

safety bulletin

Inside this issue

2 Editorial

*Safety management in skyguide,
Too much or too little?*

3-7 Lessons learned

*- Strong north-westerly winds over ZRH ACC
- ACAS world is moving on – large extracts
of the last Eurocontrol bulletin*



Safety management in skyguide; Too much or too little?



During the last couple of months I have had the opportunity to have several informal discussions with controllers and supervisors regarding the implementation of NUSAZ. It included a multitude of accounts, some positive and some quite concerned. The voices emphasizing the positive aspects have rightfully had plenty of room in flashes and press releases. We should however not forget to reflect on associated critical aspects and create room for debate on such issues, some of which I would like to launch here.

Summarizing my discussions I have encountered three areas of concern. One about the design of the sectorisation itself, one about the implementation and last but not least about the role of safety in this project.

To begin with the last point. The bandwidth of feedback has ranged from indignation over cumbersome overspecified procedures that assumingly stem from too much influence of the safety «people», to the viewpoint that the implementation, with its defects during the initial

phase, represented a total failure of safety and quality management. So either safety management was too prominent or too absent and in either way the «safety guys» became the scapegoats for unsatisfactory conditions. It makes little sense to discuss whose account is true in this matter and whether such attribution of blame is fair or not. What seems important to me is however to fill in some of the information gaps that seem to inhabit the operational environment with regards to the role of safety management in this big change.

NUSAZ has triggered discussions about the adequacy of the sector layout and the emergence of the term «safe by design». This term may create misleading expectations with regards to future achievements since no design ever is inherently safe in a complex system. Safety is not something an organization has, it is something an organization does. In other words, safety largely is created through daily practice. Of course design here can be more or less helpful in achieving safe performance and putting a sector boundary a dozen of miles next to one of the busiest crossings in Europe hardly falls into the helpful category. With regards to evaluating and deciding on the sectorisation-design options the role of the safety department was – none.

This particular choice of sectorization was consequential for subsequent safety assessment activities. A change can reach the declaration of acceptable safety by basically three interventions. An identified risk can either be eliminated, mitigated on a

systemic level or mitigated through human redundancy (where other parts of the system fail the human detects, corrects and hence stabilizes the system performance). What does this mean in context?

Eliminating a risk would often imply altering the design. Since the design in this specific case was imposed already, this possibility was not available. Mitigating on a systemic level could mean implementation of new support tools (like HST/DST). Since such tools could not be made available for the already set implementation date another option was lost. What was then left, was the operator who may need more training, more awareness or vigilance and of course the writing of more procedures for the operator to handle. In isolation choices to mitigate on this level may even seem rational and justified. After all this is why we hire, train, license and attractively remunerate highly skilled specialists and many operators equally take pride in getting the job done. The problem is that we increasingly open the bottom drawer of human redundancy solutions to solve our continuous flow of changes and that in accumulation, we are at risk of overstretching the capabilities of even the most skilled humans in order to meet ambitious deadlines and reach production goals.

So when it comes down to the problem of procedural overspecification I let you as reader reflect on whether it is connected to too much or too little influence of the «safety guys». Hopefully the safety management will also be drawn into considerations on the design level in the future.

Finally, to close the loop, it is important to know that these procedures are not handed down from the heavens above but are based on assumptions of how identified risks can be mitigated. If you as an operator encounter a potentially hazardous mismatch between how your work is performed and what has been prescribed, I strongly encourage you to make your voice heard and write a report, either a SIR or an OIR. This is the most fundamental source of information for our organization to learn about its vulnerabilities and the only formal leverage for change that the «safety guys» have available. Because as helpful or insightful as the informal discussions may be, they leave us absolutely powerless with regards to achieving safety improvements. In other words the influence of the safety department is highly contingent on your direct input, regardless whether you perceive the current outcomes as indications of too much or too little.

Closing in on the title again it should be clear to all of us that an optimum can neither be clearly defined or ever reached. The road of continuous improvement and organizational learning is the goal. By sharing your experiences and concerns with us you have been given a powerful tool to shape this road.

Looking forward to hear your voices

Sincerely

MARCIAN TESSIN

Strong north-westerly winds over ZRH ACC

Situation

RYR maintaining FL360 on course to ODINA and AFR1 maintaining as well FL360 on course to MOROK crossed each other west of TRA with a minimum separation of 4.3NM / 25ft.

Events

- RP M4 requests RYR «descending to FL360», presently maintaining FL370 west of HERBI as AFR2 from LUL to TRA as maintaining FL370 as well.
- RYR is calling M4 «descending to FL360» and RE M4 cleared RYR TRA ODINA.
- RE M4 reclears RYR direct to ODINA, present position 10NM southwest of MOPAN (Alsace).
- RE M4 clears RYR and AFR2 10° to the left and issues traffic information to both aircraft.

Analysis

Traffic situation at the Sector M4 around 18:18 was dense and complex. Additionally, strongwinds from the northwest were prevailing. As RYR from the north and AFR2 from the west would meet over TRA at FL370, RP M4 phoned Rhine Control and coordinated RYR «descending to FL360» to avoid the crossing at the same flight level.

At about the same time AFR1 from the east, flying via TRA to MOROK called in at FL360 and at 18:15 RYR from the north flying via TRA to ODINA called in as

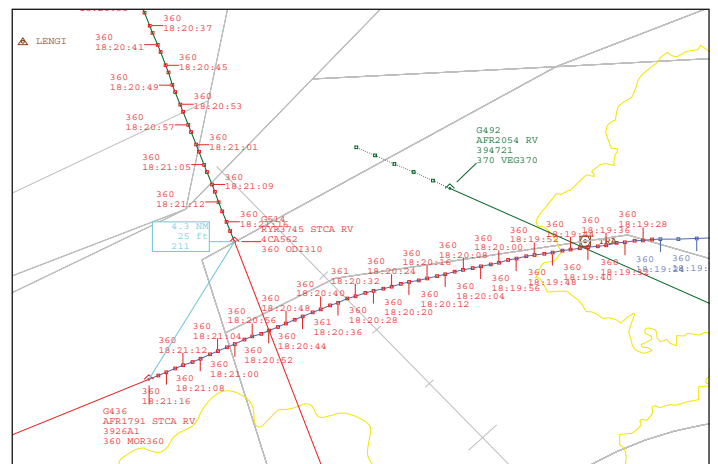
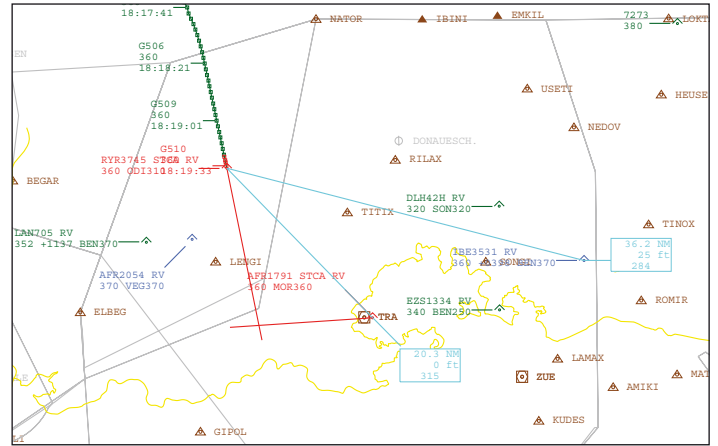
well at FL360. AFR1 was now the potential crossing traffic nearby TRA.

Due to the restricting traffic at FL370 IBE was after the initial call cleared to FL360 only, requesting FL370 later on. IBE became now the second crossing traffic for RYR, being around 28NM behind AFR1. This meant, the gap was filled for a crossing with enough space between RYR and AFR1 creating a new situation with two potential conflicts / crossings for RYR

By reclearing RYR direct to ODINA, the RE M4 achieved the result of a larger spacing between RYR and IBE on one side, but a more narrow spacing with AFR1. At this time RE M4 knew about the strong north-westerly winds and the heavily differing wind components, but had problems judging the impact on the crossing between RYR and AFR1.

Shortly before the triggering of the STCA alarm at 18:19:32, M4 RE and RP realized the problem with the two crossing traffic RYR and AFR1 at FL360 by visual judgement (no speed vectors). At 18:19:55 and a few seconds later, the RE immediately cleared RYR and AFR1 each 10 degrees to the left, followed by a traffic information to both aircraft.

Due to the amount and complexity of traffic, time for decisions became very short and almost no



monitoring capacity was left to verify the separation concept (Quote of the ATCO).

Lessons learned

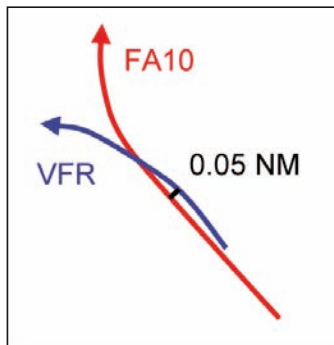
A situation like this highlights the potential advantages in the application of speed vectors to assist in the continuous monitoring of achieved separation, especially in weather situations as mentioned above, because the displayed

vectors immediately react on the change of the current wind intensity and wind direction and hence can adequately assist the ATCO in assessing the predicted separation.

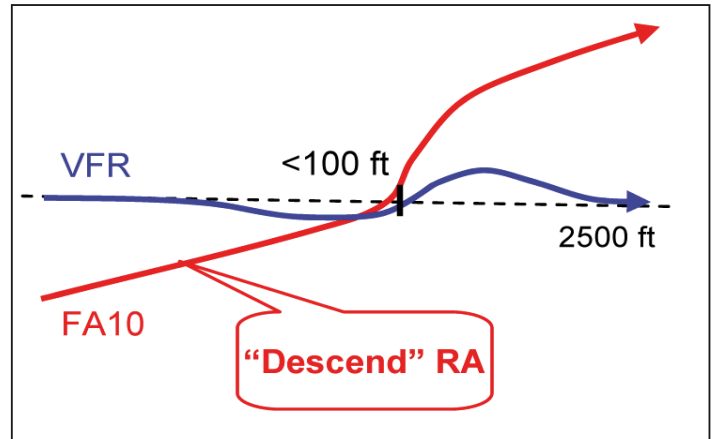
SRO
Safety Reporting and
Investigation Management

RA not followed leading to near mid-air collision with a VFR

A Falcon 100 has departed from a medium-sized airport under IFR and is heading north-west. A piston-engined aircraft flying VFR is north of the airport at 2500 ft, also heading north-west.



Owing to the difference in speeds, the Falcon is rapidly catching up the VFR aircraft and as it climbs through 2300 ft, it receives a “Descend” RA. However, the pilot of the Falcon does not react to the RA and continues to climb. A few seconds before the Closest Point of Approach (CPA), the pilot of the Falcon increases the climb rate to more than 3000 fpm to avoid the VFR traffic. Simultaneously, the pilot of VFR aircraft starts to climb but then descends back to 2500 ft. The Falcon passes just to the left of the VFR aircraft, at a distance of 0.05 NM and a vertical separation of less than 100 ft, according

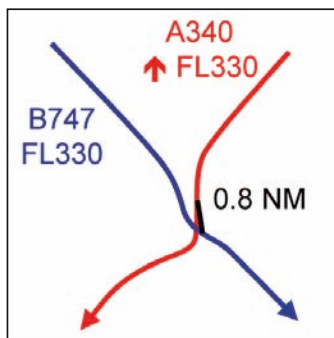


to radar data. It is unknown whether the pilots saw each other. If the Falcon pilot had responded

correctly to the RA, the Falcon would have passed about 300 ft below the VFR aircraft.

Loss of separation but prompt reactions to RAs

A B747, heading south-east, is in level flight at FL330. An A340 is climbing to FL330 on a crossing track and is expected to pass behind the B747. However, the controller has cleared the A340 direct to a waypoint further on the route and this clearance leads the A340 to converge with the B747.



Consequently, a Short Term Conflict Alert (STCA) is displayed to the controller, who then gives avoiding instructions: a 40 degree left turn for the A340, then a 40 degree right turn for the B747. At the same time, both aircraft receive coordinated RAs:

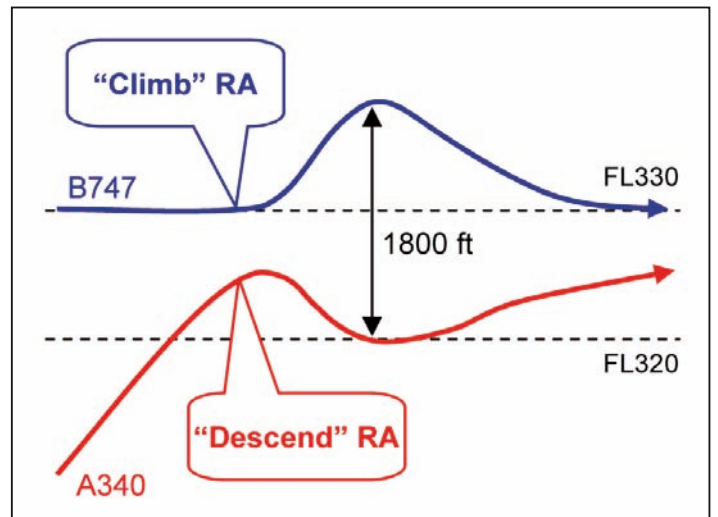
- The B747 pilot responds immediately to a “Climb” RA and reports the RA to ATC.
- The A340 pilot starts turning late, but reacts promptly to a “Descend” RA.

ATC separation was lost, but at the CPA, the aircraft were separated by 1800 ft, with only 0.8 NM in the horizontal plane.

In this event, the prompt and effective reaction by both pilots to

the RAs resulted in safe vertical separation at the CPA. The ATC avoiding action was given too late

to be effective. Nevertheless, the ATC horizontal instructions did not affect the reactions to the RAs.

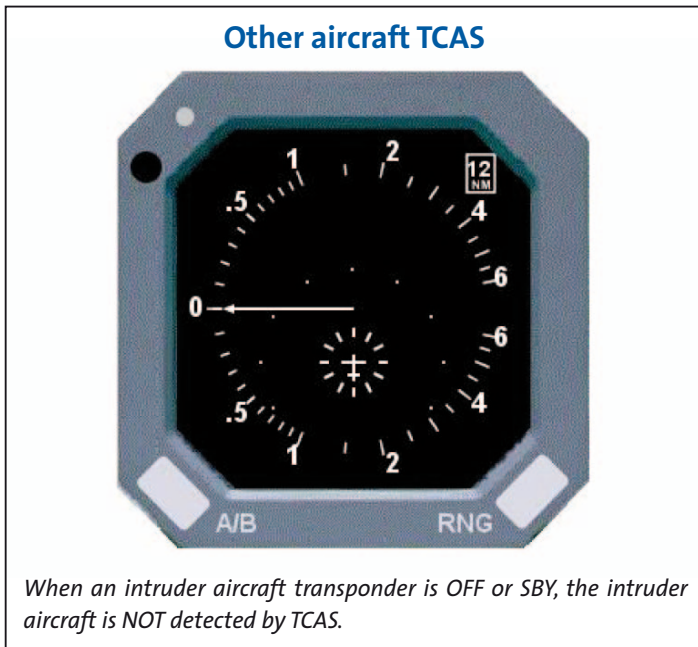
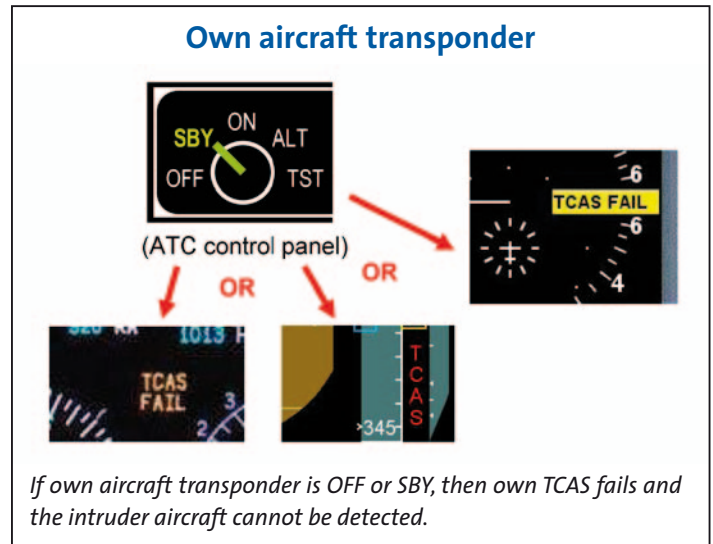


► ACAS world is moving on – large extracts of the last Eurocontrol bulletin

Mid-air collision over Brazil in 2006

A Legacy 600 Business Jet and a B737 are cruising in opposite directions on the same route. Unfortunately, following several problems related to ATC and communications, both aircraft are maintaining the same flight level (FL370), while ATC expected the Legacy to be at FL360 or FL380. Moreover, the Legacy transponder has been inadvertently set to “Stand-by” by the pilots (i.e. it is no longer operating). This has three consequences:
 (1) ATC has lost radar contact with the aircraft, and consequently the current flight level is not seen by the controllers.

(2) The TCAS on board the Legacy has become automatically inoperative.
 (3) The Legacy cannot be detected by the TCAS on other aircraft, including the B737.
 As a result, the airborne collision avoidance safety net is unable to protect these two aircraft. Moreover, neither of the pilots is aware of the other aircraft’s presence and they do not see the opposite traffic despite daylight and good weather conditions.
 The aircraft collide head-on at FL370.



TCAS II provides safety benefits between aircraft with active altitude-reporting transponders only

Vertical speed reduction when levelling off 1000 ft from another aircraft

In November 2008, as a measure to reduce the number of non-desired RAs when levelling off at 1000 ft from another aircraft, ICAO included in PANS-OPS Doc 8168 a procedure which recommends a reduction in the vertical speed to 1500 fpm throughout the last 1000 ft before the assigned altitude or flight level when the pilot is made aware of another aircraft at or approaching an adjacent altitude or flight level. A similar procedure had already been applied with success by several major airlines prior to 2008.

► ACAS world is moving on – large extracts of the last Eurocontrol bulletin

Unintentional opposite reaction to an “Adjust Vertical Speed” RA

An A320, heading north-west, is cruising at FL340. A Gulfstream 3 (GLF3) is climbing to FL330 at a rate of 2500 fpm, heading south-east, on an almost opposite track. When passing through FL322, the GLF3 receives a TA, followed at FL325 by an “Adjust Vertical Speed” RA, which in this case requires a reduction in the vertical speed to 1000 fpm or less. After a few seconds, the A320 receives a coordinated “Climb” RA.

Misinterpreting the RA, the GLF3 pilot increases the vertical speed to more than 4500 fpm instead of reducing it. This initial RA subsequently strengthens to a “Descend” RA and an “Increase Descent” RA. The GLF3 pilot keeps on climbing until TCAS generates a “Clear of Conflict” message.

On the other hand, the A320 pilot follows the “Climb” RA and the subsequent “Increase Climb” RA,

and at some point climbs at 3200 fpm which actually helps to increase the vertical spacing between the aircraft.

As a result of the opposite manoeuvre to the RAs, the GLF3 climbed 1700 ft above its cleared flight level, passing through the

A320’s cruising flight level (i.e. FL340). At the CPA, the aircraft passed each other at 0.9 NM and 350 ft.

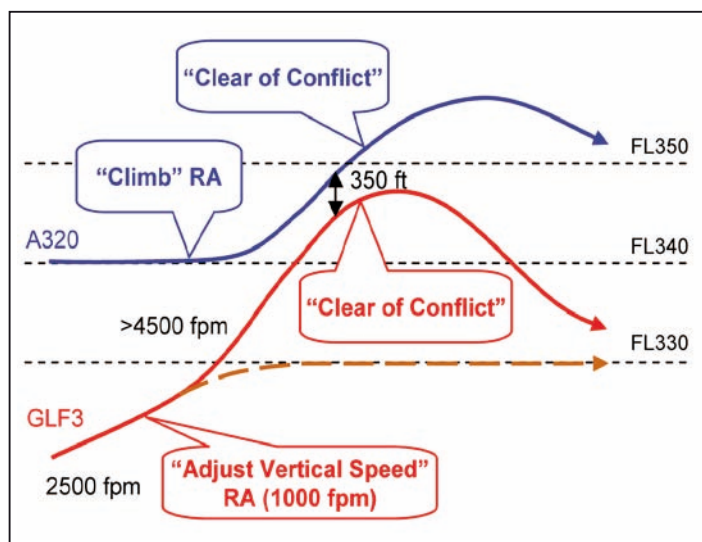
After the “Clear of Conflict” message, the GLF3 pilot merely reported to the controller that he “had a resolution, traffic alert”.

Other enhancement of TCAS operations

- EASA has recently certified a new Auto-Pilot/Flight Director (AP/FD) TCAS mode for the Airbus A380. This system allows the aircraft to automatically follow all the RAs generated by TCAS and also to resume the previously selected flight level after the “Clear of Conflict” message. This enhanced TCAS mode avoids potential overreactions or opposite reactions to the RAs. However, if the pilot decides to fly the RA manually, the Flight Director bars provide an intuitive display and guide the pilot to fly the manoeuvre required by the RA. This AP/FD TCAS mode will also become available for retrofitting to other

Airbus fly-by-wire aircraft in the coming years.

- Airbus is working on a new altitude capture law to help prevent non-desired RAs when aircraft are about to level off 1000 ft above or below a close converging aircraft. See the yellow box “Vertical speed reduction when levelling off 1000 ft from another aircraft” for additional information.
- Some ANSPs in Europe are considering the capability to downlink RAs for display on the controller’s radar screen. A workshop was organised in Berlin in October 2009 to discuss the subject. For more information visit: <http://www.eurocontrol.int/ra-downlink/>.



More examples of unintentional opposite reactions to “Adjust Vertical Speed” RAs can be found in ACAS Bulletins No. 3 and No. 7. TCAS II version 7.1 includes a modification of these RAs to address this issue (see the yellow box to the right).

► ACAS world is moving on – large extracts of the last Eurocontrol bulletin

A new TCAS II version

To address known safety issues with TCAS II version 7, a new version, named TCAS II version 7.1, was developed and approved in 2008. It will provide two major improvements.

- **Enhanced “reversal RA logic”.** The objective is to better address the situations where it is necessary to revert the sense of the RA. For instance, when one of two TCAS-equipped aircraft manoeuvres in a sense opposite to its RA, or when the manoeuvres of a non- TCAS equipped intruder are contrary to the collision avoidance logic projections. Although, this capability already exists in TCAS II version 7, in some situations it fails to generate reversal RAs. With this enhanced logic, reversal RAs will be issued, if required, in a more appropriate and timely manner.
- **Simplified and more intuitive “Level-off, Level-off” RA instead of “Adjust Vertical Speed, Adjust” RAs.** Operational monitoring programmes have identified the fact that some pilots, who are confused by the aural message and the display of the “Adjust Vertical Speed” RAs, unintentionally react in the opposite manner to that required by the RA. The new “Level-off, Level-off” RA is intended to prevent these unintentional opposite reactions thanks to an explicit aural message indicating the sense and strength of the manoeuvre and a simplified display of the RA. This new RA will also contribute to preventing level busts caused by pilots passing through their cleared flight level as they maintain the vertical speed needle in the green area.

In Europe, EASA (the European Aviation Safety Agency) has initiated a rule-making task to develop an “...Implementing Rule requiring the carriage of TCAS II with software version 7.1 as the minimum standard for aircraft operating within European Airspace”.

Conclusions

The ACAS world is moving on. The community must take into account the following changes:

- More aircraft are now equipped with TCAS II, in particular business jets, but also some light jets, very light jets and helicopters.
- Instances of RAs at low altitudes against VFR traffic have increased, as operations at secondary airport grow.
- Enhancements aimed at improving TCAS II operations are, or will be, available in the near future: AP/FD TCAS mode, new altitude capture laws and most importantly, TCAS II version 7.1.

To maximize the safety benefits which ACAS provides, pilots must:

- Ensure that the transponder is ON and that TCAS is in the RA/TA mode;
- Follow RAs promptly and accurately, including those occurring at low altitudes;
- Promptly report to ATC any RAs requiring a deviation from the current clearance, using standard phraseology (i.e. “TCAS RA”);
- While following an “Adjust Vertical Speed” RA, whenever possible try to comply with the ATC clearance (if not contrary to the RA).

Moreover, it is important that all pilots undergo initial and refresher TCAS training, which is essential in order to achieve maximum safety benefits from TCAS II.

Source: Eurocontrol ACAS II bulletin 11