	
------	----	----------	--	--

L2	2451	51	????? KINES then AMVAR, ... Onurair two four five one.	Unreadable
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2451	L2	55	After KINES – GIGUS then AMVAR.	
------	----	----	---------------------------------	--

L2	2451	59	KINES – GIGUS then AMVAR.	
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Sector in contact with:
- CRL902
- TAR788
- HLX4332
- RAM934

2451	L2	17:16:12	Onurair two four five one, descend flight level two niner zero.	
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L2	2451	15	Descending two niner zero, Onurair two four five one.	
----	------	----	---	--

2451	L2	18	Onurair two four five one, contact Swiss Radar on one three four decimal eight five, good day.	
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L2	2451	23	Three four eighty-five, bye-bye.	
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TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005



To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
<u>Coupled Frequency / Channel: 134.85 & 133.690: sectors MA/MS</u>				
MS	563	17:12:55	Genève, bonjour, Air France five six three Bravo on flight level two eight zero on course to KINES now.	
563	MS	17:13:01	Air France five six three Bravo, bonjour, squawk five seven three zero.	
MS	563	05	Five seven three zero.	
8659	MS	08	Air Nostrum eight six five niner, climb to flight level three one zero, rate one thousand feet a minute minimum.	
MS	8659	13	Okay ... three one zero, climbing at one thousand per minute minimum, eight six five niner, no problem.	
2015	MS	21	Air France two zero one five, cleared MOLUS – GALBI – TINIL, XXXXX climb to flight level two five zero.	Could be "now"
MS	2015	27	MOLUS – TINIL, two five zero, Air France two zero one five.	
2015	MS	31	It's MOLUS – GALBI – TINIL.	
MS	2015	33	MOLUS – GALBI – TINIL, Air France two zero one five.	
8934	MS	36	Air Nostrum eight niner three four?	No reply
MS	2129	42	Swiss of Air France two one two niner with you, flight level two eight zero, on route to VADEM.	
2129	MS	46	Air France two one two niner, bonsoir, squawk five seven zero one, report your requested level.	
MS	2129	53	Heu... say again for the new squawk?	
2129	MS	56	Squawk five seven zero one.	
MS	2129	17:14:04	Alors, sorry, speak slowly, but XXXXX five seven zero one?	Could be "for / four"
2129	MS	10	Cinquante-sept zéro un.	
MS	2129	14	Eh bien voilà, cinquante-sept zéro un, Air France vingt et un vingt-neuf.	

TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005



To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
8659	MS	17:14:18	Air Nostrum eight six five niner, climb to flight level three two zero.	
MS	8659	23	????? three two zero, climbing, XXXXX, eight six five niner.	Unreadable + Could be "eight"
MS	09L	29	Radar, good afternoon, Alitalia zero nine Lima, level two seven zero to BLONA.	
09L	MS	34	Alitalia zero niner Lima, bonjour, BLONA – Torino, descend to flight level two five zero.	
MS	09L	39	Two five zero, BLONA – Torino, Alitalia... zero niner Lima.	
MS	8934	44	Swiss Radar, heu... good afternoon, Air Nostrum eight niner three four, level two eight zero, direct KINES.	
8934	MS	52	Air Nostrum eight niner three four, bonsoir, KINES five Romeo, descend flight level two five zero, two thousand feet a minute minimum.	
MS	8934	58	All right, KINES five Romeo and we descending level two five zero at two thousand five hundred feet per minute minimum, Air Nostrum eight niner three four.	
8934	MS	17:15:06	Air Nostrum eight niner three four, Radar, one two four decimal two two, au revoir.	
MS	8934	11	One two four two two, Air Nostrum eight niner three four, au revoir.	
8659	MS	37	Air Nostrum eight six five niner, Radar on one three four decimal three one five, goodbye.	
MS	8659	42	One three four three one five, au revoir, eight six five niner.	
844	MS	46	Britair eight four four, Radar on... one two six decimal zero five, goodbye.	
MS	844	51	One two six zero five, Britair eight four four, bye-bye.	
2015	MS	53	Air France two zero one five, climb to flight level two seven zero.	
MS	2015	57	Climb flight level two seven zero, Air France two zero one five.	

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Occurrence: AFR563B / OHY2451 of 30 June 2005



To Col.1	From Col.2	Time Col.3	Communications Col.4	Observations Col.5
2129	MS	17:16:02	Air France two one two niner, do you request higher?	No reply
2129	MS	11	Air France two one two niner?	
MS	2129	14	Yes, go ahead.	
2129	MS	15	Do you request higher?	
MS	2129	16	No, it's okay for us, two eight zero is perfect.	
2129	MS	18	Okay, ROMTA – TINIL.	
MS	2129	20	ROMTA – TINIL, Air France two one two niner.	
261	MS	22	Alitalia two six one, Radar on, correction, contact Milano, one two five decimal two seven.	
MS	261	29	Two five ????? seven, Alitalia two six one, ciao.	Unreadable
MS	2451	32	Swiss Radar, good afternoon, Onurair two four five one, now descending two niner zero.	
2451	MS	37	Onurair two four five one, bonsoir, descend to flight level two eight zero.	
MS	2451	42	Descending two eight zero, Onurair two four five one.	
MS	5996	47	Swiss, bonsoir, Aliexpress five niner niner six, climbing two six zero to VADEM.	
5996	MS	53	Alitalia Express five niner niner six, bonsoir, squawk five seven zero two, report your requested level.	
MS	5996	17:17:00	Five seven zero two and request level three four zero, Aliexpress five niner niner six.	
5996	MS	05	Roger, cleared ROMTA – TINIL, climb to flight level two eight zero.	
MS	5996	10	Climb level two eight zero, ROMTA – TINIL, Aliexpress five niner niner six.	
2015	MS	18	Air France two zero one five, climb to flight level two eight zero.	
MS	2015	23	Two eight zero, Air France two zero one five.	

TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005



To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
09L	MS	17:17:25	Alitalia niner Lima, descend flight level two three zero and rate two thousand feet a minute minimum.	
MS	09L	30	Two three zero, two thousand per minute, Alitalia zero niner Lima.	
09L	MS	33	Correct and report your rate of descent to Milano, one two five decimal two seven, goodbye.	
MS	09L	37	Two five two seven, ciao.	
2451	MS	41	<i>Onurair two four five one, descend to flight level two five zero.</i>	
MS	2451	44	<i>Descending two five zero, Onurair two four five one.</i>	
2451	MS	48	<i>Onurair two four five one, correction, stop descent flight level two eight zero and expect lower in one minute.</i>	
MS	2451	55	<i>Stop descent two eight zero, Onurair two four five one.</i>	
MS	563	17:18:00	Air France cinq six trois Bravo, on souhaiterait débiter la descente.	
563	MS	05	Air France cinq six trois Bravo, ... reportez votre position s'il vous plaît?	
MS	563	10	Heu... oui, nous arrivons quatre nautiques de MEDAM au niveau deux quatre-vingt.	
563	MS	15	Confirmez votre code?	
MS	563	17	Cinquante-sept trente.	
563	MS	20	Très bien, vous pouvez... recycler votre mode Charlie, je ne vous reçois pas du tout là.	
MS	563	26	Oui, affirme, on recycle, heu.	
5996	MS	29	Alitalia Express, five niner niner six, climb flight level three zero zero.	
MS	5996	32	Level three zero zero and we are on heading two eight five for a few miles to avoid.	
5996	MS	38	Roger, approved.	

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Occurrence: AFR563B / OHY2451 of 30 June 2005



To Col.1	From Col.2	Time Col.3	Communications Col.4	Observations Col.5
MS	563	17:18:39	XXXXX Bravo..., TCAS climb.	Beginning of transmission cut
563	MS	41	Roger.	
MS	563	44	A priori, on est en montée vers le deux cent quatre-vingt-cinq, on avait un trafic même niveau, deux huit zéro.	
563	MS	51	Très bien, heu... suivez votre TCAS.	
MS	563	55	Ouais..., on va stabiliser au deux neuf zéro, cinq six trois Bravo.	
563	MS	59	Très bien.	

_____				Sector in contact with: - NJE300Q
2451	MS	17:19:17	<i>Onurair two four five one, descend flight level two five zero.</i>	
MS	2451	20	<i>Descending two five zero, Onurair two four five one.</i>	
2451	MS	23	<i>And did you have a TCAS... advisory?</i>	
MS	2451	26	<i>Affirmative, we had TCAS.</i>	
2451	MS	27	<i>Roger, thank you, descend now flight level two zero zero and be leveled by GIGUS.</i>	
MS	2451	32	<i>Heu... descending level two zero zero by DIKES, KINES, Onurair two four five one.</i>	
2451	MS	37	<i>By GIGUS.</i>	
MS	2451	39	<i>By GIGUS, thank you.</i>	
MS	563	42	Cinq six trois Bravo, vous avez le contact radar maintenant?	
563	MS	45	Très bien, j'ai le contact radar maintenant et vous pouvez... maintenir deux neuf, je vous rappelle tout de suite pour la descente.	
MS	563	50	Reçu, on maintient deux neuf, cinq six trois Bravo.	

TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005



To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
563	MS	17:19:53	Et on fera un rapport. Apparemment, je vous ai perdu du radar... pour quelques minutes, je sais pas si votre transpondeur était éteint par hasard?	
MS	563	17:20:00	Heu... je pense qu'au changement de code, a priori, il a du passer sur standby involontairement.	
563	MS	05	D'accord, merci.	
				Sector in contact with: - SMX5996 - AFR2015 - EZS966 - BRT477 - AFR2015
563	MS	17:21:04	Air France cinq six trois Bravo, descendez niveau deux six zéro.	
MS	563	09	Vers deux six zéro, cinq six trois Bravo, on est en route vers GIGUS.	
				Sector in contact with: - NJE300Q
563	MS	17:21:25	Air France cinq six trois Bravo, descendez niveau heu... deux cent cinquante avec deux mille pieds s'il vous plaît.	
MS	563	30	Oui, vers deux cinquante, deux mille pieds minute, cinq six trois Bravo.	
				Sector in contact with: - EZS966 - FGOYA
2451	MS	17:22:05	Onurair two four five one, contact Marseilles, one two six seven, goodbye.	
MS	2451	09	One two six seven, Marseilles, two four five one, bye-bye.	
MS	563	21	Cinq six trois Bravo, on approche deux cinquante.	

TRANSCRIPT SHEET

Occurrence: AFR563B / OHY2451 of 30 June 2005

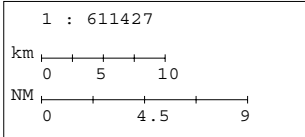
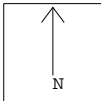
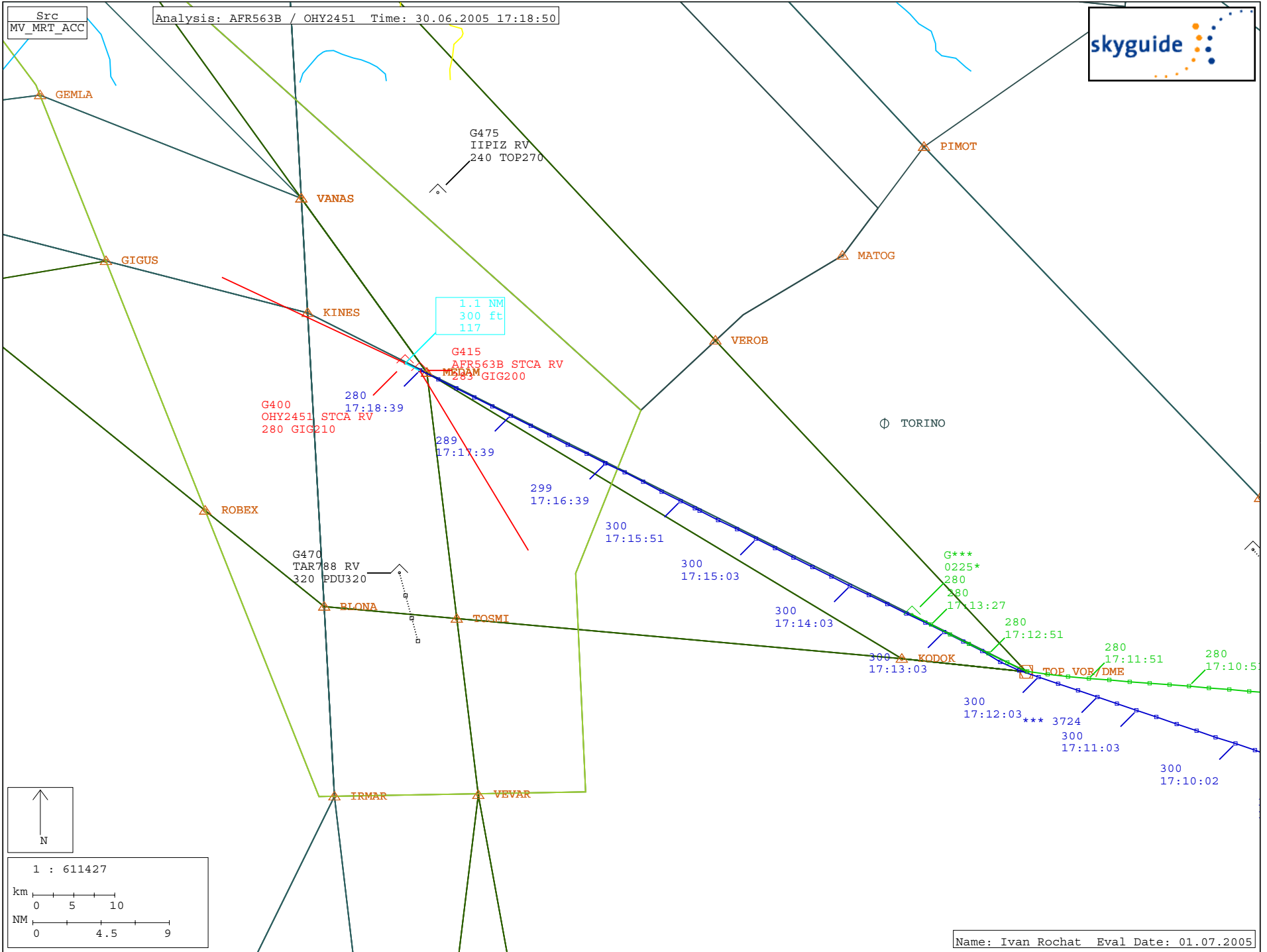


<u>To</u> <u>Col.1</u>	<u>From</u> <u>Col.2</u>	<u>Time</u> <u>Col.3</u>	<u>Communications</u> <u>Col.4</u>	<u>Observations</u> <u>Col.5</u>
563	MS	17:22:23	Je vous rappelle pour plus bas.	
563	MS	36	Air France five six three Bravo, descend flight level two two zero.	
MS	563	40	Descending level two two zero, five six three Bravo.	
563	MS	43	And... Marseilles, one two six seven, goodbye.	
MS	563	46	One two six seven, five six three Bravo, bow, bye.	

End of transcript.

Src
MV_MRT_ACC

Analysis: AFR563B / OHY2451 Time: 30.06.2005 17:18:50



Name: Ivan Rochat Eval Date: 01.07.2005

Src
ACN

Analysis: Airprox AFR563B / OHY2451 Time [UTC]: 30.06.2005 17:19:43



KINES

420
OHY2451
279 GIG210

385
AFR563B
291 GIG200

280
17:19:26

290
17:19:26

1.4 NM
-1000 ft
303°

1.3 NM
-900 ft
301°

1.2 NM
-700 ft
301°

1.1 NM
-400 ft
300°

289
17:19:14

280
17:19:03

287
17:19:02

280
17:18:50

284
17:18:50

MEDAM

280
17:18:38

281
17:18:26

283
17:18:14

285
17:18:02

286
17:17:50

289
17:17:38

290
17:17:26



1 : 142,263

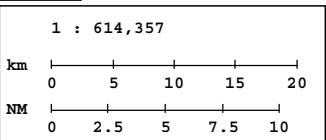
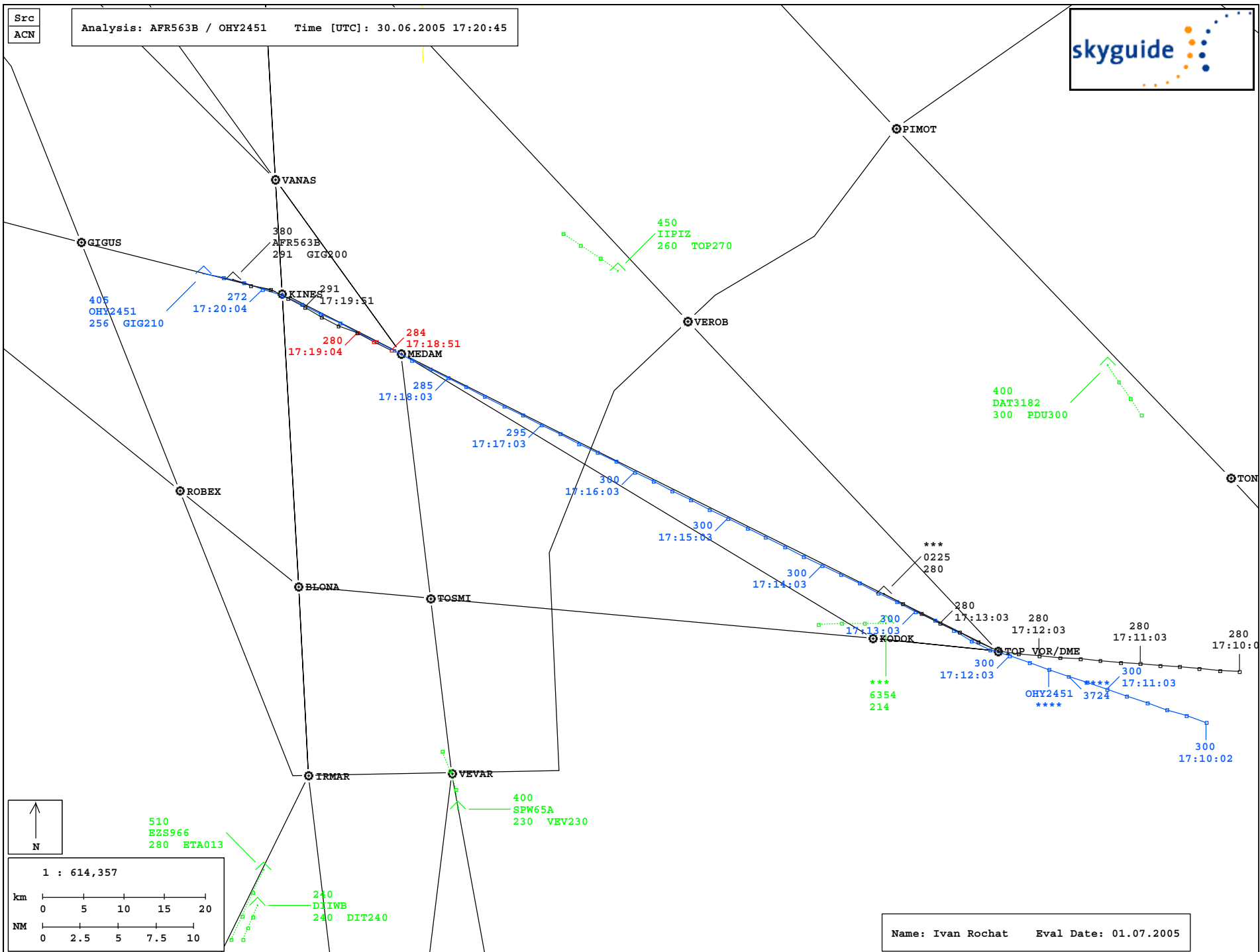
km 0 1 2 3 4

NM 0 0.5 1 1.5 2

Name: Ivan Rochat Eval Date: 15.07.2005

Src
ACN

Analysis: AFR563B / OHY2451 Time [UTC]: 30.06.2005 17:20:45



Name: Ivan Rochat Eval Date: 01.07.2005