

# safety bulletin

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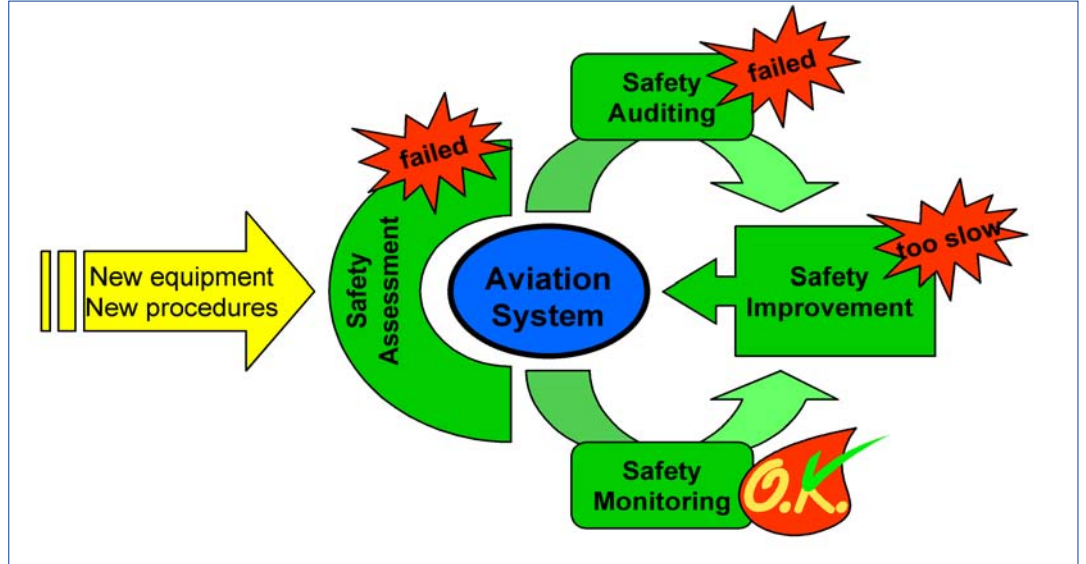


# The transponder problem: Did the SMS fail?

The recent repeated incidents with aircraft disappearing from our radar screens – for minutes in some cases – have raised doubts about our Safety Management System (SMS). Many people have justifiably asked how this could happen and, above all, why this unacceptable state of affairs was not rectified immediately. One thing is certain: the transponder problem is unlikely to go down as the finest hour in aviation SMS history.

In fact, the transponder problem is a particularly complex one. This is because it does not affect the SMS of an air traffic services provider, an airline or an equipment manufacturer; it affects the interplay among all three. As such, it challenges the SMS of the entire aviation community. This SMS has essentially the same components as our own SMS: safety assessment, safety audit, safety monitoring and safety improvement. And the performance of each of these components in this particular case is described in brief below. Safety assessment is intended to protect the aviation system from unacceptable risks which may creep in with the adoption of new equipment or new procedures. The transponders concerned were approved for use without their malfunctioning being detected. **So the safety assessment failed.**

Safety audits are designed to reveal latent system errors. But «faulty» equipment like this will never be



discovered through the kind of safety audits that are conducted normally. It would be possible - in theory - for the problem to be detected by the airlines through a «line operations safety audit» (LOSA). Similar programmes are also being developed for air traffic services providers, for whom they are known as «normal operations safety surveys» (NOSS). But in the present transponder case, **the safety audit failed.**

The last element in safety management is safety monitoring and associated actions. Safety monitoring covers all reports on deviations from the norm, be they OIRs, SIRs or automated monitoring tools. **The safety monitoring worked:** these irregularities were registered on all

the various channels; and, thanks to the extensive analyses conducted, the cause – the faulty transponders – was rapidly discovered.

It is not enough, however, just to discover the cause. Appropriate action also needs to be taken to bring the situation back under control. Otherwise, the people involved will quickly feel powerless, abandoned or let down. **The safety improvement was inefficient and far too slow in its response.**

To explain the whole problem and inform you of the next steps planned, we have made the transponder problem the key topic in this Safety Bulletin.

*LOSA: A «Line Operations Safety Audit» or LOSA is a formal process that requires expert and highly-trained observers to ride the jump seat during regularly scheduled flights in order to collect safety-related data on environmental conditions and operational complexity.*

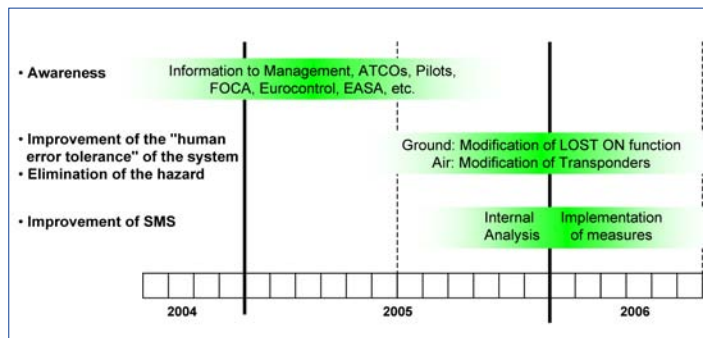
MARTIN PROBST  
Head of Safety and Quality Management

# The transponder problem: An opportunity to improve our SMS

As we already said in the editorial, our Safety Management System (SMS) was insufficiently efficient in its response to the recent transponder problem. Below we present what happened here from an SMS perspective, and what conclusions we can draw from this case.

The developments to date can be put into three distinct phases.

**Phase 1** began in September 2004, when an analysis by Andrea Motta of TDA identified the transponders of the aircraft involved as the cause of the problem, discarding hypothesis of deficiencies in our radar system. This should have laid the foundation for solving the problem at its root. What followed instead, however, was more than six months of Level 3 actions: warnings and alerts were issued everywhere. Our controllers were informed of the problem via Service Orders, Service Info and Safety Bulletins; they were urged to be alerted; and they were advised to ask the pilots to adopt a «recycle code» procedure in the event of a transponder problem. TDA informed the Federal Office for Civil Aviation (FOCA), Eurocontrol and various airlines. The airlines and the transponder manufacturers, for their part, informed the pilots and urged them to make the code change in less than five seconds. All these actions were doubtless well-intended. But the fact that the number of transponder losses remained unchanged only underlined what the theory has long been saying: Level 3 solutions are not efficient.



**Phase 2** began in mid-2005, after the occurrence of two serious incidents that were directly related to the transponder problem. The discussions between skyguide and the FOCA were now intensified at both the CEO and the Safety Management levels; and meetings were subsequently held at both the management and the expert levels.

Christoph Gilgen, Safety Officer for ACC Geneva, established close and regular contacts with the European Aviation Safety Agency (EASA) with a view to implementing Level 1 solutions. The FOCA also actively approached the EASA on the issue. On August 1, the EASA issued an Airworthiness Directive obliging all airlines to modify any faulty transponders within the following nine months.

At skyguide, the LOST ON function – a facility for displaying on the radar screen the last position of an aircraft whose transponder is no longer responding – was extended to permit these «lost aircraft» to remain displayed for longer. This can be regarded as a Level 2 action. Particular care will

need to be paid to it in connection with the introduction of a stripless approach for UAC operations. With all the above actions, Level 1 and Level 2 solutions are now being sought to ensure an enduring resolution of the transponder problem.

## Summary

- The severity of the problem was initially underestimated.
- Level 3 solutions were pursued for too long.
- The first formal meetings between skyguide and the FOCA to jointly seek solutions were held more than six months after the problem was identified.
- The workflows and interfaces between skyguide on the one hand and the FOCA, the EASA and Eurocontrol on the other are largely based on personal contacts and are not clearly defined.

These are my first personal conclusions. So what happens next?

**Phase 3** began at the end of July 2005. The conclusion that our workflows were inadequately structured and that

too much time had elapsed before efficient solutions were devised, either internally or in collaboration with the FOCA or other authorities, prompted a thorough internal analysis of the problem in all its various aspects. Tom Laursen of DMO was instructed to devise proposals to ensure that our SMS would respond more effectively in future to problems of this kind. The associated findings will be published in our next Safety Bulletin. If we can use the experience we have gained from it to improve our SMS, we will at least have learnt some valuable lessons from the transponder problem.

MARTIN PROBST  
Head of Safety and Quality Management

In the Human Factors, Management and Organisation article in our last Safety Bulletin, we presented the three levels of action available when tackling a problem.

Here is a brief summary of them again:

- The first level of action is to eliminate the hazard, thereby preventing a future accident.
- The second level of action is to accept the hazard identified and adjust the system to tolerate human error and reduce the possibility of an occurrence.
- The third level of action involves both accepting that the hazard can be neither eliminated (Level One) nor controlled (Level Two) and teaching operational personnel to live with it. Typical actions here include increasing or adding warnings, etc.

ICAO  
Circular Human Factors Digest n°10, 1993

# Learning from the Honeywell PRIMUS transponder issue

When I first got aware of the Honeywell transponder issue, back in late 2004, I couldn't believe what I heard: a certain type of Mode S Elementary Transponder, built by Honeywell, could go on stand-by unintentionally, and without being commanded to do so by the crew! After the shock settled down, I started to try to figure out what could happen? Or in more somber words: **what can go wrong?**

Not only a total loss of radar contact was possible, as blips couldn't be detected anymore by our multi-radar system. But also all the other safety nets, including our STCA, and, more importantly, the last ditch airborne anti-collision system TCAS would be rendered completely ineffective. This scenario became reality on June 30, 2005, when, South of Geneva, a Honeywell Transponder failure ended in a serious loss of separation. The Geneva ATM system failed for foreseeable and perfectly obvious reasons. Known deficiencies and weaknesses weren't taken care off and eliminated in due time.

**Can't we do more to avoid this? How to become «pro-active», which means to act, instead of reacting?**

Many answers can be given, but all are for the least unsatisfactory. Fact

is that we, as an Air Navigation Service Provider (ANSP), and as ATM operators, we are not Masters of our destiny. The current ATM system is a carefully built and constructed system and we all know that it's a very complex system where Human – Equipment – Procedures work and interact together. What is important to be noted is that airborne components and ground components are designed to work and play together in order to make the ATM system safe, error tolerant and if possible failure free.

I believe this last point, the System view, was simply forgotten by the parties involved in the resolution of the Honeywell Transponder issue. Worse even, initially all degenerated in a very unpleasant game of «why not you, instead of me»? *Fingerpointing*, mutual accusations of laxism or «non actions» were sent around Europe in sometimes strongly worded letters. In acting like this, a lot of time was lost before tangible actions finally started.

Looking at our own internal performance, I must admit that we had one peak of high activity in December 2004, and early 2005. But, afterwards, until May 2005, we all failed to put the required degree of pressure and urgency on the transponder loss issue (although the reports of incidents flowing in



continued at a very high rate). **Yes, we must do better than this, we didn't insist enough as we should have.**

The European regulator (EASA) was having difficulties to under-

stand why this sudden loss of SSR-transponders was so dangerous and disastrous for us Swiss controllers? Only later, when discussing the problem in detail with them, did we find out that they weren't aware of



► Discovering of a transponder...

because of the crossing between two different ORCAM regions. Thanks to the support of RIT, it was possible to listen to some VHF recordings and to confirm (by synchronizing voice and radar data) a cause-effect relationship between the ATCO request to change the Mode-A code, and the sudden loss. In parallel, each case was collected in a database to include the flight

identification and the operator derived from the original flight plan data. It quickly appeared that one operator was particularly involved, with the Embraer ERJ-145. Other operators were listed too, almost all involving the E145 model. To explain the presence of other types of aircraft it was sufficient to examine some of the cockpit pictures available on some specialized

websites, and find out that all those airplanes were also equipped with the same type of transponder. Furthermore, a test performed on ground with an Alitalia E145 in Geneva, confirmed that the transponder reverts automatically to stand-by mode if the code change by turning the knob in the panel takes more than 5 seconds. The consequence of this reversion is that

the secondary radar replays and TCAS become inhibited. To conclude, such transponder anomaly could only be discovered through a continuous long-term effort spent on analyses, requiring the collection and correlation of several facts and data all together.

ANDREA MOTTA  
TDA Geneva

# And what treatment by the RITs ?

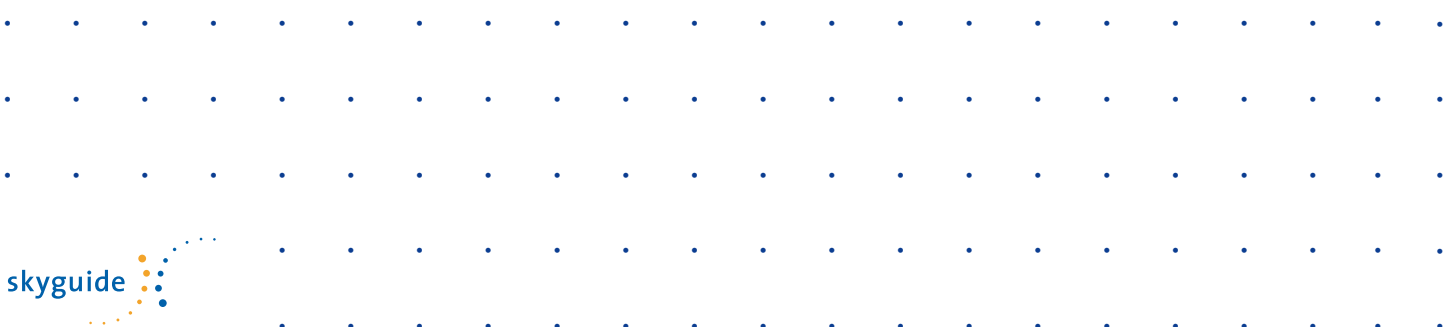
Following the discovery of the transponder anomaly back in 2004 and explained here above by Andrea Motta, the RIT's Geneva (Regional Investigation Team) were informed of the outcome of their research and the closure of the investigation by the technical department. No OIR (Operational Incident Report) reporting any redundancy of this event were received until end of June this year. Indeed, an incident marked the beginning of a new campaign of track losses from the controllers' screen. Quite rapidly, it became clear that we were facing the same situation as back in end-2004 and more reports were coming in concerning the same type of incident. After the first case, Tom Laursen, head of DMO, came up with the idea of displaying the information

in a PowerPoint presentation showing the evolution of the situation at each radar refresh. This new way of treating an incident was adopted for all new cases as it allowed to show with as much accuracy as possible what happened on the sectors radar display. In parallel, a letter informing the companies of the occurrence was sent to the flight safety officers accompanied by the EASA Airworthiness Directive. All the incidents are then entered and stored in our database and a feedback is provided to the O department management as well as the controllers involved. In most cases, the companies inform us of the corrective actions they have implemented to reduce these type of incidents. Luxair has briefed their crews by 4 notes about the design deficiency and the result-

ing procedure. Regional & Brit Air that operate flights for Air France have provided their crews since December 2004 with a temporary revision of their aircraft operating manual explaining the precaution linked to the use of transponders equipping their Embraer fleet. According to information received from EASA, as of 12 August 2005, Honeywell had updated 79 of their units; 9 for BA CitiExpress and 4 for Regional. Luxair was expected to start rotating their units back to Honeywell in the week 33. Although measures have been taken by the FOCA, skyguide's head of occurrence management (DMO) has regularly informed the EASA (European Aviation Safety Agency) of each new occurrence. This is specific for this kind of incident, but on a regular basis, skyguide informs

Eurocontrol of all loss of contact as well as TCAS Resolution Advisories.

IVAN ROCHAT  
DMO Geneva



# SVFR through CTR airspace

## Facts

An S05F departing from Geneva on concrete RWY 05 was cleared SVFR via route «Whiskey – Sierra-Whiskey». At the moment of the departure, the weather conditions were wind calm, visibility 4'000m, mist, clouds: few 300 ft & broken 6'000ft.

After take-off, the S05F turned left direct to Whiskey. As it passed the point, it was instructed to maintain 3'500 ft due to traffic and report abeam Sierra-Whiskey. It flew from Whiskey direct to Sierra-Whiskey maintaining 3'500 ft and therefore conflicted with an ATR 42 (minimum recorded separation 2.3 NM / 600 ft)\* as well as a Dash 8C (minimum recorded separation 2 NM / 0 ft)\*, both on an ILS approach for runway 05. In addition, the S05F is informed of the Dash's position and instructed to turn right to remain clear of the runway axis.

Just after crossing the second traffic, the weather conditions had lifted as the visibility was 5 kilometers, mist, clouds: few 500 ft, scattered 6'000 ft and broken 10'000 ft.

Neither crews from the ATR 42 nor of the S05F mentioned having recorded a loss of separation.

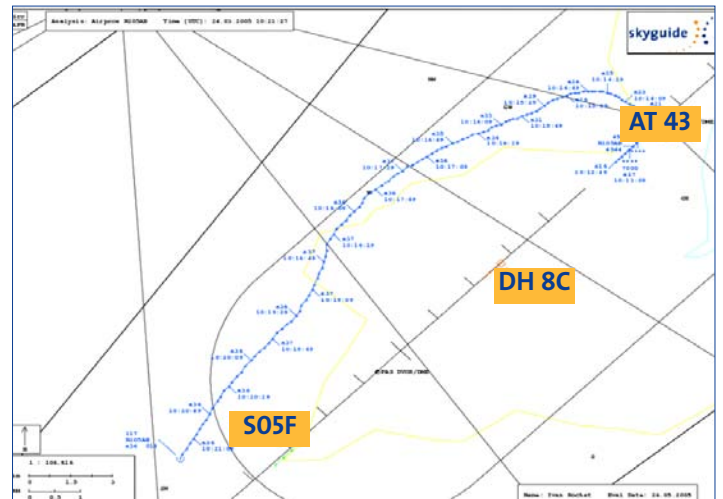
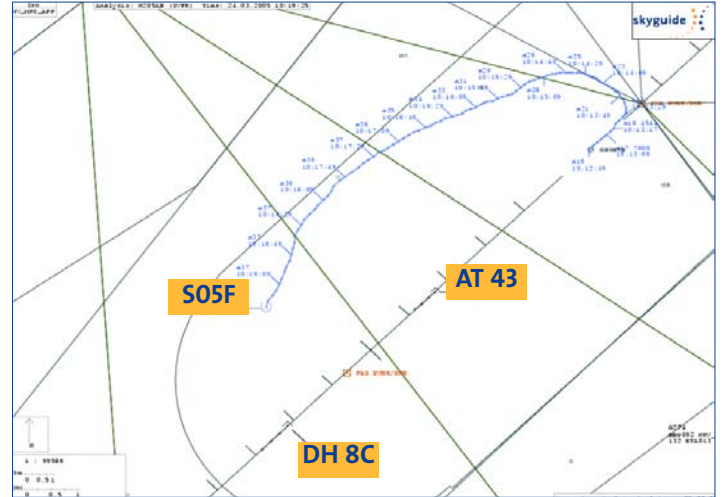
\* The minimum requested separation is 3 NM / 1'000 ft

## What can we learn from this event?

One of the lessons we can take from this incident is the absence of a published VFR routing that is to be followed between Whiskey and Sierra-Whiskey. Indeed, there is only a published route to Whiskey and the point is on the border of the CTR. This can lead to a misinterpretation from the pilot as to which track he should follow to Sierra-Whiskey unless instructed to stay outside the CTR by the controller. In the incident we are looking at, the pilot flew straight from one point to the other and this is why his track was closing to the runway axis.

Another lesson learned could be that the ATCO was faced with a situation he had been trained for but however got little practice in daily operations. In addition, the license as TWR controller (endorsement 1) does not include radar control. Therefore, the ATCO holding such a license may not use radar to establish a safe separation in such an event.

In conclusion, we may ask ourselves if the publication of a route between Whiskey and Sierra-Whiskey passing outside of the CTR would not clear the possible misinterpretation that pilots could face? It would undoubtedly also serve the ATCO who would not have to worry about having



instructed VFR pilots to stay outside of the CTR. For SVFR conditions, as for all of these procedures that are not used on regular basis in daily

operations should they not be revised in refresher courses to insure a certain experience of them?

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