

# safety bulletin

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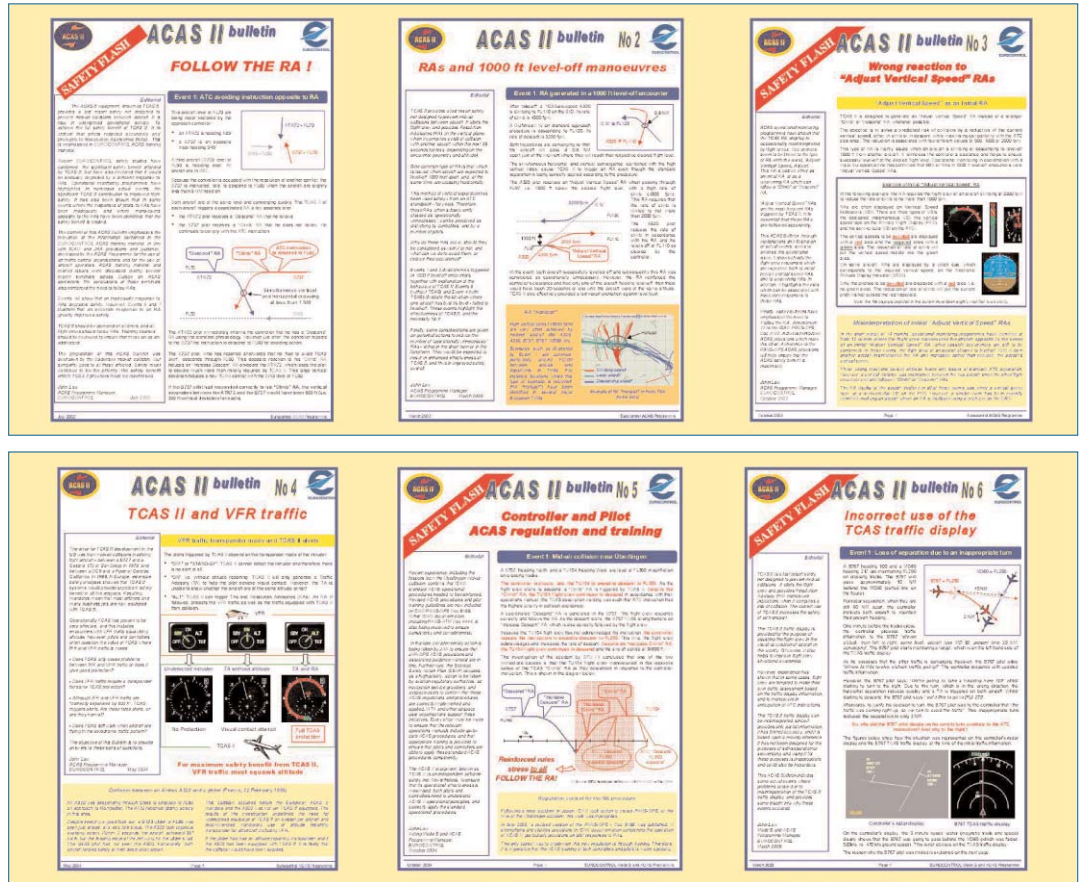
# ACAS issue update

As the European ACAS II implementation Phase 2 (extending the mandatory carriage and operation to smaller aircraft) is drawing to conclusion it is perhaps time for all of us to be reminded about the correct and best practice ACAS actions. This editorial and the next article are extracted from the ACAS bulletin No7 and are a courtesy of Eurocontrol and John Law, the Modes S and ACAS programme manager.

It is not here my intention to reproduce the entire bulletin but to give an insight in the most important issues that are explained in the bulletin. It is a fact that the amount of info around the world is huge therefore it is my goal to provide safety bulletin readers with an appropriate flavor about what was happening in ACAS issue these last months. Should you wish to have a look at the entire ACAS bulletin or at the preceding 6 issues (or the brand new issue 8) please have a look to the following link:

[www.eurocontrol.int/msa](http://www.eurocontrol.int/msa)

TCAS II version 7 showed a significant reduction in the number of RAs for the 1000ft separation level-off encounters. However these RAs still are the vast majority of the recorded RAs in European airspace and by far the most common reason for RAs triggered in Switzerland (about 75% of the recorded RAs are for this reason). Whereas the controller can do little when TCAS is activated, but it is nevertheless important to be aware of some situations that might appear, e.g. read in the next article



Picture: Eurocontrol ACAS II bulletin 1 to 6

(event 4) how a pilot used his TCAS display to initiate a horizontal avoidance manoeuvre (a 70 degree right turn) that actually worsened the situation. On the other hand read further in the next article (attached to event 4) how a controller asked a crew not to follow a ACAS alert in case they would get one.

As said before there is quite little to be done on the ground once the onboard TCAS equipment releases a Resolution Advisory and is reported via R/T. From this moment on controllers must refrain from passing

flight path modifying messages to this flight. It's a very unnatural attitude for ATCOs to wait and do nothing actively, especially in tight traffic situations, but this exactly what is expected from the controllers.

**«Controllers must not interfere when pilots react to RAs»**

Obviously the controllers have to be aware of an RA before being able to apply that rule, indeed it is not always the case that pilots report the RA. Out of the 10 do's and don'ts of TCAS operations explained in the

ACAS 7 bulletin this is one of the two «TCAS fundamentals» to be applied by controllers, the other one being the recurrent training on ACAS II operations (more a management issue indeed).

To conclude it has to be said that TCAS obviously displays many advantages, having a look at the next article you will also discover which several issues still remain unsolved.

THOMAS NOVOTNY  
Editor safety bulletin  
DM safety management

# A summary of the Eurocontrol ACAS bulletin n.7

The following article provides you with the recent cases that have been judged the most interesting to be reproduced here (with the agreement of Eurocontrol). Should you wish to have more information, the latest ACAS bulletin number 8 and

all preceding ACAS bulletins are available on the following link:

[www.eurocontrol.int/msa](http://www.eurocontrol.int/msa).

For convenience the chosen events are reproduced in the original

format and consequently do not have a correct sequential numbering.

Probably you did not encounter some pilot reactions that are described further (nor will in the future maybe). That's the very pur-

pose of the lessons learnt: possibly when you will be confronted to a similar case it will be a lesser surprise to you, which is a clear benefit, isn't it?

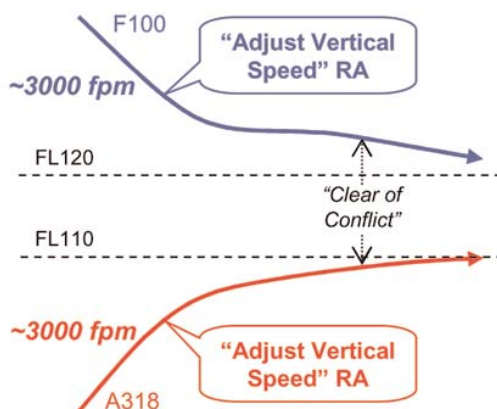
THOMAS NOVOTNY  
DM safety management

## Event 2: Level-off with 1000 ft separation

An A318 is climbing to FL110 at about 3000 fpm. A Fokker 100 is descending to FL120, also at about 3000 fpm.

The aircraft trajectories are converging both horizontally and vertically. Due to the high vertical closure rate (6000 fpm), the A318 and the F100 receive an "Adjust Vertical Speed" RA at respectively 900 and 1000 ft from their cleared flight level. Both RAs request to reduce the vertical speed to 1000 fpm.

- The A318's pilot reduces the rate of climb to less than 1000 fpm.
- The F100's pilot first stops the descent and then descends again at about 1000 fpm.



The correct reactions to the RAs by both pilots minimised the impact on ATC.

## Level-off with 1000 ft separation: what's new?

TCAS II version 7 contributed to a significant reduction in the number of RAs generated when aircraft are expected to level-off to achieve 1000 ft separation. However, these situations still cause a large majority of RAs. Recent figures from a major European airline show that they represent 70% of RAs generated on its A320 fleet.

The [ACAS Bulletin n°2](#) describes some solutions to reduce the number of these RAs. Some progress has been made regarding the reduction of the vertical rate approaching the cleared flight level.

Several airlines have modified their standard operating procedures to require the pilots to reduce the vertical rate to less than 1500 fpm within the last 1000 ft before cleared flight level (usually, when the pilot is aware of an aircraft at the adjacent flight level). Data collected by a major European airline show that the likelihood of receiving an RA while levelling off is three times lower when this reduction is implemented.

ICAO is completing its work to include this recommendation in Annex 6, Aircraft operations.

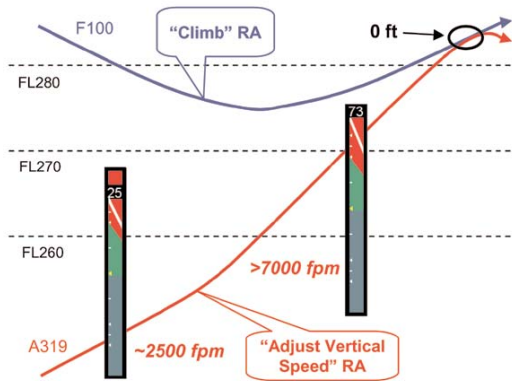
**Event 3: Wrong reaction to "Adjust Vertical Speed" RA**

An A319 is climbing to FL260 at about 2500 fpm.

When passing through FL251, it receives an "Adjust Vertical Speed" RA requiring a reduction in the rate of climb to 1000 fpm. The RA is triggered against a Fokker 100 descending to FL270 at 2000 fpm on a converging track.

The A319's flight crew misinterprets the RA and increases the rate of climb to more than 7000 fpm instead of reducing it. Due to this opposite reaction to the RA and despite a correct response of the Fokker 100 to the coordinated RAs ("Adjust Vertical Speed" then "Climb"), the A319 receives a strengthened "Descend" RA. However, the flight crew continues to climb very quickly until the "Clear of Conflict".

As a result, the A319 busts its cleared flight level by 2200 ft and the aircraft passed at a distance of 1.6 NM at the same altitude.



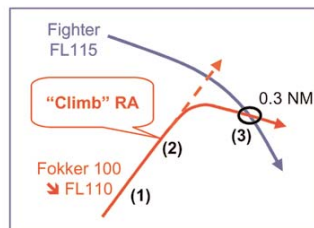
**Actions to address the opposite reactions to "Adjust Vertical Speed" RAs**

The safety issue of opposite reactions to "Adjust Vertical Speed" RAs whereby pilots believe that they are reacting appropriately was described in detail in the **ACAS Bulletin n°3**. The event above illustrates that such events continue to occur. Due to the severity of this issue, there are several on-going actions to address it, including pilot's training and TCAS II specifications.

- Some airlines have adapted their TCAS II training programmes with respect to this issue. The main objective is to explain clearly to pilots that when an "Adjust Vertical Speed" RA is triggered by TCAS II, the required action is always to **REDUCE VERTICAL SPEED**. This enhanced training has contributed in the reduction of the number of occurrences but has not fully eradicated the problem.
- RTCA, the TCAS II standardisation body, is investigating this safety issue and the causes for such opposite reactions have been identified in a recently published report. The work is going on to improve the aural message and the display for these specific RAs. EUROCONTROL, in support of RTCA work, is investigating a possible modification of the "Adjust Vertical Speed, Adjust" aural annunciation, together with a simplification of the TCAS II RA list.

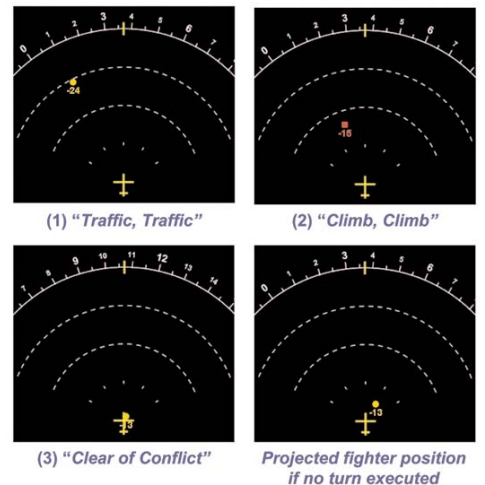
**Event 4: Inappropriate turn based on TCAS traffic display**

A Fokker 100 is descending to FL110. Its TCAS triggers a "Traffic Advisory" and then a "Climb" RA when passing a fighter at FL130, against a fighter at FL115. The pilot correctly follows the RA and starts to climb.



However, the pilot also initiates a 70-degree right turn based on the TCAS traffic display which shows the intruder on the left. The climb provides a safe vertical separation (more than 1000 ft) whereas the right turn actually reduces the horizontal separation from 1 NM to 0.3 NM.

Due to the relative motion of the symbol and the lack of speed vector on the TCAS traffic display, the flight crew incorrectly interpreted that the intruder was converging towards the own aircraft from the left under a bearing of 30°. However, the ground track angle was about 90° as shown on the figure.



**TCAS II traffic display is difficult to interpret**

The **ACAS Bulletin n°6** describes why the TCAS II traffic display is open to misinterpretations.

The display shows only a partial traffic picture, shows no history or past position and has no speed vector for intruders.

It has a moving reference: as the aircraft itself is moving, the displacement of the intruder's symbol does not correspond to the intruder's actual ground track.

The bearing of the intruder's symbol has limited accuracy.

Therefore, pilots must only use it according to its intended function: to assist the visual acquisition of surrounding aircraft.

**Incorrect controllers' reactions**

In some reported events, it has been identified that controllers have explicitly told pilots to ignore reported RAs:

- Pilot: "TCAS descend"
- ATC: "There is opposite traffic at FL290, at your 12 o'clock, 10 miles, climb immediately please"

In some other events, controller have even anticipated a possible RA:

- ATC: "Descend immediately FL370"
- Pilot: "Roger. Descending FL370"
- ATC: "The [conflicting] traffic [...] will maintain FL380. If you get an ACAS alert, do not follow it"

**Controllers must not interfere with pilots' reactions to RAs!**

Since the introduction of ACAS II, the ICAO PANS-ATM Doc 4444 has clearly stated that controllers must not interfere with the pilots' reactions to RAs:

**"When a pilot reports a manoeuvre induced by an ACAS resolution advisory, the controller shall not attempt to modify the aircraft flight path [...]"**

Even when a pilot is appropriately trained to apply the new ACAS procedure requiring to follow all RAs, he can be confused to receive from the controller an instruction opposite to the RA that he has just reported.

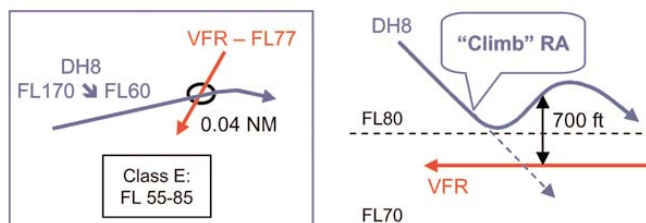
### Event 5: Necessary RA against VFR aircraft

A DH8, flying IFR, is descending to FL60. When approaching FL80, it receives a "Climb" RA. The pilot stops the descent and climbs back about 400 ft. The intruder is an uncontrolled altitude transponding VFR aircraft cruising at FL77.

The VFR was flying in class E TMA in radio contact with FIS. The vertical limits of this class E airspace range from FL55 to FL85.

The pilot's reaction to the "Climb" RA enabled the DH8 to pass 700 ft above the VFR. Simulations indicate that without TCAS, the minimum separation between the aircraft would have only been less than 150 ft and 0.04 NM.

The safety benefits of TCAS RAs against altitude transponding VFR traffic has been shown in the [ACAS Bulletin n°4](#).



### Event 6: Opposite manoeuvre to RA to follow ATC avoiding instruction

A B767 is maintaining FL290 heading West. An A319, heading South-East, is at FL270 on a converging track. The aircraft are controlled by two different ATC units (the vertical boundary is FL285).

The A319's pilot requests for a higher cruising level. Due to a coordination error between the two ATC units, the A319 is cleared to climb to FL290 with the B767 whilst in conflict.

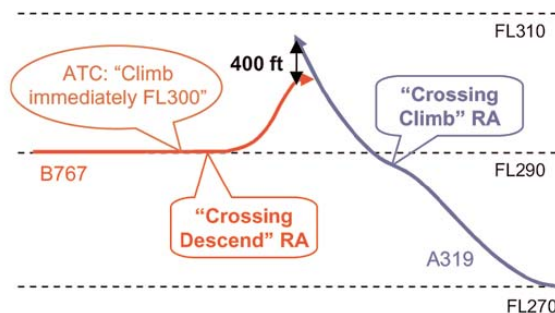
Following Short Term Conflict Alerts triggered in both ATC units, the B767 is instructed to climb immediately to FL300 and the A319 to "expedite descend FL270".

However, almost at the same time, each aircraft receives a coordinated RA opposite to the ATC instruction.

- The B767 receives a "Crossing Descend" RA. The pilot disregards the RA and follows the ATC instruction to climb.
- The A319 receives a "Crossing Climb" RA. The pilot correctly reacts to the RA by increasing the rate of climb.

Because of the B767 pilot's opposite manoeuvre to the RA, the very small vertical separation between the aircraft does not increase. Consequently, the A319 receives an "Increase Climb" RA and the pilot increases the rate of climb to 5000 fpm. The B767's pilot eventually recognises the "Descend" RA and stops the climb just before the "Clear of Conflict".

Despite the large vertical deviation of the A319 (3000 ft), the aircraft passed at 400 ft and 0.3 NM.



#### Pilots must follow all RAs!

The [ACAS Bulletin n°1](#) describes several hazardous events where some pilots reacted in the opposite direction of the RA for different reasons (ATC instruction, visual acquisition, stress, etc.).

Previously, the ICAO regulation was not sufficiently explicit. Therefore, ICAO revised the ACAS procedures and pilot training guidelines to require pilots to follow all RAs. The ICAO PANS-OPS Doc 8168 was updated in November 2003 and as described in the [ACAS Bulletin n°5](#), the ACAS procedure now clearly states that:

**"Pilots shall respond immediately by following the RA as indicated, unless doing so would jeopardise the safety of the aeroplane"**

However, Event 6 shows that there are still some pilots who do not follow RAs, and who even manoeuvre in the opposite sense of the RA, whereas the ICAO PANS-OPS Doc 8168 also states that:

**"Pilots shall not manoeuvre in the opposite sense of an RA"**

# Rwy ahead

**Facts:**

Last January and February, two incidents of a similar type occurred at Geneva Airport when two IFR aircraft crossed the CAT I stop bar on taxiway Zulu (which is not equipped with red lights) and stopped short of the active runway. Both incidents happened at night.

The first case took place on a winter evening when a Cessna 421, which had been instructed to taxi into the holding bay Zulu, crossed the CAT I stop bar (see picture). When the ATCO asked the crew if they were on the runway, they reported entering it. They were then instructed to vacate via taxiway Echo as an inbound aircraft had passed 2 NM final. As the landing aircraft passed the threshold, the C421 was reaching the CAT I line on taxiway Echo. The pilot stated in his report that it was due to a loss of situational awareness.

The second case happened early in the morning. A Cessna 56X was cleared to taxi into the holding bay Zulu for a departure on runway 05. As it was doing so, the crew were

instructed to hold short of the runway and were asked if they could accept a departure from the intersection, which they acknowledged. The C56X entered the runway while another aircraft was rolling for take-off on runway 23. The ATCO immediately instructed the C56X to hold position and subsequently cancelled the other aircraft's take-off clearance. In its report, the crew reported being busy performing a second series of standard thrust reverse checks as they had received a faulty indication during the first one and were preoccupied with troubleshooting this indication.

**Additional information:**

Another factor that may have had an influence on the course of events is the taxiway and holding bay Zulu layout and marking.

The CAT I stop bar is painted approximately 90 m from the runway center line and equipped with wig-wag lights either side. There are also two lighted panels indicating the runway that comply with the standards fixed by ICAO Annex 14. The



Cessna 56X

CAT II line is right at the entrance of taxiway Zulu (as shown on picture). However, keep in mind, that markings on airport grounds are the same as the ones on the streets and their visibility is not as good at night

and/or in rainy conditions as it is during the day. Obviously, for these two cases, the markings were not distinct enough to prevent both aircraft from entering the runway.

**Will something be done in the future?**

The answer to this is yes.

**On skyguide's side:** SAMAX (Swiss Airport Movement Area Control System) has a built-in tool called RIMCAS which has not yet been tuned for its purpose in Geneva. This tool should normally be implemented in the first trimester of 2008. The tool will monitor the target position reports and assess the traffic situation. Once a potentially hazardous situation is detected, an alert message is sent to the CWP's (Controller Working Positions) where a visual and audible warning are given to the air traffic controller. It is designed with different parameters that apply to the runway, the taxiways and stop bars. It functions with the indications received from the transponders. All aircraft are equipped, as well as the vehicles that, for various duties, are entitled to enter the runway.

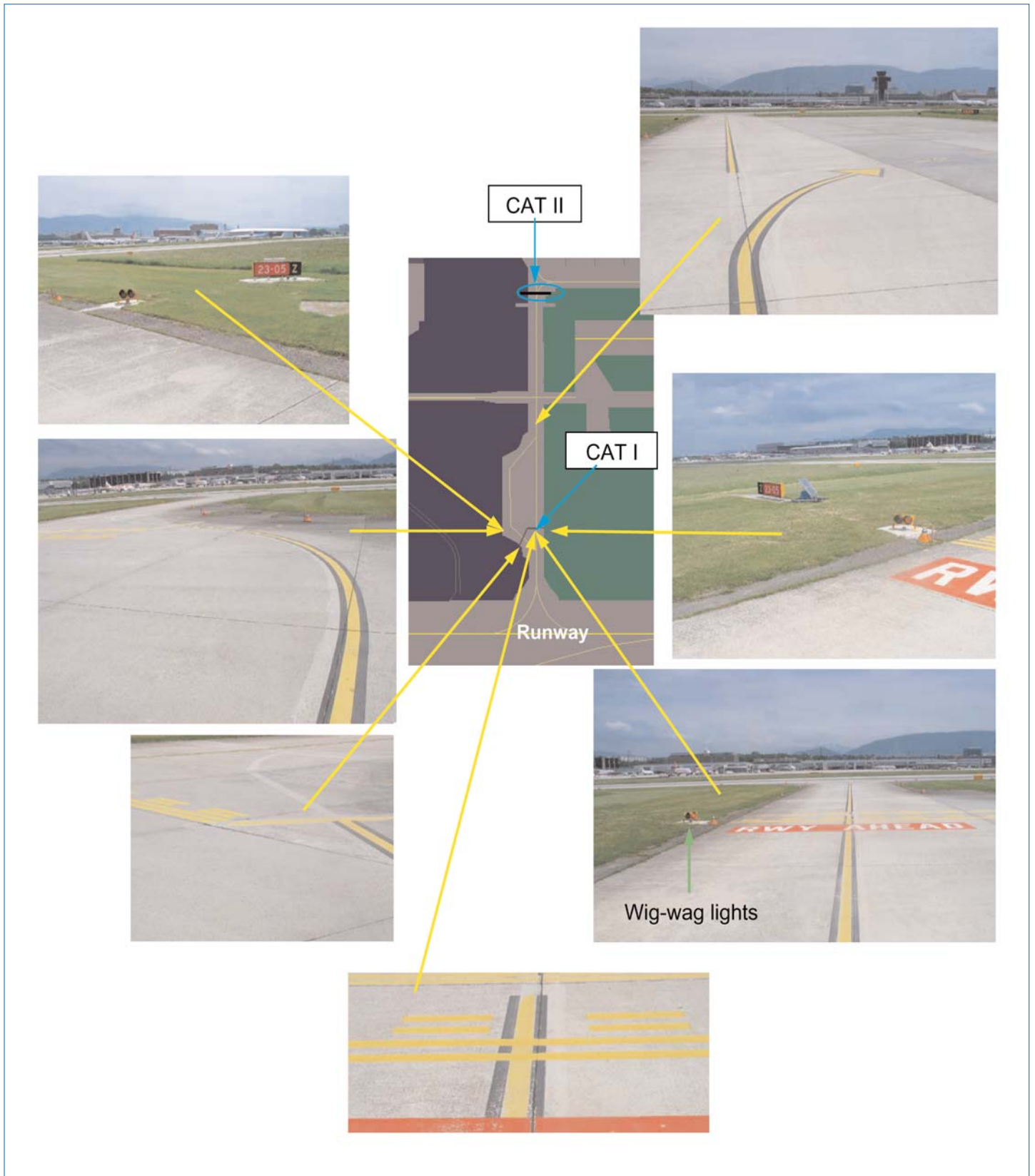
**On the airport's side:** The CAT II stop bar that is at the entrance of the taxiway Zulu (see picture) will be relocated halfway through the Zulu holding bay and fitted with red lights that will be also be operational in CAT I conditions. This lighting development is scheduled to take place this year. In addition, the study for the renewal of the complete lighting system of the AIG has been launched. The whole process will take some time, but it is promising and might improve the situation further.



Cessna 421

IVAN ROCHAT  
DMO Geneva

► Rwy ahead



# bizjet «Citation 525» contra bizjet «Hawker 125»

where: Zurich area (Southern Ticino) on 2.9.2005

## Analysis

On Thursday, September 2, 2005, a C525 from Jersey to Milan-Linate was cleared to descend to FL 230 inbound to ODINA with Zurich Upper Sector, while a Hawker 125 was maintaining FL 240 northbound with Milan Control.

RE U had received information that a C525 had been blocking the frequency of M2 for some minutes. The blocking of the frequency occurred periodically, making it difficult to determine whether the problem was continuing or not. Obviously some communication had worked since the C525 called in descending to FL 260.

Sector S authorized sector U to descend the C525 to FL 230 and transfer it to Milan. After the initial call the C525 was cleared to FL 230 with a rate of 2500 ft/min or greater. No readback was received. Two more calls were answered with «go ahead». The C525 was now cleared to FL 230 with 3000 ft/min or greater. This in order to get the C525 below the opposite Hawker 125 at FL 240 with destination LSZH. This traffic – still on Milan frequency – was foreseen to enter via CANNE, but due to CB activity it was avoiding on a northwesterly heading towards ODINA. There was again no readback received. RE U then called twice to re-establish contact. At the second call full readability on both sides was confirmed and the C525 reported to have «found the fault». Since the C525 was maintaining FL

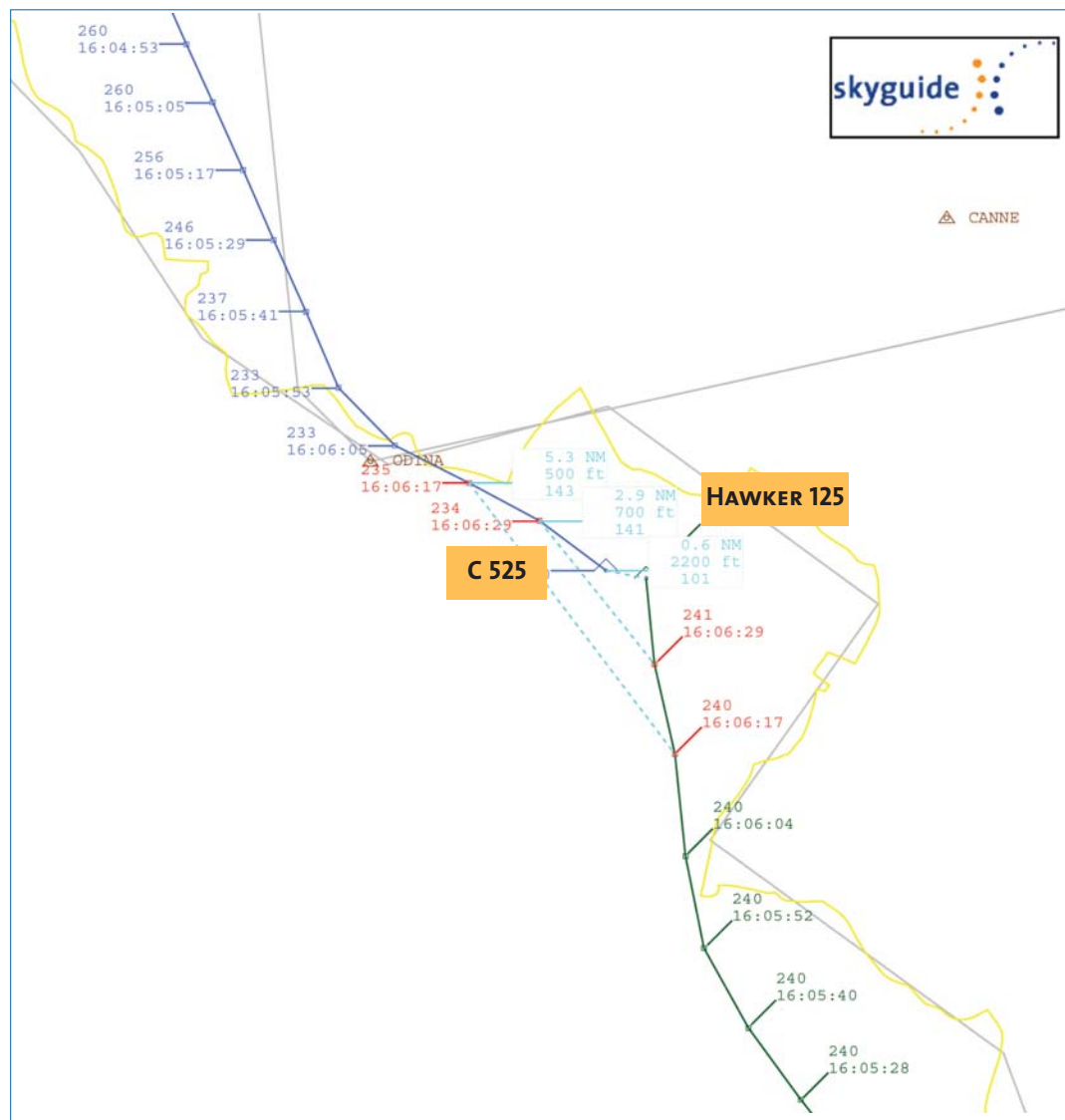
250 for 2 more updates, RE U decided that there no longer was time to get the C525 below the Hawker 125 and recleared it to maintain FL 250 «due to traffic». At this moment the MRT showed that descent had been initiated. Realizing the descent, RE U turned the C525 left onto heading east. This heading was based on the observed northwest heading of the

Hawker 125. Almost simultaneously with this clearance however, the Hawker 125 had initiated a right turn to the north and was again on conflicting heading. Since the descent of the C525 continued below FL 240, RE U then recleared the C525 to maintain FL 230. This was read back by the pilot. However, the climb back to FL 250 had already been initiated.

The C525 climbed from FL 233 to FL 235 before returning to FL 230.

## conclusion

A periodically stuck R/T transmitter combined with CB activity and several internal and external sector-interfaces, lead to a highly complex situation. Human – human coordination breakdown, where the closed



► bizjet «Citation 525»...

loop between clearance and read-back was interrupted, led to goal conflicts of achieving the coordinated exit FL versus maintaining vertical separation given the uncertainty of the R/T communication. This led to forced changes in concepts. The discrepancy of at least 12 seconds between the actual traffic situation and the MRT presentation may have hampered the monitoring of activities in a «tight» situation leading to difficulties in finding the adequate application of avoiding actions. Furthermore the fact that the con-

flicting traffic were on different frequencies –because of the interface between adjacent centers, left the RE U with insufficient knowledge or influence on the Hawker’s flight-path. The combination of this led to a separation minima infringement of 2.9NM/700ft.

**emerging considerations**

Several aircraft on avoiding heading due to CB’s combined with communication problems due to a stuck transmitter is a combination which is very difficult to manage – not to

mention the combination with an interface to an adjacent center. Some strategies to cope with similar situations are outlined in the ATMM CH (chapter 15.4 Use of EM-channel 121.5, chapter 20.2 Blocked Frequency, chapter 20.4 alternative means of COM) and in the emergency manual chapter 3.7 Radio Failure.

Unfortunately solutions to improve system design in order to otherwise cope with stuck R/T transmitters are not known to us at this stage.

**Abbreviations:**

- CB** Cumulonimbus clouds
- FL** Flight level
- MRT** Multi Radar Tracking
- M2** Zurich M2 (Upper) Sector
- RE U** Radar Executive Upper Sector
- R/T** Radio Telephony
- S** Zurich South Sector

NICHOLAS SCHERRER  
DMO Zurich

# Hindsight new issue n.3

HindSight magazine is an annual publication produced by the Eurocontrol «Safety Enhancement Business Division» and is intended for air traffic controllers. This magazine is prepared partly by the Safety Improvement Sub-Group (SIG) which is an European safety group that builds up its strength in the

exchange among different ANSPs; HindSight is one of the visible manifestations resulting from this exchange.

Hindsight issue n.3 and the 2 previous one are available at the following link

[http://www.eurocontrol.int/safety/public/site\\_preferences/display\\_library\\_list\\_public.html#3](http://www.eurocontrol.int/safety/public/site_preferences/display_library_list_public.html#3)



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THAT MIGHT LEAD TO ONE?**

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