skyguide

safety bulletin

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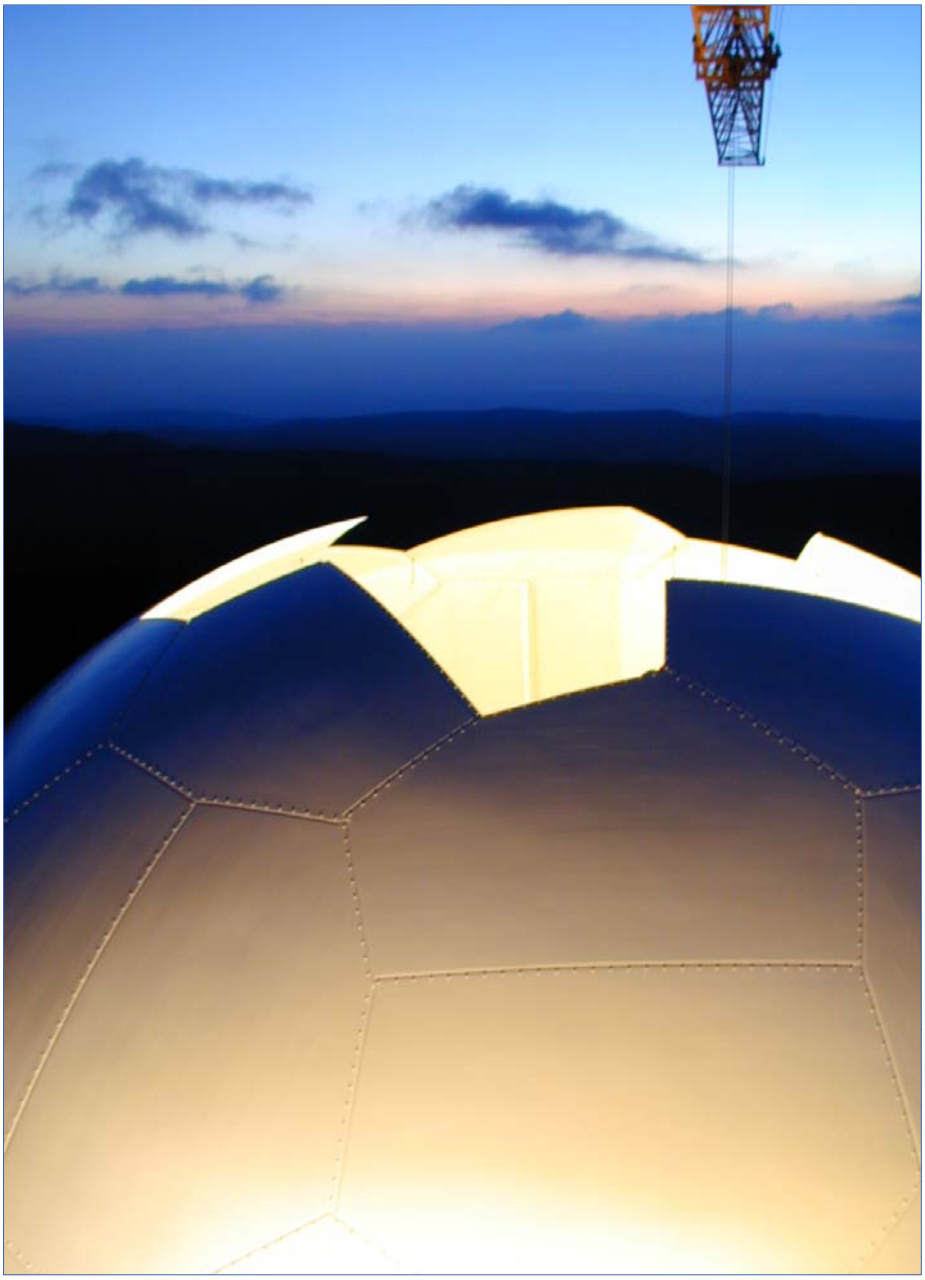

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Charlie's bar

Having had a heated argument with his wife, Charlie goes to the local bar, where he consumes several drinks. He leaves the bar and drives off in his car at high speed. Minutes later, he loses control on the highway and is fatally injured.

We know what happened here; but now we have to determine WHY it happened.

The investigation team consists of six specialists, each of whom has a completely different perspective on the root safety deficiency.

- *The sociologist identifies a breakdown in interpersonal communications within the marriage, which would have required family counselling.*
- *The Liquor Control Board enforcement officer notes the bar's illegal «two-for-one» sale of alcoholic beverages.*
- *The pathologist determines that Charlie's blood alcohol content was over the legal limit.*
- *The highway engineer finds inadequate road banking and protective barriers for the speeds permitted.*
- *The automotive engineer establishes that Charlie's car had a loose front end and bald tyres.*
- *The policeman is able to determine that the car was travelling too fast for the prevailing conditions.*

Each of these six different perspectives would result in a different definition of the underlying hazard…
… and to a different safety response

Source: ICAO

Who is right? And what would the appropriate response be?

I must say I have mixed feelings about this story. On the one hand, it's too simple and banal for our air traffic management business. It also seems to suggest that it will always take the negligence of an individual to send the system out of control. Or, to put it the other way round, it suggests that if everyone behaved themselves, nothing nasty would ever happen.
The environment we all work in is more complex than this. And sometimes it just takes a combination or a chain of unfortunate events to create a highly dangerous situation.
On the other hand, the story does have its merits, because it encapsulates all the complexity of risk management in such a simple way. And it highlights two points of risk management particularly well:

- No complex and dynamic system will ever be risk-free (so it's «vision zero goodbye»). Once we have accepted that, it's all a matter of managing the risks involved.
- To manage those risks, the first thing we need to do is agree on the scope we want to consider when it comes to improving the current state of affairs. If that scope is too small, then the actions taken – closing Charlie's bar (there are thousands of others), or putting up posters highlighting the dangers of drinking and driving (which everyone basically knows about already) – will be too superficial and too short-term. But if the scope is too large, the improvements will be virtually impossible to implement: ensuring that all roads have safety barriers, for example, would be exorbitantly expensive and probably couldn't be done in all road situations.

And what does all this have to do with skyguide? Last year, our company began to develop a Safety Risk Portfolio, which is intended to identify those risks whose management and control will generate the biggest safety improvements. And you can read more about all this in our «Safety Risk Portfolio» article on the next page.

Martin Probst
Head of Safety and Quality

The skyguide Safety Risk Portfolio

The objectives of our Safety Risk Portfolio are:

- **to ensure that managing safety risks becomes a integral part of running our organisation, and thus**
- **to improve our safety performance.**

What's the right basis of the Portfolio?

The first question we need to ask ourselves when devising a Safety Risk Portfolio is: on what basis should the risks be compiled? Should this be through a brainstorming by specialist personnel, through actual occurrences, through internal audits, through Safety Improvement Reports or by some other means? In skyguide's case, because Safety Risks are seen most clearly when an incident actually occurs, the decision was taken to compile risks on the basis of our Incident Reports.

What's the right scope?

One common way of defining risk areas is by using familiar terms such as level bust, unauthorised penetration of airspace or failure of technical equipment. But these areas are too general and too vague. They also tend to be collective terms that describe the symptoms rather than the cause. A further possible approach is offered by the well-known human errors: read-back/hear-back problems, call-sign confusion, assumptions and so on. The problem here is that it is virtually impossible to effect improvements in this field – unless we believe we can create a new human being who is immune to lapses, slips and omissions! So, in view of all these considerations, skyguide decided that underlying factors offered the best basis for compiling the safety risks for its Safety Risk Portfolio.

Underlying factors

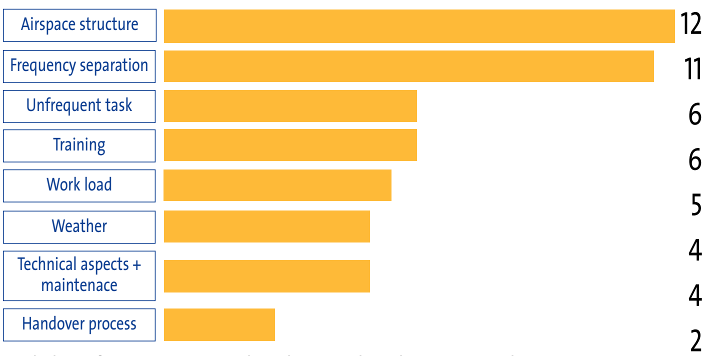
An underlying factor is a context-dependent condition that we know from experience is associated with occurrences. By focusing on underlying factors, we can broaden the scope of our inquiry in ways that enable us to identify system vulnerabilities which can lead to failures. To start the process of making progress on safety, however, we must ensure that these underlying factors highlight an area of the system that is controllable, to allow system designers to focus their attention on known and influenceable aspects.

Airspace structure	The structure of the airspace (overall or a particular sector) shows a certain degree of com plexity (e.g. areas where three or more sectors are coupled, overburdening the air traffic controller with coordination tasks and leading to coordination break downs).
Frequency separation	The involved aircraft were not on the same frequency during the sequence of incident. This could induce the concept of frequency separation or influence the working method of the controller.

Examples of underlying factors:

Since our new Occurrence Reporting system was only introduced at our two Area Control Centres last year, the corresponding underlying factors have so far been limited to these areas of our operations. But from this year onwards, the same kind of analysis will be gradually extended to incidents from our Tower/Approach and our regional airfield operations. So we should have a more comprehensive picture of our underlying factors by the end of the year.

The current situation with our underlying factors is as follows:



Underlying factors at ACC Zurich and Geneva based on 25 internal reports.

What next?

Our *underlying factors* have given us an adequate scope of safety risks which we can use to effect sustainable improvements. Two things now need to be tackled here:

- First, we need to substantiate the data which are currently available through the findings of all future incoming Incident Reports, and expand these activities throughout our Operations and Technical Services divisions. This will be the responsibility of the Safety Management unit.
- Secondly, these results need to be analysed by our line units and they have to initiate the changes required to effect the desired improvements. This is not something that can be done from one day to the next. The first analysis concerning the underlying factor frequency separation is already under way at our Zurich Area Control Centre, and they have shown how complex the solution is likely to be. There will be no quick fixes.

But this is, perhaps, one of the best possible signs that we are on the right track. Anyone who claims that there are simple ways of further improving a complex system like ATM/CNS - which is very safe already - should be treated with a healthy degree of scepticism!

MARTIN PROBST
Head of Safety and Quality

No fear of errors

The foundations for the skyguide Safety & Quality Management department were laid in the 1990s and in the meantime it has become an important part of our organisation. As part of its policy of constant improvement, skyguide is organising a special safety symposium with the aim of initiating an interdisciplinary exchange of ideas and solutions with other industries.

Safety symposium for an exchange of ideas

On the initiative of the Safety & Quality Management department, an ambitious programme has been drawn up for a one-day symposium on 3 April which will be attended by leading figures from the fields of medicine, nuclear power, neuropsychology, aviation, the media and the legal profession, who will be speaking on the theme of «Residual Risks versus Vision Zero». The symposium is aimed at safety experts, risk managers and business people. skyguide's specialists and managers from the field of safety will be taking part, with the intention of exchanging ideas with colleagues from other industries. The symposium will be held at the renowned Swiss Re Centre of Global Dialogue in Rüschlikon in the canton of Zurich.

In the context of safety «Vision Zero» certainly sounds appealing. But does 100 percent safety really exist? In reality, safety is a process which needs to be worked on every day. The symposium will function as a small but important part of this challenging and ongoing process.

Rosemarie Rotzetter,
Chief Communication Officer skyguide

A positive error-reporting culture improves safety

We have all at some time or another made mistakes, both at work and at home, and we will continue to do so. This is why the way in which we handle errors and what we learn from them is so important. As a result we are promoting a positive culture of error reporting.

If we are planning to discuss safety, then we should first of all define the meaning of the term more accurately. Eurocontrol, the European Organisation for the Safety of Air Navigation, defines safety as follows: «Safety is the freedom from unacceptable risk.» This definition may be very concise but it also raises a few questions. For example, what is the difference between an acceptable and an unacceptable risk? Who defines the standards which govern this distinction? Can these standards be applied to everyone and everything, or are there different requirements and situations in some cases?

- These questions highlight the fact that there will always be a residual risk and that safety issues can never be seen simply in black and white. The numerous shades of grey also need to be taken into account.

Risks and sources of danger are not always obvious, as for example in car travel. Although the law states that seat belts must be worn, and it has been shown that they increase safety levels significantly, according to the Swiss Council for Accident Prevention (bfu) 20 percent of drivers are still not using their safety belts. They are breaking the law and they accept the risk involved. They prefer to focus on factors which are important to them, such as comfort or a dress that is not creased.

However, risks are not always as easy to identify as the failure to wear a safety belt. Sometimes thorough, in-depth analyses are needed to reveal the potential sources of hidden errors.

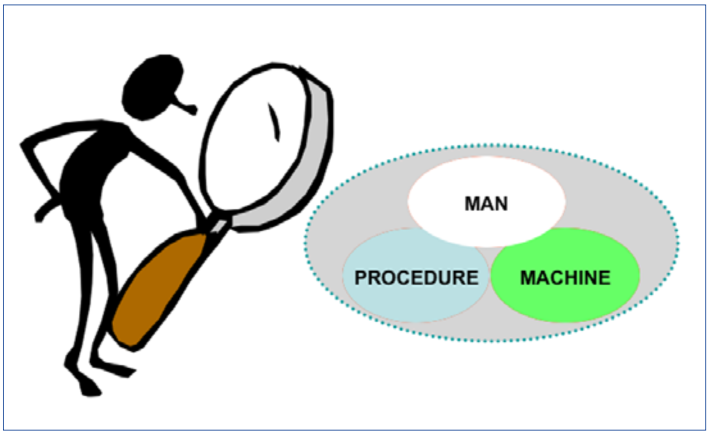
The triangle of «man/machine/procedure»
The causes of risks and the sources of errors are also the result of the complex system which we surround ourselves with in our businesses. This system consists of three elements: man, machine and procedure. Each of these three elements can fail in a number of different ways. In statistical terms they are certain to fail; it is simply a question of time. For this reason it is essential for us to be able to compensate for errors. For example, if a car tyre has a blowout on the road, the driver must be able to react quickly and apply the appropriate procedure to bring the situation under control. Or, for example, if a driver is not concentrating and brakes too sharply on a wet road, then the car's ABS system will compensate for the driver's mistake.

In the triangle of man, machine and procedure, the person is an important factor, but not the only one. However, he is the only one who can identify, report, investigate and assess a weakness in the system.

- «Vision Zero» is probably unachievable, but it is our duty and our job to add another 9 after the decimal point of 99.9 percent safety every day. This is only possible if errors are reported and the necessary measures are taken to improve the system even further.

Building trust for a positive culture of error reporting
Even though no one deliberately makes a mistake, reporting errors does not come naturally to people. On the contrary, most people dislike drawing attention to errors. There are several reasons for this, the main one of which is fear, including fear of being held responsible for errors in the system, fear of being blamed, fear of sanctions and fear of criminal prosecution, amongst other things.

- A comprehensive and well-functioning culture of error reporting is essential, in particular in the field of safety. Here the consequences of an error are much more significant than they are elsewhere and can have serious implications. It is therefore important to create an atmosphere of trust, so that people feel that they are allowed to report errors.



How to develop a culture of error reporting

A number of different criteria formed the basis for the development of a culture of error reporting at the Swiss air traffic control organisation, skyguide. The most important of these are the company culture, the organisation, the staff and an atmosphere of trust.

1 - Culture

We must develop and put into effect a culture in which we do not hesitate to report errors. Problems such as possible conflicts with the law must be tackled and resolved to ensure that everything is done correctly in legal terms. This is not a simple task, particularly in the field of air traffic control, where people can be prosecuted for the errors that they make. For some years, moves of this kind have been underway at an international level in our industry and in Switzerland we are also in the process of identifying solutions. In 2005 the Swiss Parliament laid the foundations for a confidential reporting system for the aviation industry.

2 - Organisation

The organisation must have an appropriate structure and the processes must be clearly defined. Error reporting systems are complex, resource-hungry and, of course, costly. However, only a correctly managed investigation will produce improvements.

3 - Trained staff

It is also essential to have in place trained staff who are trusted by other employees. Training courses and an exchange of ideas are needed in order to be able to investigate issues in more depth and to discover the facts.

4 - Trust

However, trust is the most important prerequisite, which determines to a large extent the success or failure of an error reporting system. The organisation must develop and promote an atmosphere of trust, to ensure that employees are prepared to report errors. This is something which cannot be put in place overnight, either internally or externally. In addition, this climate of trust, which can be so difficult to build up, can also be destroyed very quickly. The way in which errors are handled externally is a very sensitive issue, particularly in the aviation industry, which deals with errors very objectively and is highly transparent. If an error is publicised and this results in a major scandal or attacks on the perpetrator, this will not have a beneficial effect. It can even result in the people involved no longer being prepared to report errors because of the negative press that they have received. An objective approach from a public perspective would certainly increase motivation levels and give an additional impetus to an effective error reporting system.

Three tools – one objective

In 2001 skyguide updated its safety policy and began the process of putting in place the culture of reporting which prevails today. At the same time, the confidentiality of the Occurrence Reporting Policy was defined in more detail. The IREAP (Individual Responsibility and Ethical Awareness Programme) aims, amongst other things, to promote feedback and self-criticism. A range of different training courses and checks will help to give the reporting culture more depth.

The Safety & Quality Management department, which is responsible for managing the error reporting system, reports directly to the CEO of skyguide. It consists of seven people and during investigations they are supported by five active air traffic controllers who work part time for the department.

skyguide currently has three tools, which have the confidence and acceptance of employees:

- OIR (Operational Internal Report).
- SIR (Safety Improvement Report).
- OPS Request.

The three tools are different, but all of them have the same objective: to ensure that as many errors as possible in the man/machine/procedure system are reported. Every year hundreds of reports are submitted, all of which have to be analysed and processed. The more errors we discover and the more causes we identify, the safer our system will be. When we have learnt to accept and deal with this, we will have taken a major step forward. Safety is not a state, but the result of hard work every day by every individual employee in the entire organisation.

Alain Rossier
CEO skyguide

Practical drift

The main purpose of a Safety management is to recognize and identify safety risks to the company. Before skyguide created a separate department to handle this, the line management performed the task. Today it is one of the primary tasks of the safety management.

Models of how to identify, measure and control these risks have guided this process. A well known model is the «Swiss cheese model» that assume that behind every occurrence is a identifiable number of causes that can be fixed one by one and thereby the control of the risk can be achieved. This way of thinking drives many safety managements around the worlds and has helped the airline industry to the safety record that we have today.

But a «new way» of looking at occurrences is emerging from the analysis of recent prominent accidents. Here I will bring up one example that might change our way of thinking about controlling risks.

On the 31 of January 2000 a MD-83 from Alaska airlines crashed into the Pacific Ocean outside the coast of California. The cause of the accident was a stabilizer failure due to a problem with the Jackscrew controlling the stabilizer *see fig. 1*. After checking the maintenance intervals on the Lubrication of the Jackscrew a rather frightening story was uncovered *see fig. 2*. The intervals of the lubrication «drifted» from 350 flying hours to around 5000 flying hours within the lifetime of the DC-9. The creepy thing here is that all decisions made were reasonable and completed in cooperation with and by authorities. No reports of problems, mainly because what took place was «normal» for the people inside the system.

So the question is how control this «normal drift» when the old models are based on reporting and cause-effect principles. What can we do when there are no numbers to tell us what is right and what is wrong. How do we help each other identify this risk and control it?

This is the challenge for safety managements for the years to come. Skyguide is organizing a safety symposium on the 3rd of April. Here is will talk about the above-mentioned problems and will try to show a way to follow to be able to better handle the upcoming challenges.

Tom Laursen
Head of Occurrence Management

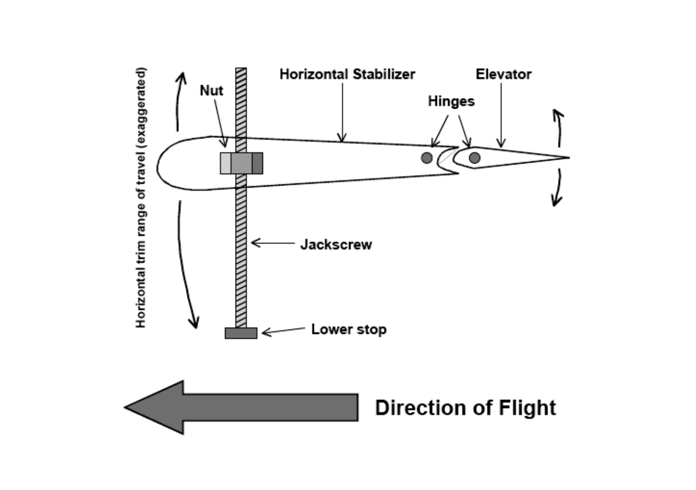


Fig.1.: Simplified workings of the trim mechanism in the tail of an MD-80 type aircraft. The horizontal stabilizer is hinged at the back and connected to the jackscrew through the nut. The stabilizer is tilted up and down by rotation of the jackscrew

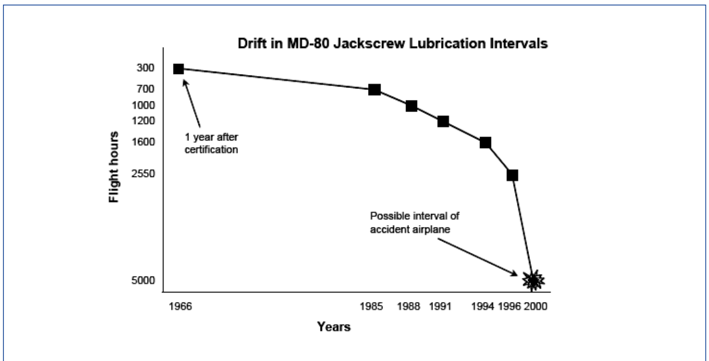


Fig.2.: Drifting into failure over decades. The jackscrew lubrication interval gradually got extended (almost by factor 10) until the Alaska Airlines 261 accident.

Occurrence involving OJT

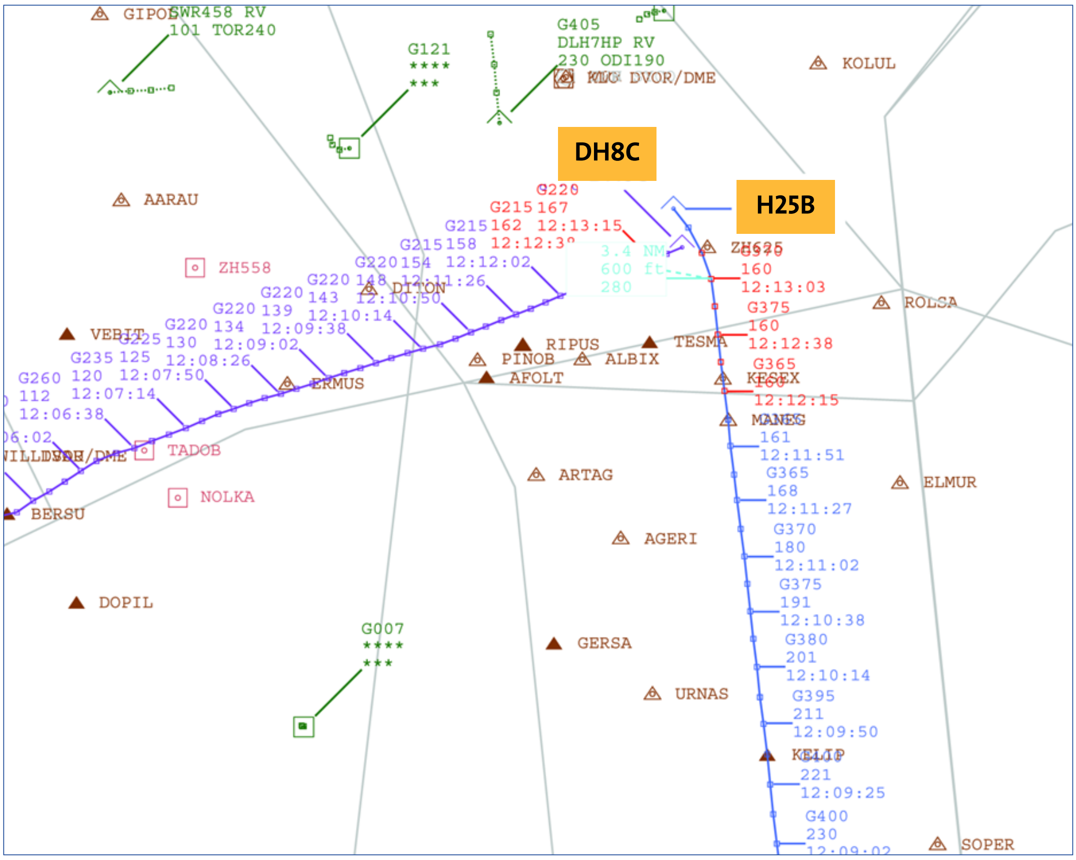
Event description:
A crossing between an DH8C outbound from Basel climbing to FL190 and a H25B inbound to Zurich descending to FL160 led to an AIRPROX in the region of KESEX. At the time of the incident the Zurich ACC South Sector was combined with the Zurich ACC West Sector. Both positions, RP S/W and RE S/W were manned with trainees and OJTIs.
The H25B checked in on Sector S/W frequency passing FL286 descending to FL250 inbound to KELIP. One minute later the DH8C checked in on the same frequency, with a request for heading H065° to avoid build-ups. When H25B was passing FL267, the ATCO instructed it to descend to FL160 with 2500ft/min or more. Half a minute later when the DH8C was passing FL125, it was cleared to climb through the level of the H25B to FL190.
The DH8C was cleared direct to NUNRI - FUSSE. Half a minute later both aircraft were instructed to increase their rates – the H25B to descend now with 3000ft/min or more and the DH8C to climb with maximum rate until out of FL160. The pilot of the DH8C stated, that the maximum would be 700 to 800ft/min. At this moment the distance between both aircraft was 19nm and 5100ft.
Both aircraft were given a traffic information about each other. The pilot of the DH8C reported, that he had no visual contact yet. 20 seconds later the Short Term Conflict Alert (STCA) highlighted the conflict. At this moment the distance between both aircraft was 8nm and 0ft. The trainee gave 4 instructions to other aircraft, when during a transmission the coach overruled the voice of the trainee and instructed the H25B to expedite descent to FL130. The coach repeated the instruction three times. Because of the use of the table mounted microphone and transmitting without switching the receiver from trainee headset to table mounted microphone, the quality of the transmission may have been affected. The separation got to its recorded minimum of 3.8nm and 500ft.
Half a minute after the instruction had been successfully transmitted, the coach issued a second traffic information to both flights. The H25B reported, that he has TCAS contact but no visual contact. The DH8C reported the traffic in sight.
The H25B was finally cleared direct Trasadingen, informed that a report will be filed and transferred to Zurich Arrival. The DH8C was also informed, that a report will be filed and transferred to the East sector.

Conclusions:
A developing task saturation of the trainee was not detected. The identification of a traffic problem by the trainee led to a fixation by all participants. It could be helpful to consider the problem as solved and continue on with other awaiting tasks. The continuous monitoring of activities by both coaches brought back the attention to the developing conflict almost simultaneously with the STCA. The immediate intervention by the RE coach was possibly hampered by the lowered quality of the R/T readability as a consequence of the attempt to transmit via a muted microphone.

Emerging considerations:
It is very difficult for OJTIs to detect the stage where trainees are reaching their limits. It is stated that the OJTI should avoid the overloading of the student and retake the control if necessary to prevent dangerous errors. There is little guidance on how to achieve these goals. Also the perception of this, especially in high workload, is hampered by the monitoring of activities on the radar, telephone and other environment.

Measures:
It's not possible to facilitate the immediate use of R/T for the OJTI (via a coach-headset) with the current SWI04. With the new system VISTA the situation will change. Until then it has been considered that the use of the handset is the most appropriate means of intervention on the frequency for the OJTI.

Elke Elisabeth Schaffer
DMO Geneva



Crossed Transmissions

Radio communication is one of the key elements of ATC. It highly contributes to the safe and efficient management of the traffic flow. Consequently, a dysfunction in the «read back/hear back loop» may lead to an uncomfortable situation, and crossed transmissions may be that sand grain which disturb the mechanism. Unfortunately, these overlapped messages are not rare, whatever the traffic load. The following incident illustrates this kind of problem in a busy environment.

Facts

An Avroliner (RJ85) in contact with sector KL2 was routing MOROK – GVA –TOP at FL290 and at the same time, an Airbus from the west at FL270 was cleared GVA – MOBLO – TOP by the sector MA/MS. When approaching GVA VOR, the Avroliner requested descent. It was then instructed to contact MA/MS for a lower level, which is the standard procedure if no coordination was made previously. The crew complied with this instruction and on its first call with the new sector asked for descent. But at this very moment, the controller was already occupying the frequency, clearing a B738 to descend to FL250, and the two messages overlapped each other. This third aircraft read back its cleared level and shortly after the ATCO answered to the Avroliner's crew: «XXX, bonjour, identified, call you back». Once again, the RJ85's message overlapped with the controller's transmission and only part of its call sign was understandable. At that time, the Airbus and the Avroliner were on the same leg, the one above the other.

Half a minute after the controller's message, the RJ85 left FL290 in descent without clearance and this new flight path conducted it towards the Airbus, leveled 2000 ft below. As the Avroliner was observed descending through FL280 and at the same time the STCA triggered off, the ATCO instructed on a first step the Airbus to descend immediately to FL250 and on a second step the four jets aircraft to maintain FL270.

Analysis

After the incident, a discussion on the frequency between the concerned crew and the controller highlighted the reason why the Avroliner descended by its own:

Crew: «… we read back to descend level two five zero, we meant the clearance was for us to descend level two five zero.»
ATCO: «Well, I just identified you and I didn't give any level to descend to.»
Crew: «In that case, we did a read back for somebody else, sorry for that.»

As the FL250 was mentioned in the B738's read back immediately after the Avroliner's first call, the crew may have interpreted the Boeing's message as a clearance to descend in response to its request.

What can be done?

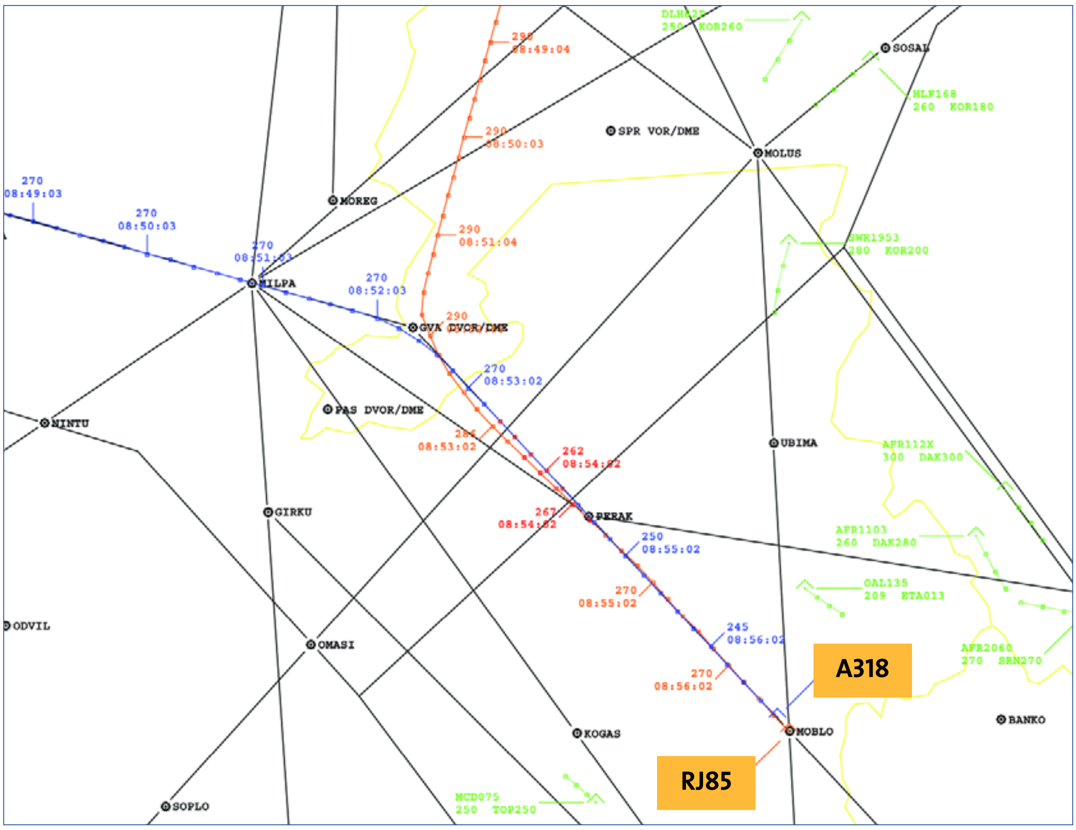
This was not the first time and will unfortunately not be the last that this kind of problem led to a misunderstanding in the air/ground communications, and controllers are disappointed not to have any system available to detect these crossed transmissions. The possible use of mode S data link to issue clearances to aircraft in the future can be considered as a mitigation to prevent such incident but will not solve the problem completely.

Should you have any proposals, comments or ideas on the issue, you are warmly welcome to communicate them to us.

NB: Eurocontrol launched a study called AGC and dealing with that kind of problem. Information available on the following link:

http://www.eurocontrol.int/safety/public/site_preferences display_library_list_public.html

Yannick Berthet
DMO Geneva



Traffic complexity

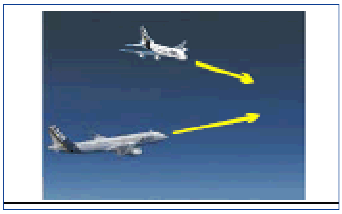
The following article is based on a study conducted by PRU (Eurocontrol, Performance Review Unit) and it points out how complex the traffic in our airspace is.

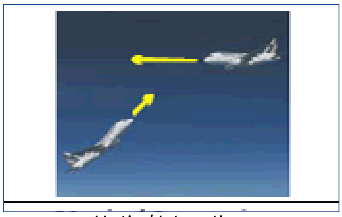
The working group developed a consistent framework based on the concept of «interactions». Interactions arise when there are two aircraft in the same «place» at the same time. For the purpose of this study, an interaction is defined as the simultaneous presence of two aircraft in a cell of 20x20 nautical miles and 3,000 feet in height. On this basis, a first complexity indicator was identified.

Traffic density indicator: A measure of the potential number of interactions between aircraft. The indicator is defined as the total duration of all interactions (in hours) per flight hour controlled in a given volume of airspace. The traffic density indicator is illustrated in *Figure 1* for each ANSP. There is a ratio of 16 between the densest ANSP (Skyguide) and the less dense ANSP (Moldavia).

Traffic complexity also depends on the flow structure and the extent to which aircraft pairs simultaneously present in the same cell interact either vertically, horizontally or in speed. For this purpose, three additional «structural» complexity indicators were identified *(see also illustration in Figure 2)*:

- **Horizontal interactions indicator:** A measure of the complexity of the flow structure based on the potential interactions between aircraft on different headings. The indicator is defined as the ratio of the duration of horizontal interactions to the total duration of all interactions.
- **Vertical interactions indicator:** A measure of the complexity arising from aircraft in vertical evolution based on the potential interactions between climbing, cruising and descending aircraft. The indicator is defined as the ratio of the duration of vertical interactions to the total duration of all interactions.
- **Speed interactions indicator:** A measure of the complexity arising from the aircraft mix based on the potential interactions between aircraft of different speeds. The indicator is defined as the ratio of the duration of speed interactions to the total duration of all interactions.


Horizontal Interactions


Vertical Interactions

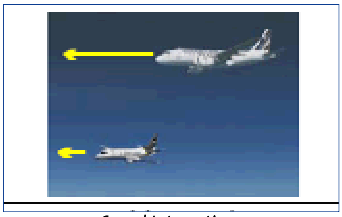

Speed Interactions

Figure 2: Structural complexity indicators

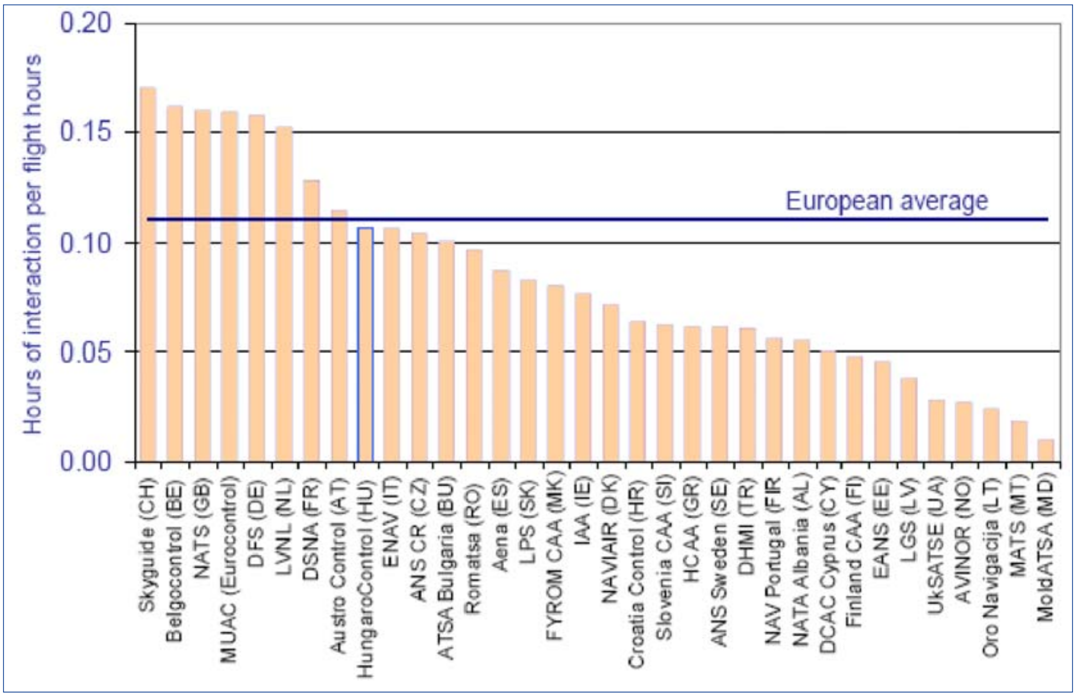


Figure 1: Traffic density

trafic complexity

For each ANSP, the overall traffic complexity score is the multiplication of the traffic density by the structural complexity index. The results are presented in Figure 3.

For example, traffic is two times denser in Bulgaria (BU) than in Norway (NO), but structural complexity is higher in Norway, where most flights are in vertical evolution, than in Bulgaria. The product of both components for the two ANSPs results in similar aggregate complexity scores.

Influence of traffic complexity on ATM performance

The relationships between complexity and ATM performance is not straight-forward. The effects of complexity on ATM performance are, a priori, two-fold:

- Positive effects: Higher density is expected to contribute to a better utilisation of resources and to some economies of scale;
- Negative effects: Higher structural complexity entails higher ATCO workload and/or more sophisticated systems for the same volume of traffic.

Our vision and mission statement reads as follows:
Skyguide specialises in the safe management of dense and complex airspace.

To cope with such a complex airspace we have to continuously develop our ATM/CNS system. We need well trained people, advanced and reliable equipment, simple, straightforward and fault-tolerant procedures and a mature Safety Management System.

Martin Probst
Head of Safety and Quality

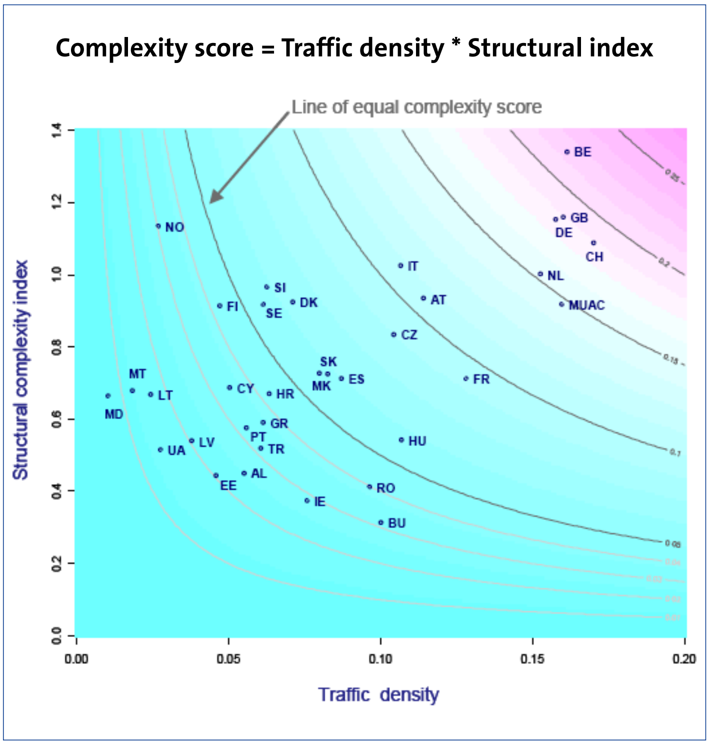


Figure 3: Components of complexity scores


LET US KNOW WHAT HAPPENED!
EXPERIENCE IS REALLY USEFUL,
BUT ONLY IF IT IS SHARED.