HindSight 11

The ability or opportunity to understand and judge an event or experience after it has occured

EUROCONTROL

Airspace Infringement - again?!

To see or not to see
by Bert Ruitenberg

Let's get rid of the bad pilots
by Professor Sidney Dekker

Airbus altitude capture enhancement to prevent TCAS RAs
by Paule Botargues

Summer 2010

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The success of this publication depends very much on you.
We need to know what you think of HindSight.

Do you find the contents interesting or boring?
Are the incident descriptions easy to follow or hard to understand?
Did they make you think about something you hadn't thought of before?
Are you looking forward to the next edition?
Are there some improvements you would like to see in its content or layout?

Please tell us what you think – and even more important, please share your difficult experiences with us!

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Time to act

Tzvetomir Blajev
Editor in Chief of Hindsight
Fellow of the Flight Safety Foundation

"We don't have any problems with airspace infringement in our country. I pretty much think the whole issue is overexposed. Well, it may be important for some big European countries, but not here." The middle-aged safety manager was talking with a confidence which was somehow magically transferred to us. We felt both relaxed ("no problem" is good news, after all) and a little bit disappointed that we had made the long trip from Brussels for no reason. As part of a European safety improvement initiative, we were expecting to collect the opinions of general aviation pilots about the airspace infringement problem, their explanations of what factors contribute to these events and their suggestions regarding how the system can be improved to better control this risk of mid-air collision.

Six hours later, the group of enthusiastic aviators of all sorts, both users and non-users of engines to help their flying, were still giving story after story to our exhausted team. We could hardly keep up with recording all the details.

A woman in the loudest possible blue blouse was trying to explain one of the strangest flying practices you may ever have heard about: "They come here to experience our special airflow wave effects – "riding" them with their aeroplanes to get an exhilarating thrill, just like the sea surfers hoping for the big wave. Sure, they sometimes enter the control zone, but this is the last thing they are thinking of at the time."

"I had an event with a military fighter aircraft, maybe an F16." A young man, presented as an instructor at a local flying club, started his story. "I am still not absolutely sure of the type of military jet – it was so fast. I'm sure there was no risk – they monitor for traffic with their on-board radars. Fighter aircraft are well designed for this, aren't they? We often enter the military area, but they never use it – fine, except for that one time. Why do they need to block this airspace all the time for just occasional use?"

"Pilots from my country are always blamed abroad for causing problems." A "foreign" pilot, visiting from another country, finally got his turn. "But in my home country the level of Flight Information Service is up to a very high standard, and the FIS officers are really very attentive and helpful. This spoils us in a way, and it is understandable that when we fly cross-border we feel more uncomfortable."

Over a period of two years, our team from EUROCONTROL succeeded in getting feedback from more than 1,000 general aviation pilots from all over Europe. You may or may not be surprised to learn that 53% of them said that they had made at least one airspace infringement that they knew about.

Every second general aviation pilot admits to having been involved in airspace infringement at least once.

Every second general aviation pilot admits to having been involved in airspace infringement at least once

This was only a part of the pan-European Safety Improvement Initiative, which also includes the collection and analysis of hundreds of incidents, dedicated workshop discussions with regulators and air navigation service providers, and a lot of analytical work to define the best possible list of potential mitigation measures. Finally the product is here – in **December 2009, the Provisional Council, the EUROCONTROL's highest decision-making body, approved for implementation the "European action plan for airspace infringement risk reduction".**

The Action Plan recognises that the nature and scale of the airspace infringement issue varies between States. Its recommendations are therefore presented like a "shopping list", on the basis of which each State is to assess its own operational environment and formulate the optimum risk reduction strategy. National authorities should take the leading role in establishing and promoting the local implementation priorities and actions in consultation with civil airspace users, service provider organisations and the military.

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The ability or opportunity to understand and judge an event or experience after it has occured

In this issue of HindSight,

our editorial team would like to support the implementation of the Action Plan by providing more stories and looking at more aspects of the risk. We invite our readers to contribute actively to the implementation of the Action Plan in their own countries.

Partnership between all concerned is the most efficient way to address this high aviation risk.

Our team at the EUROCONTROL Agency is ready to provide you with our support to organise local partnership workshops and to help devise your own approach.

The risk in Europe is high.

The 2009 EUROCONTROL Safety Regulation Commission Annual Safety Report shows an increase in reported events of 18% in 2007 and 13.5% in 2008. We believe that it is time to act and urgently implement the provisions of the Action Plan.

Enjoy reading HindSight!

Front Line Report:
To see or not to see

By Bert Ruitenberg

Last January there was a runway safety occurrence at Luxembourg Airport. A cargo B747 landed while there was a maintenance vehicle on the runway, close to the touchdown area. Fortunately there were no people injured, and the damage was limited to one of the B747's wheels, which had to be replaced, plus the roof of the maintenance vehicle, which had been somewhat modified from its original design.

Bert Ruitenberg

is a TWR/APP controller, supervisor and ATC safety officer at Schiphol Airport, Amsterdam, The Netherlands.

He was the Human Factors Specialist for IFATCA from 1996 until April 2010, and now is a member of the IFATCA Safety Council.

He furthermore worked as a consultant to the ICAO Flight Safety and Human Factors Programme.

In December 2007 there was another runway safety occurrence, this time at Bucharest Otopeni Airport (Romania). A B737 passenger aircraft took off while a maintenance vehicle was on the runway, close to the mid-runway point. Fortunately no one was injured, and the damage was limited to the B737's main gear and left engine, plus the maintenance vehicle, which had to be written off.

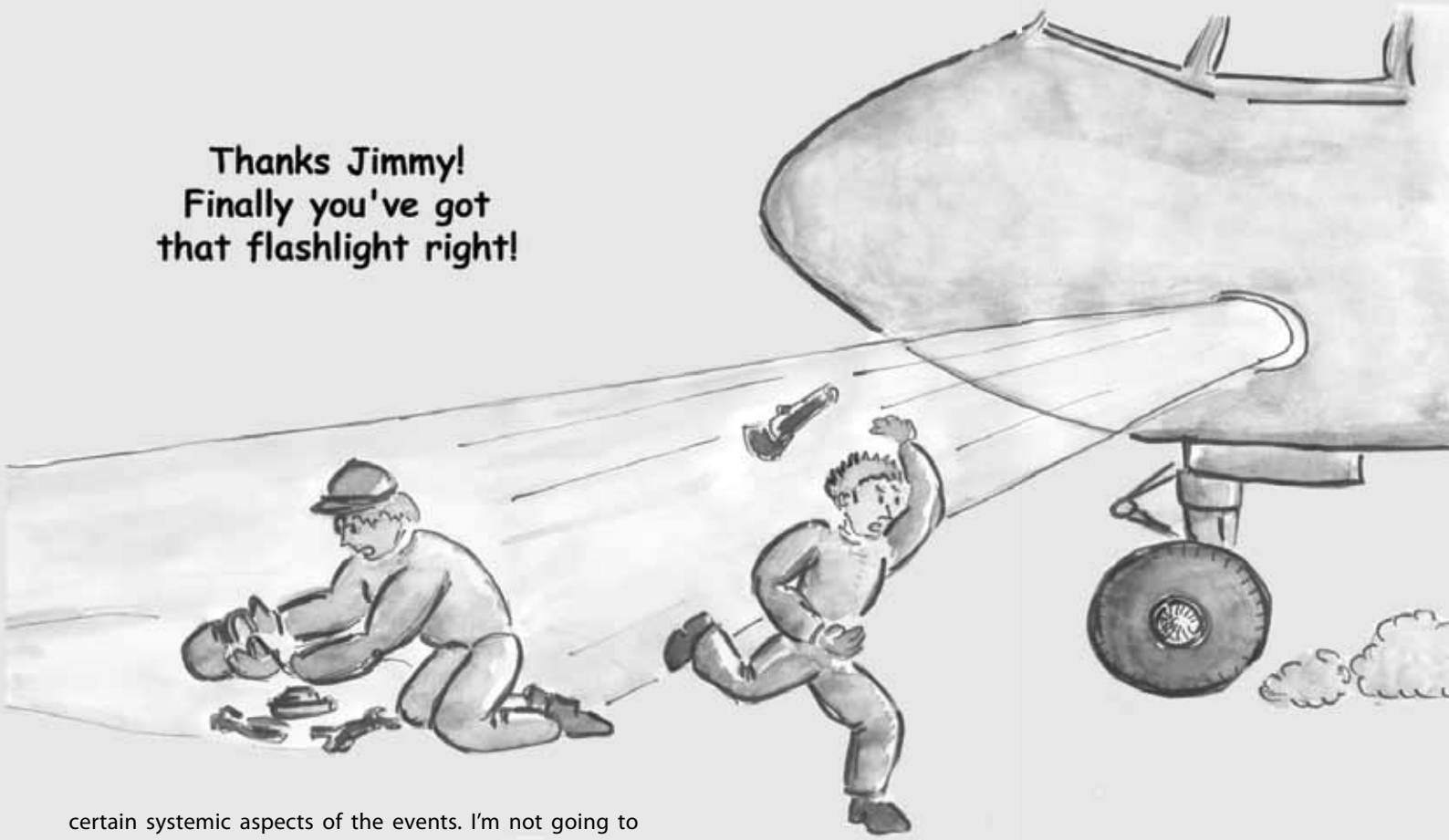
Despite the obvious differences between these two occurrences (e.g. landing vs departure; cargo vs passengers; aircraft types) there are also some similarities. Both events occurred during low visibility conditions, and both events have come under the scrutiny of the judicial authorities, with the result in the Bucharest case of a court case against one of the controllers on duty that day. And in both cases the ANSP almost immediately imposed disciplinary measures against the controllers on duty at the time of the occurrence.

> Let's take a moment to reflect on the wisdom of taking disciplinary measures against the controllers.

Let's take a moment to reflect on the wisdom of taking disciplinary measures against the controllers. In both cases this was done within days of the occurrence, so well before any serious type of systemic safety investigation could have been completed. The ANSPs therefore must have felt obliged to "do something" as a result of the commotion that undoubtedly arose after the media got hold of the event. It must provide a certain kind of satisfaction to be able to tell reporters that the controllers involved have been suspended (or words to that effect) and that the population can sleep safely once more because surely something like this can't happen again. And the same message is of course conveyed by the ANSP to the regulator: no worries, we have it all under control because we removed the perpetrators from the work floor. But I honestly hope that the ANSPs don't believe their own story.

Remember that I mentioned that the disciplinary actions were taken within days of the occurrence and before a systemic safety investigation had been completed? The aim of contemporary safety investigations is not only to reconstruct what happened and how it happened, but more importantly to explain why it happened and with that knowledge/understanding, to present recommendations as to how similar events can be prevented from happening in the future.

In no way would I like here to pretend to assume the role of the competent investigation authorities which are looking into those occurrences, but based on my experience as a controller and a safety expert I would be curious about



certain systemic aspects of the events. I'm not going to provide an exhaustive list here, I just want to mention some key words from the SHEL model: software (low visibility procedures and runway occupancy indication method), hardware (ground radar availability, aerodrome layout and communication equipment) and liveware (training, currency, staffing and rostering).[1] The question that begs answering in both investigations is: why were the controllers convinced that the runway was clear when they authorised the aircraft to land/take off? I'm pretty sure that elements of the answer are to be found by looking into the key areas which I indicated above.

Going back to the systemic nature of a contemporary safety investigation, there's a related question which I'd like to pose with respect to the two occurrences: why was routine maintenance work being carried out on a runway under low visibility conditions? My philosophy about runway maintenance work is simple: either it is routine maintenance work which can be done at any time in principle, in which case you do it when the runway is closed, or it is essential maintenance work which has to be done immediately because otherwise the runway cannot be used, for which you close the runway until the repair is completed. Either way, the runway is closed when maintenance work is taking place.

Why was routine maintenance work being carried out on a runway under low visibility conditions?

OK, I can already hear the critics pointing out that it's easy for me to say this, working at an airport with six runways and all that. My reply would be that they're absolutely right, and that for airports with a mere one or two runways it is far better to keep a runway open during maintenance work, especially under low visibility conditions. Admittedly there will be the occasional accident like those in Bucharest and Luxembourg, but at all other times the maintenance work gets completed nicely as planned (never mind the weather), which is what matters to us. Yeah, right!

Again, my short article here is no substitution for a full systemic safety investigation, but indulge me and try and give an honest answer to the following question: which is more likely to result in the prevention of events similar to those described here in the future, disciplining and/or prosecuting the individual controllers involved, or performing runway maintenance only on closed runways?

I thought so. If you can see it, let's hope the various authorities concerned will see it too...

1- The fourth element of the SHEL model, environment, is not included because I lack information on this aspect from both events.

Let's get rid of the bad pilots

By Professor Sidney Dekker

"I'd be interested to know what you think of our proposal," the woman said to me innocently. As representative of an ANSP in a European country, she explained how her country had been struggling with airspace infringements, particularly by VFR traffic. The problem seemed intractable – whatever the ANSP did, traffic kept entering its airspace without permission. Controllers would have difficulty getting in touch with such rogue traffic. It created problems for IFR traffic flows, separation and of course safety.

It wasn't the first time we had spoken, and I expected a proposal based on a thorough analysis of the problem. I expected that she would show me an investigation of the deeper reasons for airspace infringements in her country. There was no shortage of reasons. My mind had been running wild with ideas. Was it the lousy availability of VFR charts in that country (because, really, where do you buy those things?) so that hobby pilots had no up-to-date information in their cockpits? Or was it the extortion-like purchase prices of those charts once you'd found them?

Was it perhaps the proliferation of GPS systems in general aviation aircraft? I could imagine how this technology could give pilots with little proficiency or experience a false sense of security and positional certainty, while they are actually tumbling into various display and mode error problems. After all, the enthusiasm with which such new GPS navigational technology is bought and installed (and the way prices have dropped) is matched in hardly any European countries with serious investment in training programmes so that general aviation pilots actually know what they are doing and seeing with their new gadgets.

Or was it the rise of a new generation of general aviation aircraft, faster and more capable than their aluminium forebears, surprising pilots with their speed and progress along a route, and in weather that would be much more marginal than they would have dared to fly in before?

Was it the surge of instructional flights in the economic boom times (yes, we did have those not long ago) in which everybody and their grandmother had the resources to learn to fly, while pilots could still move on to other jobs, which caused a shortage of experienced instructors?

Or was it the fact that the airspace which was continually being infringed upon was itself a dynamic, moving target as the result of airport and runway construction, and approach and departure procedure changes?

Or was it the arcane, hieroglyphic language of NOTAMs, a prehistoric leftover of numbers, latitude-longitude digits and abbreviations so absurdly abstruse, and meant perhaps more to get an authority off the liability hook than to inform a hapless pilot?

I mean, really. Here's the hobby pilot who is going to pick up a sleek new Cirrus SR22 with a spread of displays the breadth of the entire cockpit, for a €300 hamburger run to a nearby strip. His last landing was 89 days ago because it has been a lousy winter. He's in sales in his normal life, or something, and his most pressing concern is that he hopes he remembers how to prime the engine before starting (it was an injection engine on this one, right?). His three kids are hungry. "We wanna eat now dad, now!" Suppose the pilot even has the memory or wherewithal to go and find the

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He flies as a First Officer on B737NG.

Making people afraid of the consequences of their actions does not necessarily prevent those actions. But it sure makes people smarter at hiding the evidence of such actions.

NOTAMs relevant to his flight (which is an amazingly generous assumption in many clubs, where this is easier said than done, mind you). "And we're hungry, dad! You promised us that hamburger!" He fends off the children for a few seconds and he then reads something like "VALID 251730-262159 ALL FL CS:WWWESOS INSIGNIFICANT NOTAM INCLUDED, EXCEPT OLD PERM NOTAM AREA: 6100N01300E 6100N01919E 5915N02100E". Uh, say again? Board the kids, crank it up, go feed the hordes.

We in the ANSP establishment apparently continue to have serious hopes that a VFR pilot will be able to translate a hieroglyph like the NOTAM above into something meaningful, that he'll say: "Ah, now I see, there's the boundary today!" (Because, among other things, where's that OLD PERM NOTAM AREA? You mean it's older than our hapless hamburger pilot's 89 days on the ground? Not even a German Enigma machine could crack that one and draw a line on a map). The hopes which we in ANSPs have border on the insane.

Pilots today, like most members of our global society (at least on this side of the digital divide), are increasingly used to getting information from little quick snippets on sites like YouTube. On YouTube, our hamburger pilot can probably learn how to perform an Immelmann on the snappy red Extra 400 of his Microsoft Flight Simulator to the beat of Queen's "We are the champions". His son's little iPhone-recorded film of the Cirrus he's about to rent is on there too. That's how pilots learn stuff, share stuff, and get information today in 2010 A.D.

NOTAMs, in contrast, are stuck in the Telex Jurassic. 1935 A.D. Messaging and coding modelled on technology which was developed for pulse dialling and circuit switching, and for data sent by Baudot code (do you even know what those words mean?). Our hamburger pilot's father wasn't even born in 1935. Our pilot would probably be just fine, and not bumble into your airspace if you gave him a little YouTube animated film of a chart and a line across it after you've changed it around (again). That's when his generation will more likely say: "Ah, now I see it!"

But the ANSP woman whose proposal I was about to hear had a much better solution. And I was amazed. "Here's what we'll do," the woman said. "We are introducing a system of successive penalisation. If the pilot makes a first infringement, we will put all the information on him and the flight in a national register. He will be informed by letter that he is now on file, and will be watched from now on." A slap on the wrist. I was silent (or stunned, or both).

"Then, at the second infringement, we are going to fine the pilot. He is going to have to pay a financial penalty." "And the third?" I almost didn't dare ask. "We'll go to enforcement action." Go yank the license in other words.

Her solution? Get rid of the bad pilots. Just fight the symptoms. Identify the bad apples and remove them from the system. And how was she going to do that? By planting a police state in the middle of VFR territory. A police state that would monitor, watch, trace, record, track, file and store. And then punish.

What was I to say? You see, history is not on the side of police states. Not in the long run, at least. Before police states eventually crumble under their own bureaucratic weight and moral bankruptcy, people will have found a million ways to subvert and outsmart them. They will switch off transponders. They will fly using someone else's name. They will falsify records. They will stop filing flight plans. They will take off from undisclosed grass strips, hiding the aircraft under a camouflage net. They will do everything to rent a general aviation aircraft with stealth technology (as soon as that becomes available). You name it. Humanity's creativity under the threat of penalty is boundless. Making people afraid of the consequences of their actions does not necessarily prevent those actions. But it sure makes people smarter at hiding the evidence of such actions.

The airspace infringement problem should not be trivialised, of course. But if all we do is fixate on the infringement part of the problem, and not the airspace part (how its boundaries are created, changed and communicated), all we will do is fight the symptoms, getting rid of the bad pilots. And, as usual, if we leave all other conditions in place, new "bad" pilots will keep coming up to take the place of the ones we removed. Or, in a language we apparently, innocently, expect everybody else to be able to make sense of in 2010: ALL ATCO VALID PERM IF PROG ON SAF TOBE MADE 7000N0000E 7000S0000W DONOT BLME PILOT.

Infringement is not always by "puddle jumpers"

By Captain Ed Pooley

This is a story about how an experienced pilot inadvertently became an airspace infringer and took his paying passengers into an active danger area after becoming distracted from navigational reality because of weather avoidance.

It happened to a good friend of mine who was known as a careful but commercially aware flyer. Commercially aware? I mean that he always made every effort to leave on time, give the passengers a nice ride, arrive on time and not carry too much extra fuel unless the company had a tankering policy from a particular airport because of a cheap price there.

Captain Ed Pooley

is an experienced airline pilot who for many years also held the post of Head of Safety for a large short haul airline operation.

He now works as an independent air safety adviser for a range of clients and is currently acting as Validation Manager for SKYbrary.

Careful? I mean that he was known for getting the best out of his co-pilot, but also for consciously putting safety first when deciding who should be PF for a particular approach.

At the age of 54, he had spent his flying career entirely in turboprop flying, because of a decision early on that family life was better if he was at home most nights and had a job based at a regional airport in a nice part of the country. No jet time, but lots of "real" flying and no boredom in what was currently a 50-seat twin turboprop. Of course there were by now few unexpected challenges, and, with little expectation of any serious challenges in aircraft management or handling, there was perhaps at least a risk of complacency.

This was the third flight of four that morning. It was a little unusual in that the route took them on a direct track from near the departure airport to near the destination airport, following a route largely outside controlled airspace. It was a nice day, with just a risk of some heavy showers later on in what was scheduled as a one-hour flight, so keeping a good visual lookout and carefully monitoring traffic on the FIS radio frequency were the only real priorities during the cruise. Any weather ahead would be obvious and thus avoidable. The BRNAV was set up for the flight-planned route and the AP was engaged in LNAV. My friend decided that he would be PF as it was actually over a year since he'd flown this particular route. His company was now one of Europe's biggest regional operators and about five times bigger than when he had joined it ten years before. As a result, there were more new faces in the right-hand seat, most of whom were less than half his age and at the very beginning of their professional flying careers. He had described them to me as having the usual combination of lack of experience and apparent naivety balanced by little more than enthusiasm. He suspected that they might not be that much use if he really needed them.

Forty minutes into the flight, an unexpected build-up appeared on the weather radar ahead. It was difficult to see which way it might be moving, so for the time being, they decided to continue on track as per their planned route. It seemed as if they might be able to get away with a slight corner-cut at their next way-point in order to miss the worst of the weather. And probably the APP radar at their destination would be able to help get them

> ... we still seem to rely on incidents to produce solutions, when an effective and proactive safety management system should easily have been able to stop incidents...

straight onto long finals. They might even be early.

Ten minutes later, the build-up had only moved a little and it was beginning to look like quite a significant corner-cut would be needed. They advised their FIS frequency that they would make an early free call to the destination APP radar and obtain vectors from them. The crew members were aware that a series of permanently active danger areas which lay to the right of their flight-planned route would be nearer to their requested "direct to final" track than normal, but they knew that the peripheral danger areas which surrounded the permanent ones, some of which were within little more than 5 NM of their normal track, were rarely notified, and they felt sure that they would be able to rely on ATC to know if any were currently active.

APP were, as expected, happy to help. Their radar had no conflicting traffic, and the crew explained where the worst of the storm appeared, since the ATC primary radar had recently been upgraded to a "weather free" version. Once ATC had identified the aircraft, a direct track was obtained from the present position to a 10-mile final where they would be visual – and there was no mention of anything about getting only "radar advisory" service until they entered controlled airspace about 15 miles north of their destination.

They were abeam of the danger areas when, all of a sudden, a flare appeared ahead and slightly to right of track. As they were considering this development, another similar flare appeared, this time a lot closer. APP radar was advised and suggested that a left turn of about 40 degrees would take the aircraft clear of the firing range, which was the reason the danger area cluster existed.

And that was it, until they were taxiing in after landing, at which point ATC sent a message asking the crew to come and see them after shutdown…

Of course, the "peripheral" danger areas had been notified active for that morning – apparently the range was hosting a visiting team of ground-to-air missile specialists for an important demonstration, and the incursion had resulted in this being suspended for a critical 25 minutes. The landline between the APP radar unit and the range had been temporarily down, with no fallback comms procedure. And neither the ATCOs on shift at APP radar nor the flight crew had read the NOTAM about the exceptional activation of the whole range area…

Both the radar controller and the captain were "counselled" by their respective employers as to their lack of professionalism. The civil and military ATC unit managers agreed a comms back-up to cover landline outage. And the operator decided that a specific caution box would be inserted on the pilot navigation log sheets for the route, that a review of all scheduled operations involving routing through class G airspace would be subjected to a further operational risk assessment, and that a new general brief would be produced to remind flight crews of the various additional considerations relevant to flight outside controlled airspace. They also decided to enhance flight crew recurrency training on the role of the monitoring pilot, since it seemed that, in this case, there had been little evidence of its contribution to incident prevention.

My only thought on hearing the story and its consequences was that we still seem to rely on incidents to produce solutions, when an effective and proactive safety management system should easily have been able to stop incidents such as this from occurring, when so many of the preventive measures were found with hindsight to have been absent. Our "layered approach" to managing the risks of airspace infringement does not easily accommodate the absence of a series of the obvious defences against it.

Since the last issue of HindSight, five safety alerts have been published. They are all online at ***http://www.skybrary.aero/index.php/Portal:EUROCONTROL_Safety_Alerts,*** *but we have reproduced three of them below.*

SAFETY REMINDER MESSAGE

S-Band Primary Surveillance Radar: co-existence issues with 2.6 GHz transmissions

Published 25 November 2009

Background information

European Commission Decision 2008/447/EC of 13 June 2008 obliges EU Member States to do the following:

"No later than six months after entry into force of this Decision Member States shall designate and subsequently make available, on a non-exclusive basis, the 2,500-2,690 MHz band for terrestrial systems capable of providing electronic communications services, in compliance with the parameters set out in the Annex to this Decision."

In Air Traffic Services Information Notice 168, issued 10 November 2009, the UK CAA states that the use of the 2.6 GHz band may, if no suitable mitigations are in place, result in radars that operate in the 2.7-3.4 GHz band (the S-band) being adversely affected because of their susceptibility to authorised transmissions from within the 2.6 GHz band. Tests and studies carried out over the last 18 months have confirmed such potential adverse effects.

Your attention is required

- Air navigation service providers are invited to review the issue, investigate its relevance for their operational environment and, as appropriate, introduce appropriate mitigation mechanisms.
- Aviation authorities are invited to review the issue and investigate its relevance to their State.

Additional information

- Commission Decision 2008/447/EC of 13 June 2008 on the harmonisation of the 2,500-2,690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community
- UK CAA ATSIN 168 S-Band Primary Surveillance Radar – Co-existence issues with 2.6 GHz Transmissions

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SAFETY REMINDER MESSAGE

Non ACAS-equipped aircraft operations

Published 21 December 2009

Synopsis

This safety reminder message is prompted by a recent incident involving an ACAS-equipped aircraft and a non ACAS-equipped aircraft.

Currently ACAS II shall be carried and operated in the EUR region (including FIR Canarias) by all civil fixed-wing turbine-engined aircraft having a maximum take-off mass exceeding 5,700 kg or a maximum approved passenger seating configuration of more than 19. However, the provisions of the Minimum Equipment List (MEL) allow "mandated" aircraft to operate without ACAS II in specified circumstances (see below). In addition, it is possible to obtain temporary exemptions from ACAS II MEL requirements for certain categories of flight (see below).

ATC may therefore experience situations in which participating traffic has serviceable ACAS, unserviceable ACAS or even no ACAS at all.

ATC

Air traffic controllers are reminded that aircraft type is not necessarily a guarantee of serviceable ACAS equipment. At any one moment in time, an unspecified number of aircraft ("mandated" and "non-mandated") will be operating in European airspace without an operational ACAS II system. This should not have an effect on controllers, since the following is stated in the provisions of ICAO PANS ATM (Doc. 4444) (15.7.3.1):

"The procedures to be applied for the provision of air traffic services to aircraft equipped with ACAS shall be identical to those applicable to non-ACAS-equipped aircraft. In particular, the prevention of

collisions, the establishment of appropriate separation and the information which might be provided in relation to conflicting traffic and to possible avoiding action should conform with the normal air traffic services procedures and should exclude consideration of aircraft capabilities dependent on ACAS equipment."

AIRCRAFT OPERATORS ACAS II MEL requirements

With the exception noted below, the MEL requirement for ACAS II throughout Europe is 10 days (excluding the day of failure discovery). Operation under the terms of the EASA-OPS 1 ACAS II MEL has been agreed and accepted by the ECAC Member States. JAA TGL 26 (which is still applicable) states that ACAS II "may be inoperative provided the system is deactivated and secured, and repairs or replacements are carried out within 10 calendar days. Note: Local Authorities may impose a more restrictive rectification interval days."

Additional MEL requirements concerning partial failures are also listed in TGL 26.

Note: The actual MEL period applicable to an aircraft is set by the national authority of the aircraft operator, but if longer than 10 days it would cause operational issues for flight in European airspace. In German airspace the time period during which ACAS II may be inoperative is reduced to 3 days (refer to German AIP GEN 1.5 para. 5). This applies to all aircraft. In Europe, there is no requirement to notify ATC or to make a remark in the flight plan about ACAS II being inoperative. There are different requirements outside Europe, e.g. in India, where ACAS equipage needs to be stated in the flight plan. Please refer to each individual State's authorities for more information.

EUROCONTROL ACAS II Equipment exemptions

ACAS II equipage exemptions must be requested directly from the national regulatory authorities of all countries whose airspace the flight will enter. From 1 January 2010 EUROCONTROL will no longer process any ACAS II exemption requests, including those for delivery or maintenance flights.

Exemptions for any reason must be requested directly from the regulatory authorities of all countries whose airspace the flight will enter.

Further reading

- EUROCONTROL Mode S and ACAS Programme Website – ACAS II Safety Bulletins, Equipage Requirements, FAQs, etc.
- ICAO Doc. 4444 PANS-ATM
- ICAO Doc. 8186 PANS-OPS
- ICAO Doc. 9863 ACAS Manual
- EASA-OPS 1 ACAS II MEL
- JAA TGL 26

Your attention is required

Please note the subject and investigate the relevance in your operational environments. Share your experiences concerning the issues described.

SAFETY REMINDER MESSAGE

Own separation between IFR flights inVMC and interaction

Published 30 March 2010

Synopsis

This safety reminder message is prompted by an incident in class C en-route airspace between two IFR passenger-carrying aircraft whose pilots were requested by ATC to apply "own separation" (based on visual acquisition) for a short period of time. In the State in which the incident originated, ATC uses this practice as permitted by that State's Rules of the Air. The intention of the request was to continue the climb of one aircraft through the level of the other one. Essential traffic information was passed to both aircraft, but the outcome of the subsequent VMC manoeuvring was a close encounter between the aircraft. Events such as these raise a number of safety issues relevant to air traffic controllers, aircraft operators and aviation regulators:

- **The use of "own separation" between IFR flights in VMC in circumstances other than those specified in existing ICAO provisions.**
- **The potential incompatibility between VMC "own separation" manoeuvring and ACAS II operations.**

Own separation between IFR flights in VMC

ICAO Provisions

ICAO PANS ATM § 5.9 states that, *"when so requested by an aircraft and provided it is agreed by the pilot of the other aircraft and so authorised by the appropriate ATS authority, an ATC unit may clear a controlled flight, including departing and arriving flights, operating in airspace Classes D and E in visual meteorological conditions during the hours of daylight to fly subject to maintaining own separation to one other aircraft and remaining in visual meteorological conditions. When a controlled flight is so cleared, the following shall apply (inter alia):*

a) the clearance shall be for a specified portion of the flight at or below 3,050 m (10,000 ft), during climb or descent and subject to further restrictions as and when prescribed on the basis of regional air navigation agreements."

Moreover, PANS ATM § 5.10.1.2 states that "Essential traffic information shall be given to controlled flights concerned whenever they constitute essential traffic to each other.

Note: This information will inevitably relate to controlled flights cleared subject to maintaining own separation and remaining in visual meteorological conditions and also whenever the intended separation minimum has been infringed."

Note: By definition, the use of "own separation" should also be limited to aircraft flying at 250 kn or less (speed limit imposed inside airspace classes D and E when flying below FL 100).

State Rules of the Air

In the State in which the incident above occurred, the Rules of the Air for "Visual self separation on VMC" specify that such separation can be applied as follows:

"a) Aircraft so authorised should guarantee that they will not fly so close to the other aircraft as to endanger safety.
b) When requested by the aircraft or upon proposal by an ATC unit, clearance can be granted to an (IFR) flight upon condition of self separation, on VMC during day hours, provided:

- Clearance is only to facilitate climb or descent.
- Alternate clearance must be given when there is a possibility that VMC cannot be maintained.
- Essential traffic information is issued as necessary."

Furthermore, the State Rules of the Air make no provision for any particular airspace class, or level at which such clearances can be granted, or for the pilot's acceptance of another aircraft's crossing his level visually.

with ACAS II OPS

VMC own separation and ACAS II operations

VMC "own separation" may result in close proximity between aircraft that could cause an ACAS resolution advisory (RA) to be generated. The use of visual "own separation" manoeuvring may not always be compatible with the main objectives of ICAO PANS OPS § 3.3.2 related to ACAS II RAs, namely that, *"pilots shall respond immediately by following the RA as indicated, unless doing so would jeopardise the safety of the aeroplane" and "visually acquired traffic may not be the same traffic causing a RA. Visual perception of an encounter may be misleading, particularly at night".*

Further reading

- SKYbrary - Loss of Separation
- ICAO Doc. 4444 PANS-ATM
- ICAO Doc. 8186 PANS-OPS

Your attention is required

- **Aircraft operators, air traffic service providers and aviation regulators are invited to consider the advisability of permitting the use of visual "own separation" between IFR flights in VMC in circumstances other than those specified in the current ICAO PANS ATM § 5.9 provisions.**

- **Pilots must understand the full implications of requesting or accepting a clearance to maintain "own separation" in VMC, namely:**

  - **There is a possible incompatibility with ACAS ops – a pilot has no means of knowing whether or not the visual separation he is applying is likely to trigger an RA.**
  - **Moreover, it cannot be excluded that an RA will be generated only on one of the aircraft in the "VMC "own separation" constellation", and not necessarily the one that is manoeuvring and keeping the other(s) in sight.**
  - **If an RA is generated during "own separation" manoeuvring, then pilots must follow the RA.**

Note: Notwithstanding the above, ICAO PANS-OPS states that, "Nothing in the procedures... shall prevent pilots in command from exercising their best judgement and full authority in the choice of their best course of action to resolve a traffic conflict or avert a potential collision".

Aviation professionals are invited to share their operational experience concerning the issues described.

Case Study - My hovercraft is full of eels

By Bengt Collin, EUROCONTROL

The controller

How many English football team names in the Premiership, Championship, League 1 or League 2 contain the name of a part of the body? They were sitting in the local bar sinking a pint or two of Boddingtons. It was still early evening, but the challenge was there to be solved. Not that it really mattered; this was not a contest, more of a fun experience. They shared the same kind of humour; being from Sweden and the UK, this was obvious. That afternoon they had both enjoyed Monty Python's "The Hungarian Phrase Book" on YouTube: "My hovercraft is full of eels." "Brilliant," they thought, but this was another challenge. So far they had managed LIVERpool, ManCHESTer United and ManCHESTer City, BournMOUTH and PortsMOUTH, not forgetting the famous ARSEnal. Is LEiGhton Orient OK? "Why not?" Joe replied, "What about (H)IPswich?" They finished their pints. Time to get home soon – work at the centre tomorrow.

The GA pilot

This was another fantastic day, although the endless sunshine had come to an abrupt end this very morning. He planned to fly north to visit his parents; they were living some six hours' driving distance away, too far to drive for a day or two, but a quite feasible distance for flying. He was an experienced IFR pilot, not that he was flying big commercial jets, rather small twin piston-powered aircraft. He also used to fly on a regular basis outside normal working hours; today he had booked a single-engine Piper.

Bengt Collin

works at EUROCONTROL HQ as an Senior Expert involved in operational ATC safety activities.

Bengt has a long background as Tower and Approach controller at Stockholm-Arlanda Airport, Sweden

The local grass field was located close to his parents' house. The President of the Flying Club (this was how he titled himself) was a good friend of many years' standing; he had just phoned him. Conveniently, since his friend was also the local MET expert, he had learned that the forecast for his planned arrival looked good. "I can see the old church tower clearly, and Chris, you know, the guy who sells vacuum cleaners, he told me that the weather should stay dry. Give me a call when you arrive and I will pick you up." His friend rang off.

The fighter pilot

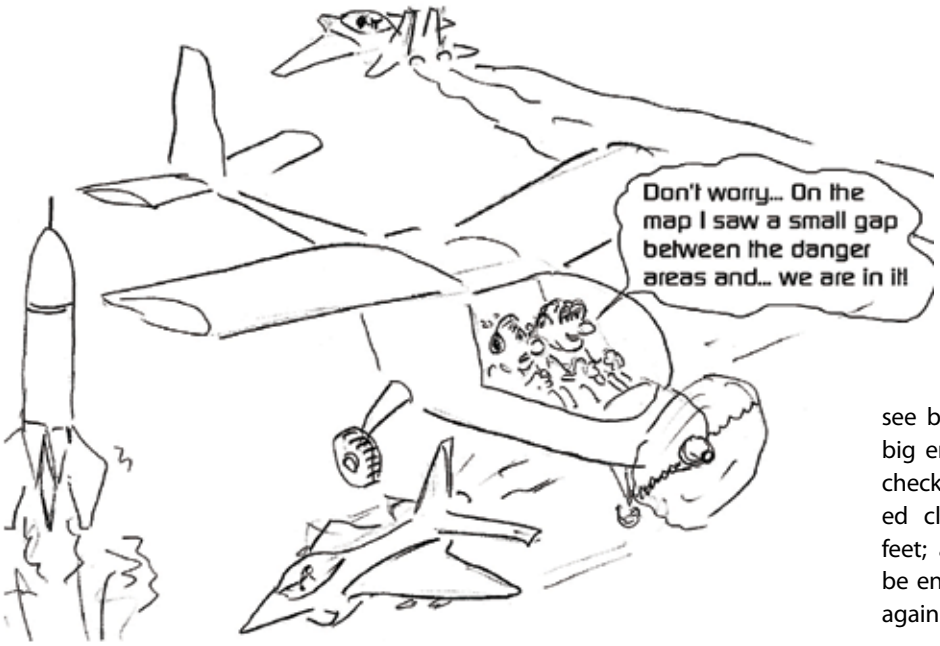
The military airport was some seventy kilometres north of the big city; driving to work, the weather had been sunny as usual, but now the sky was almost overcast. Following the morning briefing, everybody not flying the first shift went downstairs for a cup of coffee; he and his colleague were not flying until ten o'clock and had plenty of time to prepare the exercise which was standard for him but not so easy for his relatively inexperienced colleague. This colleague was some ten years younger than he was, and had red hair and a terrible accent (he had been born in the south of the country). More importantly, his colleague was dating the sexiest young lady in town. He was jealous. But his accent; he wondered how the couple communicated. Well, he had one or two ideas; but seriously, he was thinking of sending him to an elocution teacher. Why not offer the lady company while his colleague was being trained in pronunciation? A nice but unrealistic thought. He smiled to himself. It started raining. No risk of cancellation, though; he had seen worse.

The GA pilot

His local flying club, located at an former air force base west of the big city, was housed in an old building from the 50s. The yellow building had several rooms, one of them with maps and other useful information for flight planning. He tried to get on to the Internet and file a flight plan. The computer needed replacing. It was slow, irritating and generally user-unfriendly. Anyway, he did not need to file a flight plan after all; his priority was to depart before the weather got worse. The cloud base was still acceptable, both outside and at the arrival airfield (he trusted the local forecast), but he was aware of that this could change.

The controller

He was handling departures and arrivals for the military air force base. To his left was the position for the final approach director, to his right the controller position for helping and coordinating military traffic crossing the civil TMA towards the south-east. The traffic intensity was relatively low and neither of the other two sectors was actually open. Not that they did not have enough personnel: the other control-



lers strangely preferred playing cards and drinking coffee; he liked working on his own. Three pairs of fighters had departed towards the north-east thirty to thirty-five minutes ago. They should be back in about ten minutes. He also had an activated flight plan on a military navigation training flight from the east, planning to fly VFR below controlled airspace.

The GA pilot

He got airborne and headed north below the TMA. He navigated using his car GPS; many pilots at his club used the same method. He remembered the discussion at the last club meeting: a salesman from a GPS company had presented new products. Interesting, but his car GPS was quite enough, he had decided.

He also remembered that ATC had recently asked to visit and inform club members about airspace infringements after a couple of VFR flights had crossed the control zones nearby without clearance, but his plan was already decided and he did not mind. He knew the airspace relatively well. After all, he planned to stay at low altitude avoiding the control zones, so there would be no problem. The visibility was OK; he could see increasing cloud ahead. Should it get worse he could always turn around. He did not really like to disappoint his parents, knowing that they always looked forward to his visits.

The fighter pilot

Finally they got the exercise right. They had to make a few extra turns, but it was worth it; now they could head back to their home base. "You can lead us," he both instructed and asked his trainee. He got some unreadable answer and repeated what he had just said. He almost gave up, got irritated, but then calmed down, instead taking another turn to locate his colleague. "Follow me visually instead," he said. At the same time, they received instructions to contact approach control. "My fuel is on minimum," the trainee informed him. This time he understood his language. "It is actually below minimum," he updated. He noticed the tone of the trainee's voice changing. Low fuel was not unusual, but this time something told him that it was a bit more serious. He would ask for priority; in any case, they could rely on getting the shortest routing from approach, who were always excellent.

The GA pilot

Time to decide whether he should continue or turn back. There was a lot of cloud ahead, but above him he could see blue sky, not a lot, but probably a big enough hole to climb through and check the weather to the north. He started climbing through twelve hundred feet; a few more hundred feet should be enough, and then he could descend again and continue north.

The controller

The first pair of fighters called on the frequency. They immediately declared fuel below minima. He was not surprised. They were number one anyway, straight-in approach, no frills, easy. He remembered years back when another fighter which was too heavy asked for an extension of the approach pattern. One minute later he declared he was short of fuel. When something happens, it happens quickly! Suddenly an unexpected aircraft called. It was the VFR from the east meeting low cloud and climbing. He saw the label far away in the civil part of the TMA; he started to coordinate and turned the aircraft away from other traffic. He looked back at the fighters; straight ahead of them he noticed a primary echo on the radar screen. It was exactly on final for the landing runway, still some eight miles ahead of the fighters. The echo was definitely an aircraft. It was now turning left, but although it should be below controlled airspace, something told him it was not. It was a strange feeling; his experience?

The fighter pilot

They were maintaining seventeen hundred feet, locked onto the ILS. His colleague followed him visually two miles behind. The fuel should be enough for him, he thought, thankful for no extra turns during approach. Normally they followed on radar. It was an excellent

tool for locating other aircraft; even the altitude indication was correct. Now, although this was no longer officially allowed for some reason he did not understand, the trainee needed to switch it on, otherwise he would lose contact in cloud ahead. "Unknown traffic twelve o'clock six miles," the controller informed them, "twelve o'clock four miles." He looked ahead but could see nothing. He was just above a layer of cloud. The visibility was good, but the sky was empty, completely empty.

The controller

He focused on the VFR flight to the east. More coordination needed, back to focus on the finals traffic. The unknown echo had disappeared. Suddenly he saw it again. It was straight ahead of the first fighter. "Twelve o'clock half a mile," he called.

The GA pilot

He had tried to climb but unexpectedly met clouds; he had descended and now tried a second time to climb above them. Sixteen hundred feet and he was almost above the clouds, just two hundred feet more. He looked north, more clouds. He could definitely not see any church tower; better turn back.

The fighter pilot

"Twelve o'clock half a mile." Nothing, Then, like a bolt from the blue, a small aircraft passed to his left, climbing through the same altitude less then fifty metres away. It happened so quickly that there was no time to react. "Contact straight ahead. It's a Piper. Now it is descending again." His trainee sounded focused.

Case Study Comment 1 by Radu Cioponea

Why did I feel this was coming the moment I read about the GA pilot's "preparation" for the flight? Of course, we all know that GA pilots are unprofessional, superficial, reckless and disrespectful of rules. Besides, they often think they're far better than they are, and like to show off. Of course this guy was going to cause problems not only to himself, but potentially to others too.

Next, why did I know this was coming the moment I read about the fighter pilot's predicament with his younger team-mate? But then again, we all know military pilots tend to be show-offs, think they're far better than they are, think they're entitled to all the pretty girls, are disrespectful of other traffic, fly those fast and ridiculously expensive aircraft, and pretend they must always have priority. So they can even disregard their own safety because someone else will make sure they get priority no matter what. They're defending our airspace against intruders, after all.

So, why was it clear this was coming when I got to read how the controller was working and how the positions were organised? Of course, this particular controller liked his work. So much so that he, like almost all other ATCOs, thinks he's better than God, doesn't need a team next to him, takes unnecessary risks, thinks he's far better than he is and likes to show off how well

he handles the traffic, sometimes even at the limits of the regulations. But of course, they move the traffic safely and we all owe our lives to them.

OK, so the conflict was clear. The players were clear. The conditions were more than clear. Or was it all that clear? Let's pause for a moment here and take another look.

All those involved are humans, whether pilots or controllers. Yes, they are. Don't listen to any gossip to the contrary. Right, now that we've established that all of them are humans, we must accept that they're all very complex entities. They're likely to be very good at certain tasks. They're likely to think well, be imaginative, adapt well to new or unforeseen situations, and be able to recognise known situations; but they also have all sorts of limitations, as we all do. They can make mistakes. They can be stressed. They can forget or overlook things. Worse still, they can even have feelings! Don't we all have the same limitations, as humans?

This is precisely why this situation developed. Because we had humans who are good at what they do, but not perfect. So there's this nice gentleman who's eager to please his parents, and he presses on regardless of his own concerns about the less than ideal weather. There's a potentially heroic pair of military pilots, who would not hesitate to fly into the fire if that were their mission, who have to cope with differences of character between themselves and are also bogged down by a communication problem. That's trivial, one could say. Who doesn't have communication problems? And finally, there's the brave ATCO who loves his job and takes great pleasure in doing even more than he should normally do. So what if the adjacent positions are closed because the controllers are drinking coffee and playing cards? He can still do a bloody good job of shifting aircraft.

Let's make sure we form a team, a proper team. In which communication is properly established, in which we know what others are supposed to do and they do it.

All of the above are absolutely ordinary issues that we meet almost every day: the rush to get somewhere, paying little or no attention to the dangers lurking along the way; our colleague whom we don't particularly love; or our other colleagues who didn't show up for that last meeting at which we had to prepare all alone. That's all fine. Because, normally, no one will notice. Because these things usually happen in isolation. But this time, the stars were in alignment. The weather deteriorated faster than the GA pilot had hoped, but his wish to reach his destination was stronger. The exercise was tough but had to be finished, no matter what. Military pilots don't have the luxury of failure. Neither do ATCOs. So regardless of the missing colleagues and the missing help, the job had to be done.

But all these things happened in the "right" sequence and within the "right" time-frame. The outcome was a bolt from the blue, passing to the left, less than fifty metres away. This time, chance didn't want to screw things up, and watched over our pilots. But what about next time? And the time after that? Are we willing to continue gambling on the presence of luck within those fifty metres? No, I didn't think so.

Then let's make sure that chance is not flying our aeroplanes or controlling our traffic. Let's make sure we plan adequately for our VFR flights, which are supposed to be visual and should therefore not be flown in clouds, and in particular not willy-nilly, chasing some elusive blue sky when the adrenaline is pumping. When, apparently, it's hard to see anything beyond the end of one's nose. Also, let's make sure we form a team, a proper team. In which communication is properly established, in which we know what others are supposed to do and they do it. Let's make sure that the only stars in alignment are the ones in the sky.

Case Study Comment 2
by Dragan Milanovski

This case study relates to an airspace infringement caused by an experienced GA pilot in a familiar environment but under complex meteorological conditions. His plan was to remain below controlled airspace, but he failed to do so. He had to climb to remain clear of clouds, and forgot to ask for a clearance, or was not completely aware of his exact position, or simply did not have the time to call.

Dragan Milanovski

is ATC training expert at the EUROCONTROL Institute of Air Navigation Services in Luxembourg.

Most of his operational experience comes from Skopje ACC where he worked for a number of years on different operational posts.

Now, his day-to-day work involves ATC training design as well as Initial Training delivery for Maastricht UAC.

Was it just the weather that caught him by surprise? One could argue that he made a series of "strange" decisions and that being an experienced pilot he should have done better.

To start with, he put himself unconsciously under pressure to fly. He did not want to disappoint his parents, who were always happy to see him. He kept pushing and delaying the decision until it was too late.

He did not bother to obtain a proper forecast from the MET office. He seems to have been afraid of what the forecast might be. Instead, he called a friend with local knowledge and experience, who in turn believed the forecast of the guy who sold vacuum cleaners: "it should stay dry."

Maybe he meant to say that he wouldn't sell anything. At least the pilot was aware that the weather could get worse.

Having the local knowledge and being familiar with the airspace did not help in this case. On the contrary, the flight could have been prepared better and various options could have been considered before departure.

Although there was no need to submit a flight plan, the pilot had made an effort to do so. Bearing in mind the developing MET conditions, this was a good idea (flight information service, possible diversion, change of planned level, alerting service, etc.). This is where his experience should have shown, and he should have looked for another way of submitting the flight plan.

On the other hand, using a car GPS was not a good idea. Having a clear indication of where petrol stations and other places of interest are does not help when airborne. What helps is airspace structure, airspace boundaries, airways, location of ground navigation aids, reporting points and many other features commonly available on any GPS unit intended for use on board an aircraft. The "scary" part is that this was common practice; many pilots in his club were using the same navigation method. Analysing this event will probably make them aware of the associated risks.

The controller did well in this situation. Although he was relatively busy with coordination regarding the VFR flight from the east, he suspected that the primary target was not below controlled airspace, and passed traffic information to the fighter pilots. Maybe he would have had more time for this particular case if the other sectors had been open (especially the one that normally does the coordination), but I nevertheless do not think that he could have done anything better. Still, there is a sentence in there that bothers me: "the controller liked working on his own". Maybe he needs to reconsider his preferences.

The ATC unit was also trying to increase awareness about airspace infringements. Visiting the club and talking directly to pilots is probably a good way to start.

The trainee pilot had no problems identifying the Piper, which was not the case with the other fighter pilot. Was this because he was slightly behind, or because he had his radar on? It is definitely worth investigating.

MY RECOMMENDATION this time goes to the GA pilot. Being experienced and having the local knowledge of airspace and terrain allows you to use your skills more efficiently, but it cannot replace the basics learned in training. This incident could probably have been avoided if the flight had been properly prepared and if an appropriate navigation method had been used (even map reading would have been better than using a car GPS). Try to recognise situations where you are under pressure and act accordingly; avoid pushing it to the limits.

Case Study Comment 3
by Martin Robinson, UK AOPA

Situational awareness, or more specifically the lack of it, is the only constant in airspace infringements, if, that is, we mean by situational awareness a state of knowing where the aircraft is, where it has been and where it is going in terms of the four dimensions of flight.

This process can never become fully automatic and always requires some conscious effort of thought. The pilot is vulnerable when there is high cockpit workload but perhaps also when complacent or distracted. Pilots can and do also sometimes misinterpret correct information, reaching the wrong conclusion by rejecting the right conclusion. This could be incorrect map reading - identifying the wrong town on a map, or not correcting for DI precession against the compass and believing the DI to be correct when it is 20 degrees off. It could also be setting the DI on an extended runway centre-line of '012' instead of '120'.

Fortunately, over the years, acronyms have been developed to help pilots such as FREDAC[1], or FREDACP, where the 'P' is 'position'). If this check is done every 10 minutes during a flight, it should help to combat poor situational awareness.

Finally, I am reminded of the following piece of wisdom apparently attributed to Albert Einstein: "Computers are incredibly fast, accurate and stupid. Humans are incredibly slow, inaccurate and brilliant. Together, they are powerful beyond imagination."

Maybe he was thinking of GPS and pilots.

SUGGESTED READING

- **Human Performance and Limitations in Aviation by R. D. Campbell and M. Bagshaw - 3rd (online) edition 2008**
- **GPS Problem Areas article in SKYbrary**

1- Fuel, radio, engine, DI, airspace, carburettor heat

Case Study Comment 4 by Captain Ed Pooley

We are reminded that although mid air collision is relatively rare, it can be a direct consequence of airspace infringement.

Captain Ed Pooley

is an experienced airline pilot who for many years also held the post of Head of Safety for a large short haul airline operation.

He now works as an independent air safety adviser for a range of clients and is currently acting as Validation Manager for SKYbrary.

Of course, we also know that for every actual collision, there will be many 'near misses'. Sometimes, the subsequent investigation of near misses does not examine their context as well as it might, and is confined to the discovery of the root cause – in this case the airspace incursion by the GA pilot. It is perhaps understandable that in the 'real world', the rigour of an incident investigation is usually directly dependent on its actual rather than its potential outcome. But of course, except for the final details added by 'fate', the reasons why a near miss might occur need not of course, as in this case, be any different from those which might lead to a mid-air collision. So let us take this opportunity to examine the 'players' in this scenario and see what we can learn.

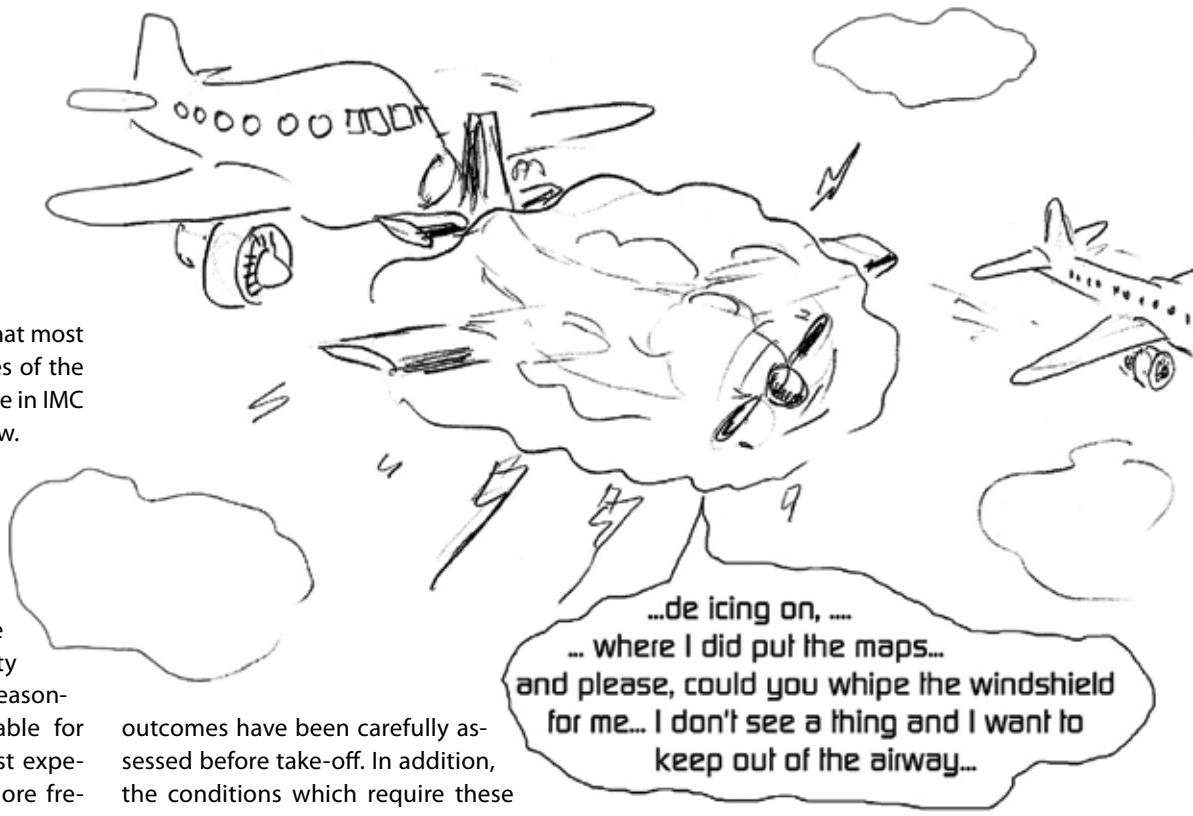
The controller clearly had at least a suspicion that the primary return which had appeared on his screen was a light aircraft in the vicinity of the base of his radar cover – temporary pre-occupation with establishing separation for the 'VFR from the east' probably meant that the usual clue of an intermittent return from traffic near the base of the radar was missed but perhaps the likelihood was assumed by an experienced controller, who thus suspected that a climb towards the altitude of the fighters was a definite possibility. Since he had observed this traffic manoeuvring on the ILS LLZ track in 'good' time - well probably just over 3 minutes ahead of a possible conflict - he did have the option to attempt to vector the fighters around the traffic. However, this would not have been an easy response, given that a successful landing off this first approach was essential because of the low fuel situation. We do not have all the details, but it might have made it impossible for the fighters to establish on the ILS GS at 1700 ft and an attempt at any lower GS capture height might not have been sensible.

We were told that the 'Director' position was not manned but that this was because of low traffic density rather than a lack of controllers on duty. So maybe there was just enough time when the return was first seen to call the 'Director' into position and, in anticipation of that, to retain the option of vectoring the fighters temporarily off track if the unknown height return remained at their 12 o'clock and there was still a way to ensure that a landing was possible off their first approach. However, I accept that this may not in fact have been a realistic plan in these particular circumstances, and just giving traffic information on the basis that the risk of an actual collision was much lower than that of the fighters losing control and crashing due to fuel exhaustion caused by breaking off the priority approach seems to be a not unreasonable choice.

> Let's make sure we form a team, a proper team. In which communication is properly established, in which we know what others are supposed to do and they do it.

I therefore recommend that the ANSP involved considers whether a minimum 'return-to-position' time should be established when positions are shut down (or merged) owing to a lack of traffic as opposed to a lack of duty controllers. Such clarity could be useful when unexpected traffic situations develop and the controller with a problem needs to know whether re-manning of positions might provide a useful part of the ATC tactical response.

The fighter pilots took a typical and understandable view of the 'traffic information' they were given. With no height on it and low fuel status declared by the trainee, continuing



their priority approach was what most would have done. The chances of the traffic being at a similar altitude in IMC were effectively assessed as low.

However, military pilots should not be expected to routinely carry out practice exercises which easily lead to low fuel status and the subsequent need for a priority approach. This is of course a reasonable solution to have available for occasional use, but in my past experience it tends to be used more frequently than 'exceptionally'. I therefore recommend that this military base aligns its fuel loading policy for training sorties more effectively with the requirements of the exercise, if necessary limiting the maximum exercise duration so that the quantity of reserve fuel which can be carried will reduce the prevalence of 'priority approaches'. A distinction must be drawn in fuel loading and in flight management policies between operational missions and the more common training details.

The GA pilot is, of course, the 'offender' here - 100% the 'root cause'. His incursion invited my earlier remarks about 'defensive risk management' by the victims of his poor airmanship, but we must now take a look at his attitudes and their context.

VFR flying in potentially marginal weather is not to be undertaken lightly. Prior to any planned VFR flight, the pilot must make a very cautious assessment of whether completion of the flight under VFR can be guaranteed. Any flight where continued VMC may be questionable must be undertaken only after alternative flight outcomes have been carefully assessed before take-off. In addition, the conditions which require these alternatives to be adopted in preference to a continued attempt to reach the originally intended destination must also be considered before take-off.

A decision to adopt an alternative such as a turn-back or an en route diversion will need to be informed by prior assessment (variously making use of a current aeronautical VFR Chart of at least 1:500,000 scale, current NOTAMS and current 'official' MET data) of:

- terrain clearance issues
- controlled and restricted airspace and other routine or exceptional aviation activity;
- potential weather complications, including lack of reliable pre-flight weather information and the options for obtaining updated weather information during flight.

This GA pilot failed to follow this scheme before he took off and was then faced with a situation which he had not fully considered before take-off in terms of either its occurrence or his response. This was a GA pilot suited to flying his single-engine Piper only on a guaranteed VFR day … and with an up-to-date chart on board, as well as the car GPS we were told about. The opportunities for pre-flight planning at his flying club were clearly not ideal, but this is frequently the case at small airfields, and simply demands from individual pilots a recognition of the limitations which it imposes on them. The less which is known, the greater the required margin for the unexpected.

A SAFETY RECOMMENDATION

A recommendation for the flying club which rented the aeroplane is that it is in its own interests to find a way of involving itself in pre-flight planning for flights away from base being made by its members in club planes. Since this goes for all flying clubs, I would also recommend that the periodic regulatory inspections made of all flying clubs should be required to look at the way this involvement is achieved and be satisfied that it is sufficient.

What have we missed?

By Anthony Seychell

"Er ... ABZ Approach, there seems to be traffic at our 4 o' clock, about 1000 feet below. It's a small plane and it doesn't show on our TCAS!"

Here we go again, another GA aircraft without a transponder and a pilot who has lost his way and ended up inside the TMA. These infringements seem to have increased lately and it is not yet summer. Imagine how it is going to be as the weather gets better. I was lucky because I did not have any loss of separation as a result of the infringement, but a couple of my colleagues were not so fortunate. Anyway, I still need to write an occurrence report about it. What is causing these infringements all of a sudden? What has changed? Had something been missed?

Airspace infringement is regrettably a common occurrence and its causes are various. Often there is little an ATCO can do about it, particularly if the aircraft is not a cooperative target and only secondary radar is available. However, it is important to report such occurrences, because they contribute significantly to trend analysis and the identification of root causes. Of course, finding the root cause is only part of the process, because the next step is to come up with a corrective action plan.

Time and time again, it is noticed that the root cause is something common and the corrective action quite simple, and that it had been implemented before, likewise again and again. If the same cause is being repeated and the same corrective action taken, then why is it happening again? Is something being missed? Regrettably the answer is often YES.

One of the most effective tools in the prevention of recurrences is lesson dissemination. Human memory is short and organisational memory even shorter. It is not often that the same occurrence happens in the same sector/unit/airspace (luckily), but this, on the other hand, contributes to the organisational loss of memory. This makes lesson dissemination even more important. ATC/ATM is not just the ATCO sitting at the CWP but a series of interlinked units which

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ensure safe flight from point A to point B to point Z.

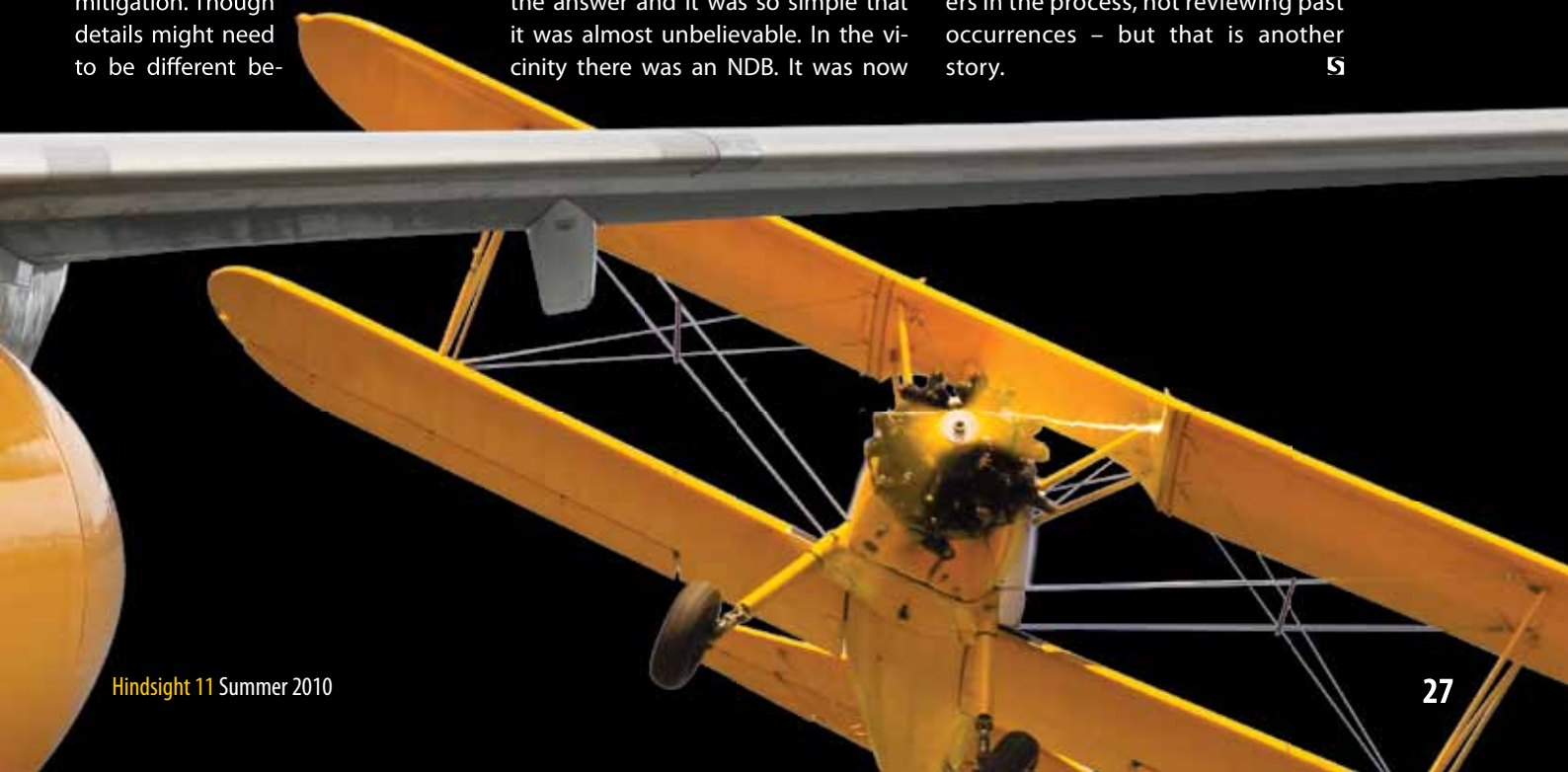
One of my 'old' instructors was fond of saying that 'coordination is the name of the game'. He was of course referring to coordination between sectors and units regarding traffic, but his saying could easily be interpreted as a need for lesson dissemination. Much of such 'coordination' takes place in conversations in the restrooms or while on break, but this is not enough. They do say that word of mouth is the best form of marketing, but an SMS is by definition a systematic, explicit and comprehensive process for managing safety risks. Consequently, lesson dissemination cannot be left to just word of mouth.

Often, lesson dissemination is the 'Cinderella' of SMS processes. Frequently, great attention is paid to safety assessments and investigations, and it is forgotten that these processes/procedures identify hazards and possible mitigations not only arising out of 'changes' but also already present in the system. Lesson dissemination is also a very cost-effective means of mitigation. Though details might need to be different between sectors/units/airspace to take into account their specific environment, the generic lesson is often applicable everywhere. After all, distributing a lesson between sectors/units/airspace is much cheaper than performing an occurrence investigation and even less damaging to all concerned. When it comes to safety assessments, it can save lots of effort as it cuts duplication.

Lesson dissemination can take various forms. The humble newsletter/safety bulletin, which nowadays can be electronic, is just one of them. Refresher training needs to include lessons learnt. Other forms of lesson dissemination could be on-line fora or even dedicated workshops/seminars. Someone might consider the latter to be expensive and disruptive, but if you think that safety is expensive, try an accident. Luckily accidents are rare but occurrences more common, and they DO still have a financial, human and emotional cost.

So in this case, what had we missed which was leading to all the infringements? It took quite some time to find the answer and it was so simple that it was almost unbelievable. In the vicinity there was an NDB. It was now considered obsolete; after all, many modern airliners do not need en route ground-based navaids at all, and none need something as ancient as an NDB. It was simply switched off as there was no further need for it. However, everyone forgot that the TMA was not used solely by modern airliners. There were the modest GA aircraft, which used this NDB to stay away from controlled airspace, but they now no longer had a reference point for the TMA boundary.

There are also lessons missed – not conducting a proper safety assessment, not including ALL stakeholders in the process, not reviewing past occurrences – but that is another story.



Expect the unexpected

By Pedro Contreras Blanco

As part of its Safety Alerts programme, EUROCONTROL has adopted the slogan "Expect the Unexpected" to spread the idea that no complacency or relaxation of standards is acceptable in ATM safety.

Over the active working life of any aviation professional, there are always stories which can be told to illustrate this vital message. If all of these stories were put together, they would fill volumes with a collection of epic stories of triumph, a few delusions and unfortunately also some sad tales. Here are a few taken from my personal experience.

Lanzarote control tower, December 1972

There were three controllers to man the tower, one on duty each day from 0700 to 2300. The tower was accessed by climbing 143 steps, because no lift had been provided. In theory, the solitary duty controller could not leave the control room and go down to the airport cafeteria, and the cafeteria staff were not willing to climb up all those steps with a food tray.

The airport management solution was introduced. A speaker was installed in the AIS department so that, if an aircraft called whilst the duty controller was at lunch, AIS personnel would hear it, and then run the 150 metres to the terminal, and another 100 metres through an obstacle course of assorted tables, doors, and customers through the cafeteria to tell the controller who had come down to eat during a period without scheduled traffic that he was needed. The controller would then have to leave his lunch, climb the stairs quickly back to the control room and respond to the call - taking several minutes at least!

This worked well enough for nearly a week until, on the sixth day, the first test of the system came. Whilst the controller was at lunch, the loudspeaker broadcast a call in English and activated the process. Our colleague in AIS, ran at F1 speed and reached the cafeteria to announce that there was a guiri (foreign) flight calling the tower.

The controller, with barely time to swallow the food in his mouth, sprinted out of the cafeteria and terminal to the tower stairs and arrived back at his position devoid of breath to exclaim "station calling Lanzarote (cough) go ahead". There was no answer, even to a repeat, so a check was made with both Fuerteventura tower and Las Palmas ACC, but neither had heard any request.

Later, the recorded tapes were replayed and from the French accent heard, it was deduced that it had probably been an aircraft transporting material or technicians to mining camps across the water in the Spanish Sahara. At least it was not an emergency.

We controllers decided that we could not accept these additional risks of expecting the unexpected and so we contacted the National Control Service (NCS) headquarters in Madrid at the military Air Ministry, the so called "Monastery of Wind". At a meeting with management the next day, the procedure was changed. The controller would remain in the cab for the entire shift and a waiter would bring up the daily meal and take the tray back down.

This, however, is not the end of the story, as the show still has a finale! Owing to 'industrial relations issues', it turned out that the waiter who brought the tray up was not prepared to also take away the previous day's tray. Time passed and after 40 days the pile of 'used' trays had accumulated an impressive collection of flying and crawling insects. It had become the first entomological-aeronautical museum, not to mention the smell. Since insects could get into the tower cab through even the smallest gap, everything was sealed tight and that was the end of the 'air conditioning'!

We had had enough, so one day, at the time when the airport management were having their lunchtime vermouth on the airport terrace below, two controllers launched each of the 40 trays one by one, off the top of the tower. Like colourful kites, they fell with majestic elegance. As if unwilling to reach the ground in a hurry, they glided in gentle circles, floating slowly (later it was stated 'dangerously') towards where our viewers looked on in astonishment.

"The controllers have gone mad!" cried the employees, managers, crews, passengers and even the taxi drivers. The passengers, especially those on the terrace, were probably wondering if people like that could be trusted to control aeroplanes. For a few days, comments and photos were published in the local newspaper, and the story became the joke of the island, but the truth of the matter is that the situation was settled. How? Well, it was soon agreed that a waiter would bring up the trays and a security guard, for a bonus, would take them down.

We should be careful, because the unexpected may await us.

Lanzarote tower, February 1973

It had been a busy Wednesday. There was lots of traffic, as was normal in those days, with almost 90 programmed movements. Now it was close to sunset and the remaining expected traffic was down to the 6 regulars plus 2 more charters which were spaced so that they would occupy the operational hours until the end of duty at 2300hrs.

The evening was lovely, a soft 'alisio' breeze from the north-east, a calm sea and the sky slowly taking on the orange colour which gives one the impression of a tropical environment, away from the rigours of winter on the distant mainland. The busy time of the morning and afternoon traffic has now passed into calmness. Maybe it was too calm and too relaxing.

While we were absorbed in these thoughts, a Cessna 178 called on frequency for a two-hour local flight VFR, as it often did for either a charter flight or for an aerial photography session. We informed them that the only notified traffic we had was the expected arrival of a Norwegian-operated Boeing 737, which was still under the control of ACC Canarias.

Moments later, the Cessna was cleared to take off and to climb to and maintain 3500 feet, operating between Punta Papagayo and Famara on the west of the island, with a reminder to call before returning to the CTR.

After 20 minutes, the 737 called giving its estimated time at the VOR/DME 'LT' and descending from FL100 to 5000 feet. It was cleared to route direct to the VOR as on the flight plan and then to continue with a procedural VOR/DME approach to runway 22, maintaining 5000 feet until overhead the VOR.

Expect the unexpected (cont'd)

The sun, now transformed into a huge bright orange ball, filled the mountains, water and sky with shades of fire, and tried to hide between the White Mountain and sea to sleep. Then suddenly, over the frequency, was heard the almost trembling voice of Victor, the pilot of the Cessna, reporting that he had just had a very close encounter with a huge Boeing 737 heading in a southerly or south-easterly direction, with less than 300 feet of vertical separation and about 500 meters of horizontal distance.

A DME distance from the 'LT' was requested, confirming that, at 20 nm, at least the Cessna was outside the CTR! Searching for the 737 in the sky, we looked north of the airport, since that would be his route to the 'LT', but there was no trace. We called him on frequency, requesting his current position, and there was doubt in the voice which responded "Ah! We are abeam your airport just to the west flying over the coast and we are now proceeding to the 'LT'."

His altitude was requested and he responded "descending to 4000 ft". We asked for an explanation for his deviation from clearance and told him of the near-collision with the Cessna 178. We heard "Sorry, sorry indeed, sir. We are flying over the coast because many of the passengers are employees of Scandinavian Travel Agencies and everyone on board was astonished by the marvellous and exceptional sunset. Very sorry indeed."

Was it the sun, the magical environment and his unthinking reaction which were to blame?

The investigation of the incident confirmed the deviation from clearance by the B737 and an official apology was received from the captain and his airline.

This incident also taught us to remain attentive and expect the unexpected

Madrid/Barajas, July 1974

It was dawn, close to sunrise, and at the apparently sleeping airport there was not even the slightest movement of traffic. Various refuelling and catering trucks were beginning their work around aircraft with early departures.

Over the Barajas tower radio-repeater frequency came the first communications between the duty controller and, in strongly-accented English, the Russian navigator of Cubana de Aviacion flight 652. Everything was normal, the IL62 was in sight, and its lights were mixed with the emerging clarity of the newly dawning day. The controller cleared the aircraft to land and it could now be seen flying over San Fernando. Suddenly, the startled voice of the Russian radio navigator was heard: "Barajas tower. We have an ass in sight, just on the runway centre-line." The controller was now in doubt, since 'ass' also means 'buttocks' in English, and of course requested confirmation. "Yes sir, yes. One animal, one horse or cow, in the middle of RWY 33," replied the Russian. "Ahhh! one donkey!" replied the controller. The CU652 without continuity announced: "We miss the approach and go around." The controller transferred the flight to the approach frequency for what would now become an arrival on RWY 01.

Out of the tower window, the outline of the donkey could now be distinguished just before the intersection of the two runways, and the arrival of a vehicle with three marshallers, who tried to move it by means of the rope hanging from its neck. However, the spirit of this particular donkey, combined with the well-known stubbornness of all donkeys, defeated their attempts, and the animal proved impossible to capture. They were now joined by two agricultural-type tractors, normally used for grass cutting, together with more personnel. They finally managed to get close, tie the rope to the back of the tractor, and drag the donkey clear of the runway.

The CU652 landed without further event on RWY 01, perhaps still with vision of the stray donkey in his mind. As for the animal, its fate is unknown, but the reason for its adventure was clear. The airport perimeter fence, admittedly in somewhat poor condition, easily allowed the local people to take their donkeys, horses, goats, etc. down to graze in the green areas. All the animals were, of course, restrained by a rope tied around the neck with its other end attached to an iron stake driven securely into the ground, The airport 'enclosure' also provided for pleasant diversions, hunting the perennial airport tenants, such as rabbits and hares, whose activity also made an interesting spectacle for airport employees, pilots, and passengers. Besides the wildlife, families also came in summer to picnic, and young lovers too. Everyone enjoyed being inside the fence, in the green surroundings sheltered by small pine trees. It was another world!

Once again, we see the importance of not assuming that all will be 'normal'... expect the unexpected.

EXPECT THE UNEXPECTED!

Madrid ACC in the 1970's

There are situations which repeat themselves and even though they were dealt with long ago, they are still remembered as events which characterised particular traffic scenarios and especially the quiet times, which are so different from busy periods

To orient ourselves, it happened in the old Madrid FIR/UIR west sector, the space between the VOR/DME 'NVS', VOR/DME 'ZMR' and VOR/DME 'STG'. It was usually quite busy between 0700 and 0830. The sequence varied little from day to day, but more than once, it went more or less like this:

- Flight IB952 from KJFK, destination LEMD, passing STG, in radio contact with the Zamora Radio relay station and later with LECM (ACC Madrid) when the RTF range allowed.
- Flight AO117 from LEMD, destination LEVX, with an ETA between 0750 and 0830.
- Just at, or a few moments after, shift change, on the night-to-morning change, the ATC service in the West Sector was procedural - no radar was available.
- IB952 requested descent either directly or via the ZMR relay, and was accordingly cleared to FL130 or FL 150 at its discretion.
- The enormous western sector of Madrid ACC was still without any other traffic.
- The atmosphere was calm and relaxed; one sector supervisor entered as another left. Conversations and comments were about shift events or with the supervisor or with adjacent sectors for updates.
- Shortly afterwards, AO117 made initial contact with destination Vigo, overflying VOR/DME NVS and climbing to FL130.
- The shift remained calm without any further flights. It was monotonous, even boring.
- After a while, AO117 wanted a higher level and here began the sequence which has been so often repeated and which appears more like a witches web of human behaviour with its factors (now so fashionable) based on simple mistakes or misunderstandings.
- AO117 was cleared to climb to FL 170 as in the flight plan.

And there it was, the conflict with IB952 descending to FL130 or FL150. We should point out that there were variations in these crossing conflict events. At times, it was the IB952 which was cleared down to FL130/150, while the AO117 climbed to FL170, and on other occasions the Zamora Radio Relay Communicator acted like a controller, "taking into account that one of the two aircraft had passed over his VOR" and issued a re-clearance on his own judgment.

Although statistics about these events were never compiled and they were relatively infrequent, they did keep happening in the western sector.

Pedro Contreras Blanco
retired after working as Air Traffic Controller, Iberia Air Flight Dispacher, Flight Operations Regional Manager in South America, Montreal and Nairobi, PANS-OPS expert, ICAO OCP-IFPP, and Spanish AENA Safety Manager from 2000 to 2007.

Many supervisors and flight crew still remember them to this day.

While we could cite a larger number of often more complex examples, our simple repeated case is a valuable, if modest, lesson to the effect that we must learn from our mistakes. Human beings, with all their complexity, sometimes generate situations which, if left uncorrected, could escalate into serious incidents affecting safety. Nobody should turn their back on the traffic display or fail to remain aware of traffic movements in relation to constraints. Continuous attention must be maintained. It is necessary to always remember that many incidents happen at times when workload is light. That is when the mind becomes relaxed and one can lose the focus which our role demands.

So, instead of waiting until a difficult situation develops, we should remain vigilant – and please, always expect the unexpected !

Airbus altitude capture enhancement to prevent TCAS RAs

By Paule Botargues, Airbus Engineering – Automatic Flight Systems Department

In a context of continuously increasing traffic, analysis of EUROCONTROL reports and airline feedback leads to the finding that more than half of RAs triggered by TCAS systems in RVSM airspace are due to current tuning of altitude capture control laws.

Paule Botargues

works in the Engineering Automatic Flight System Department of AIRBUS France. She is in charge of the multi-program development of the AP/FD TCAS Mode and also of research activities for the auto flight system.

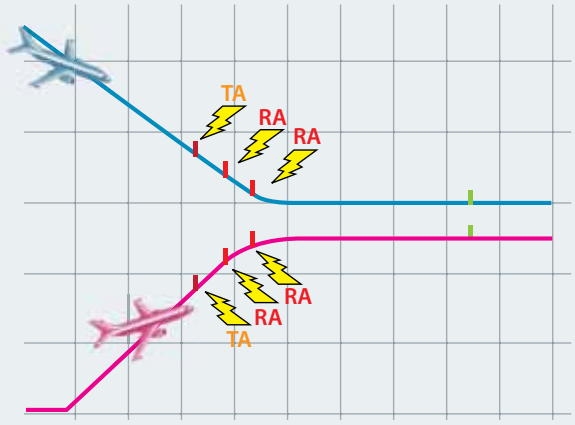
Indeed, in a situation of level-off encounter (i.e. an aircraft capturing with another one levelled 1000ft beyond the intended capture level), the TCAS system ignores aircraft objectives. It anticipates conflicted trajectories in a timescale which is less than RA-triggering thresholds due to the high vertical speed rates reached with current altitude capture control laws. Those RAs are judged operationally "nuisance", since from a crew's viewpoint, the job has been done correctly.

Although considered a nuisance, those RAs have to be followed, leading to traffic perturbations and stressful situations.

A new safety initiative has been launched by Airbus in response to airline requests to resolve this issue of nuisance RAs occurring during level-off manoeuvres. The objective of the so-called "TCAP" developed function is to reduce the number of these RAs by providing a new altitude capture control law, which "softens" aircraft arrival at a selected flight level in the presence of air traffic.

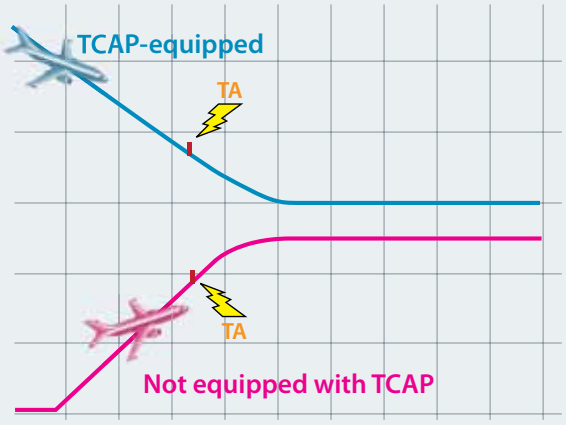
The expected benefit from the new Airbus solution is a prevention of almost 100% of nuisance RAs occurring during level-off manoeuvres for TCAP-equipped aircraft.

This new altitude capture enhancement will be available on the A380, A350 and other Airbus fly-by-wire aircraft in the near future.



Classical ALT → 2 RAs

BEFORE



New ALT → No more RA

Benefit for the non-equipped a/c also!

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Airspace infringement: sudden & unexpected

By Nikolay Iotchev, BULATSA

Rather than look at how airspace infringement (AI) affects the controller's job – safety, workload, capacity, etc. – I will instead illustrate by examples some of the types of AI which our ANSP experiences. It may be that your 'usual' experience of AI differed from ours.

If so, some of our AI types may not be so common and might be a surprise if they were to happen to you. So now you can read about them first, and if you do experience them in the future, then you will have 'seen them before' here!

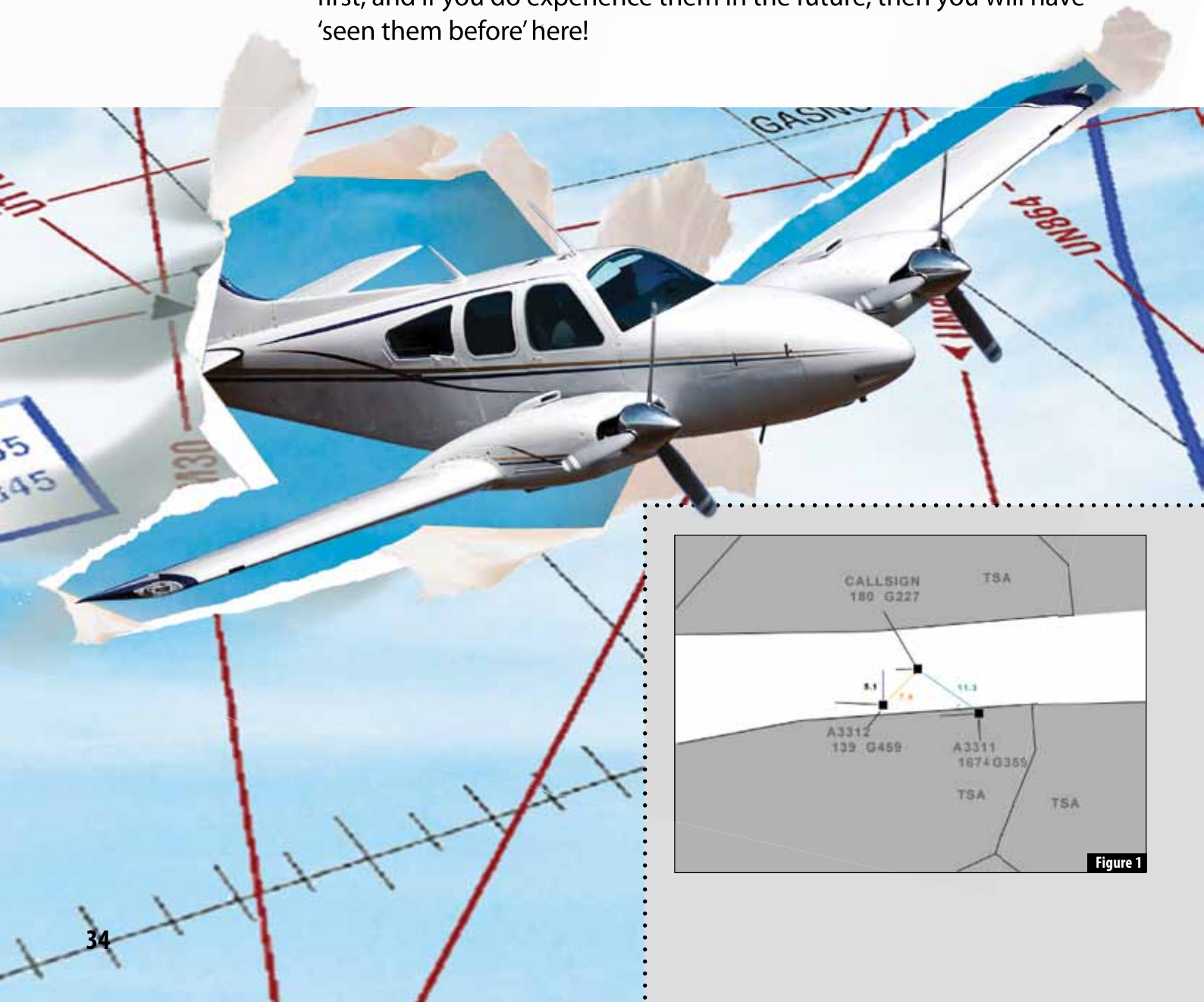


Figure 1

Nikolay Iotchev

has been working with Bulgarian BULATSA since 1994. Started as FDO (flight data operator), worked ad Tower Controller, and now holding licence for en-route controller. Current he is BULATSA Head of Safety Department.

We controllers like to think that pilots infringe airspace and that we are there to help them not to. Why is that? Because we do our best to keep the traffic under our control from entering unauthorised airspace in the form of temporary segregated areas (TSAs), danger areas (DAs), prohibited areas (PAs) and restricted areas.

To help us in our task, our ANSP provides us with area proximity warning (APW), which is fully integrated in our radar system. Does it help us to succeed every time? Not really.

Our APW works by warning the controller when their own traffic is about to enter a TSA or other restricted airspace rather than the other way around. Up to now, however, it does not warn a controller when traffic not being controlled by our unit enters our controlled airspace. Most of the time for us, such intruders are military aircraft from the national air force. Because there is no radio contact, their behaviour is unpredictable and poses a danger if there is civil traffic nearby. What separation should our controllers aim to apply when this happens?

Our APW works by warning the controller when their own traffic is about to enter a TSA or other restricted airspace rather than the other way around.

We have a regulation which stipulates the separation minima between controlled traffic in terms of the minimum horizontal or vertical distance but does not and cannot lay down any rule for infringements, so we must 'do our best' to achieve safe separation even if it turns out to be less than it would be if both aircraft were under our control.

Our situation is made worse by the fact of airspace designation. TSA horizontal boundaries come as close as 6 miles to controlled airspace used as civil air routes. Until recently, we were required to maintain a minimum horizontal separation of 10 miles between civil aircraft under our control below FL245, which meant that it was possible to have less separation than this between a civil aircraft in the airway and a manoeuvring military aircraft in a TSA without needing an AI to occur! Have a look at Figures 1 and 2.

However, since March 2010 we now apply only a 5-mile minimum horizontal separation above FL095, so this particular dichotomy in separation standards has been 'fixed'. See Figure 3.

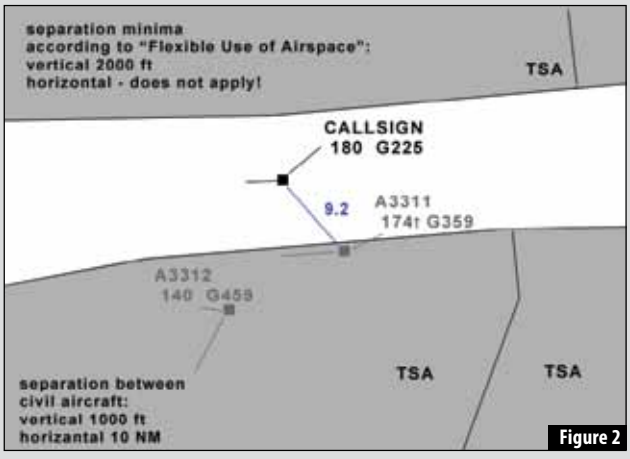


Figure 2

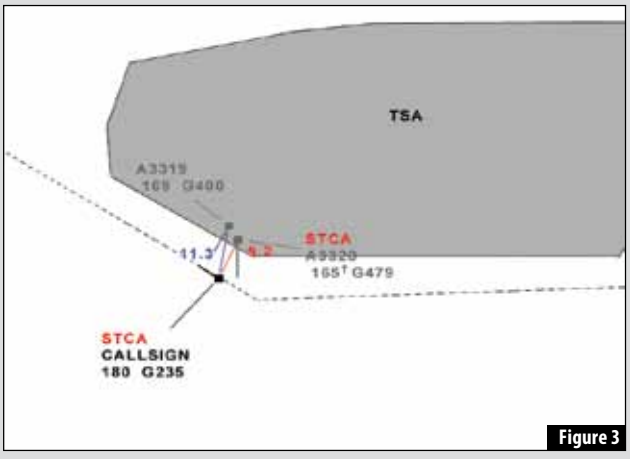


Figure 3

Airspace infringement: sudden & unexpected (cont'd)

LET US LOOK AT SOME MORE EXAMPLES OF AIs FROM OUR EXPERIENCE:

Controlled civil aircraft enters TSA or a danger, prohibited or restricted area

A summer day with a lot of big Cb build-ups making tracking the airway centre-line difficult for civil traffic leads to lots of requests for deviation.

Poor communication between two sectors on transfer meant that the transferring sector was unaware that deviation requests were likely ahead and agreed with the military authorities the activation of a TSA requiring a minimum overflight altitude of FL250 when the traffic being released was at only FL200. A transfer to the wrong frequency was then inadvertently given - thus wasting precious time - and as a result a passenger aircraft entered an active danger area at FL200 with neither the (correct) receiving sector or the aircraft being aware of its existence. APW, although activated, provided no practical help. See Figures 4 and 5.

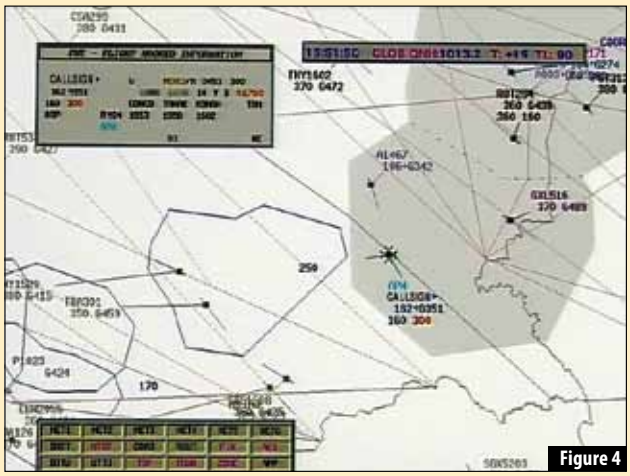


Figure 4

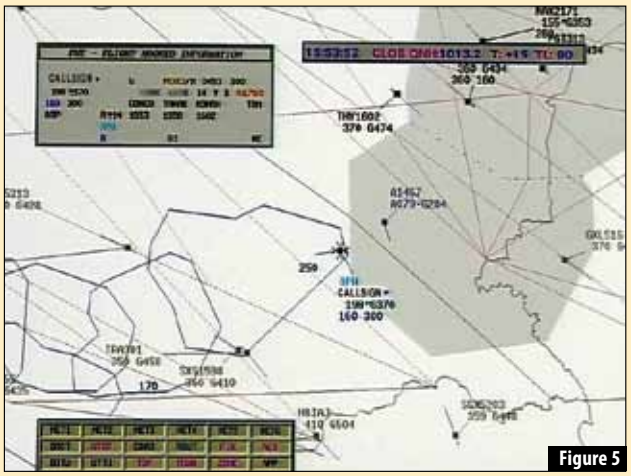


Figure 5

Military aircraft working in a TSA enters nearby airway horizontally without clearance

This is relatively easy to see coming if a careful watch is kept on the TSA boundary and returns (radar symbols) from military traffic near the edge of it - it is relatively easy to see when a military aircraft has left the TSA even though we have no APW protection.
See Figures 6 and 7.

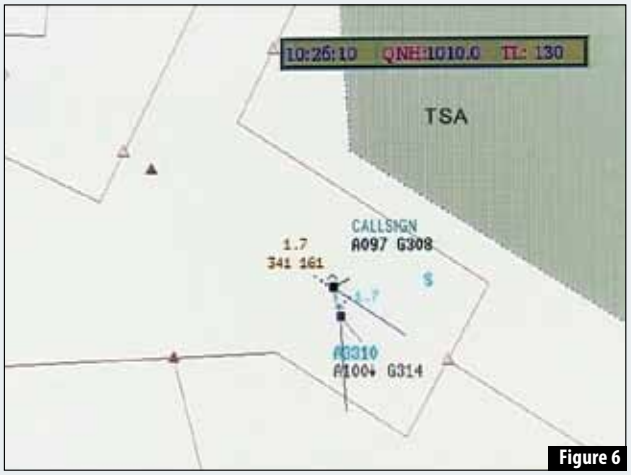


Figure 6

Military aircraft working in a TSA enters nearby airway from above without clearance

A breach of an upper boundary is much harder to detect than a horizontal breach. Loss of separation is a real risk. See Figure 8.

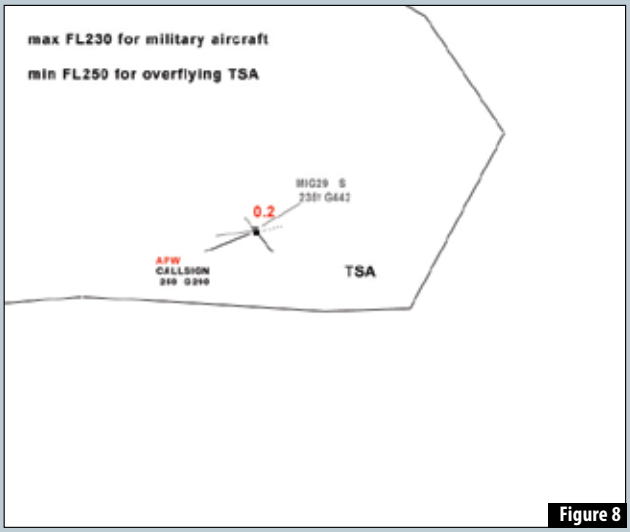


Figure 8

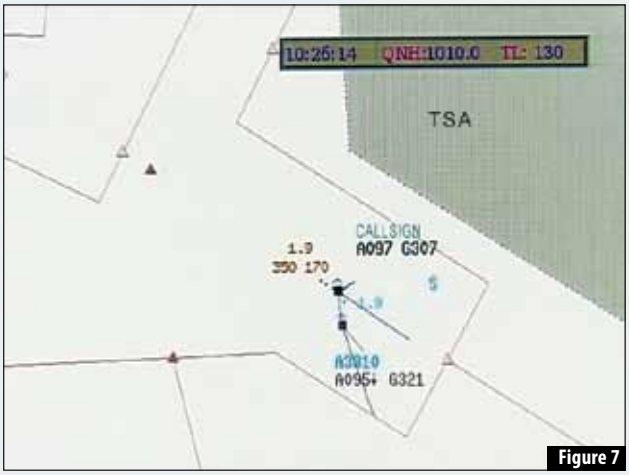


Figure 7

A totally unexpected intruder

Unlike military aircraft, where the potential for an incursion is known to exist whenever they can be seen manoeuvring nearby, we sometimes see primary returns entering our airspace not only with no radio contact and unknown intentions but also with no SSR return. This type is scary. You know that an aircraft is in 'the vicinity' but you do not know exactly where. We controllers do not like uncertainty, we want to be sure, and in this case, the only way to do this is to try and create an outsized safety buffer in case the intruder actually is in our airspace, at whatever altitude. See Figure 9.

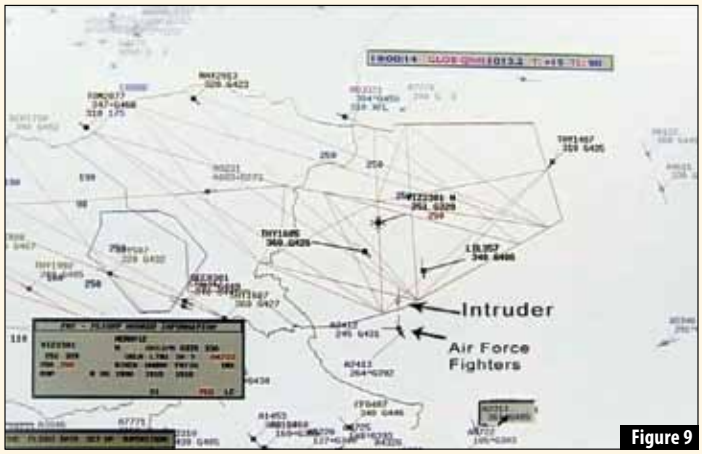


Figure 9

Perhaps it is usually different for you, but we often have our most difficult times during the summer at peak traffic periods when the weather is good enough for our military friends to have planned all their exercises, and perhaps good enough too to encourage a GA pilot from one of our neighbouring countries to visit.

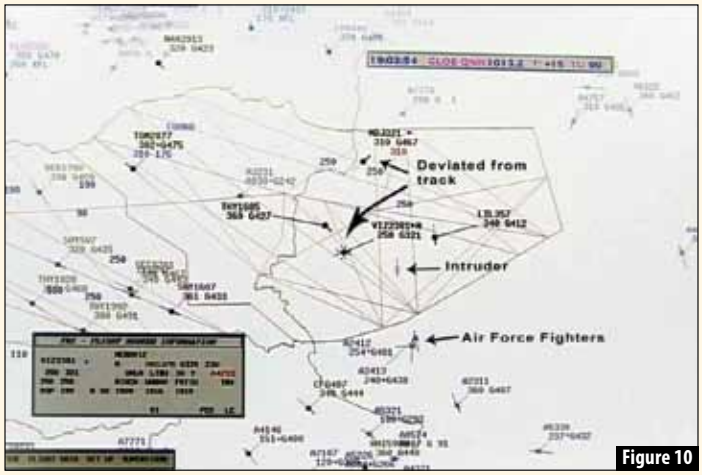


Figure 10

Getting the best out of APW

By Dijana Pasic

Airspace infringements remain one of the top safety issues. Whilst efforts are being made to raise pilots' awareness in order to minimise the numbers of airspace infringements, it is worth examining whether the ATC ground-based safety nets can play a better role in alerting controllers about airspace infringements.

In this article, I will look at different types of airspace infringement and how ATC ground based safety nets can be improved to provide controllers with alerts of airspace infringements before they occur.

So what could be done at system level to reduce airspace infringement events?

Currently, many ATC ground systems are equipped with a safety net that warns controllers in situations when aircraft are predicted to penetrate or have already penetrated a designated airspace volume without clearance. The airspace volume in question could be a restricted/danger/prohibited area or even designated parts of controlled airspace.

This safety net, depending on the implementation, is called Area Proximity Warning (APW), Danger Area Infringement Warning (DAIW), Restricted Area Intrusion (RAI) or Controlled Airspace Infringement Tool (CAIT). The alert is provided at the controller's working position and the resolution of the situation is left entirely to the controller's decision – there is no resolution advisory.

The APW can be used to warn controllers when an aircraft is about to infringe (or has already infringed) the designated airspace area. A typical example is a civil aircraft penetrating military airspace, see Figure 1, which can pose a significant risk to the civil aircraft and additionally to any aircraft operating within the military area.

Area Proximity Warning (APW):

Ground-based safety net intended to warn the controller of unauthorised penetration into an airspace volume by generating, in a timely manner, an alert of a potential or actual infringement of the required spacing to that airspace volume.

Ref: EUROCONTROL Specification for APW. Edition 0.5

Another concept of use of this safety net is to warn controllers when an unauthorised aircraft is about to infringe or is already infringing controlled airspace. A typical example is a VFR flight penetrating controlled airspace or a military aircraft leaving a military exercise area without clearance. Although in these cases the controllers probably do not have two-way communication with the infringing flight, sufficient warning time can enable them either to act on the flight under their control or to initiate coordination in regards to the infringing flight.

Some APW systems provide 2 different levels of alert with a different display for each level. For example, when an aircraft is about to penetrate a restricted area, the APW alert at the controller's working position could be displayed in yellow. When the aircraft has already penetrated the restricted area, the APW alert could be displayed in red - see Figure 1.

How does APW work?

APW uses surveillance data (including tracked pressure altitude information) and flight plan data to predict any potential airspace infringements. Either Mode C or Mode S data can be used to make a prediction in the vertical dimension. Environment data and parameters are used to define the airspace volumes and the parameters for alert delivery.

APW makes use of data from:

- the flight data processing system to determine which flights are eligible for alert generation using aircraft type and category of flight;
- affected sectors to display alerts to all controller working positions concerned;
- cleared /blocked flight levels – and manually entered flight levels if altitude information is not available;

Dijana Pasic

works at EUROCONTROL HQ as an Operational Expert, is involved in operational ATC safety net activities and is an active member of SPIN.
She has a background as an approach controller at Sarajevo airport, Bosnia and Herzegovina.

Figure 1

Defining:

the initial step of the lifecycle is the definition of roles and responsibilities (ideally a team that consist of operational, technical and safety experts) inside the organisation and the definition of the operational requirements of APW.

Implementing:

next step is taking a decision about the APW procurement. This phase is mostly performed by engineers and technical experts. System verification is performed either when implementing a new APW from scratch or when enhancing an existing APW.

Optimising:

the third phase is aimed at optimising the system in order to meet the operational requirements identified in the first phase. It also addresses validating the system before making it fully operational. This phase relies on close collaboration between technical staff and operational experts.

Operating:

When APW is considered to be validated or optimised, adequate training is provided to both Controllers and engineers. Once APW is fully operational, a set of parallel processes are put in place: Collection of feedback from Controllers, Analysis of Pilots/Controllers reports, Monitoring of APW performance and Maintenance. All this requires a close collaboration between operational and technical staff. Safety experts should also be involved, to ensure that the APW role is adequately considered in evaluating the whole safety performance of the ANSP.

Ref: EUROCONTROL Guidance Material for APW. Edition 1.0

Figure 2

- recorded aircraft RVSM status to determine the defined spacing from the airspace volume.

In addition to APW alerts, controllers are normally provided with information on the availability of APW. They also have the option to inhibit APW alerting for a specific radar track or group of tracks, e.g. one based on the SSR code group.

One of the most demanding tasks when improving the performance of any safety net is to achieve the best balance between the length of the warning time and nuisance alert rate. Increasing the warning time, depending on the conflict geometry, could create more nuisance alerts. On the other hand, reducing the number of nuisance alerts may result in insufficient warning time or even lead to some conflicts being missed. It is definitely not a one-off activity and it requires a team of technical and operational staff working together.

How does APW interact with other safety nets?

APW works in conjunction with the Short Term Conflict Alert. STCA alerts controllers in situations of potential or actual infringement of separation minima and so helps prevent collisions between aircraft, whilst the APW does this indirectly by predicting or detecting unauthorised airspace volume penetration. Very often, STCA is disabled within airspace such as restricted/danger/prohibited areas which are normally protected by APW so as to reduce the nuisance alert rate. For example, military traffic flying within a military area could create a lot of STCA nuisance alerts. In order to still help protect the surrounding traffic, the APW is activated in the segregated area and alerts occur for any departure from or penetration into that defined airspace volume.

Why do we need safety nets?

Even the best systems fail. Safety nets help prevent incidents from developing into significant incidents or even accidents, and serve as "another pair of eyes".

Can we improve APW performance?

Many controllers will have already had experience of APW and have probably sometimes had questions about its performance.

In order to get the best out of APW and improve its performance, it is important to follow a defined lifecycle. The lifecycle, see Figure 2, represents an ideal process to be followed by ANSPs to implement and maintain a satisfactory level of APW protection during normal operations.

The Safety Nets Performance Improvement Network Sub Group (SPIN) has developed the specification and guidance material for ground-based safety nets including Area Proximity Warning (APW). The documents are available at www.eurocontrol.int/safety-nets.

Tuesday lunch, my colleague and the new ATC system

By Svetlana Bunjevac

Over time, over budget, over-worked staff – why is this often the case when new ATC systems are implemented?

On returning from lunch at work or at training establishments, we often meet people who have attended our courses in the past. This was the case today, and I had a great chat with a colleague I met from a Member State which will be implementing a new ATC system relatively soon.

My colleague is a young engineer willing to contribute all his effort and knowledge to this new system, although he is witnessing things which he wonders about. For example, he has seen that (for the time being) there is not a single ATCO involved in the group which is working on implementing this new system. Although my engineer colleague has not been in our industry for very long, he saw a possible risk here. This reminded me of one of my own memories, so I told him about it, but I also believe many of you could continue the story.

Once upon a time, months and months were lost because of one sentence in a functional ATC system specification document. The sentence described, in a very precise manner, the technical requirement for cleared flight level (CFL) distribution through lateral and vertical sectors of the airspace concerned. The problem was that it did not make any sense operationally.The outcome, as already mentioned, was that more than a few months (for which, read euros) had to be invested into reworking it. Right from the start of our efforts, it was clear that involving both ATCOs and technical staff was going to be necessary to correct this sentence. It was a cunning plan, but we gave it a go, and yes - we started arguing right from the word go!

After a few "arguing sessions", in which we learned that ATCOs know nothing about the technical side of the ATC system and that technical staff likewise know equally nothing about the operational side, we took a short break. I would like to think that both "camps" used this break for reflection and that the subsequent intervention by our manager was not necessary. Anyway, the team continued to work on the project for many hours, with discussions which were not always easy, but eventually we managed to appreciate the differences in our expertise and to actually take advantage of them.

My colleague from the start of this article and I both thought that this is a lesson we have all been taught so many times, but it seems that we have still not learned from it. For both of us, the project plan discussions contained a sentence which we have heard all too often and felt was not quite right.

Svetlana Bunjevac

teaches in EUROCONTROL Institute in Luxembourg. She is former controller, OJTI and shift supervisor.

"At the start of system specification, having a mixed team will cause project delays, as engineers and ATCOs may spend time arguing how the system should actually work."

Are you sure that they'll reach a common language soon?

There are 3 potentially serious misconceptions in this sentence:

1. **The reference to "... will cause delays …" is to the start of a project, but experience has shown that delays are caused because the project requirements are not properly understood right from the start.**
2. **"… may spend time arguing …" suggests that we tend to see argument as a bad thing and want to avoid them. What is wrong with a healthy (non-threatening) argument if people need to clarify their understandings? Why not give it a go, collect all concerns and suggestions, use them when checking the system performance, and then move on?**
3. **"… how the system should actually work." Assuming it is bad thing, the two "camps" may start off from two completely opposite understandings of how it should work. Of course they will – one will have technical understanding and the other will have an operational understanding. This is certainly not a problem, as these are two essential aspects of any system which people will use.**

After we had had our talk about everything which I have written about above, my colleague said: "I am on the system development team and I have never been encouraged to sit next to an ATCO to see how they work. I will use my free day to do that next week."

I thought of this as a great initiative on his part, but I also thought that it should be a part of their project plan. At that point, both of us realised that we need to talk more about this before it turns into another case study with an unfortunate outcome. That is what I am trying to achieve with this article, and I also wish our colleague a safe and successful ATC system implementation.

Thank you for reading the article.

Aviation safety
an evolution of change

By Tom Lintner

Everyone who is involved in aviation, regardless of our roles, has always considered safety to be our first priority. Whether we are air traffic controllers, pilots, dispatchers, maintenance professionals or other members of the aviation community, our actions are driven by the principle "safety first".

Interestingly however, when we are asked, "is it safe?" our unanimity ends, since we all see safety in different ways. When I ask an aviation professional, "is your system safe?" the universal answer, after a pause, is "yes" followed very quickly by the comment "but it could be safer." When you ask the follow-up question "how would you measure that?" the answers become less definitive.

Since it is very difficult to manage something which you cannot easily measure, the quest for the "holy grail" of aviation safety metrics continues to be an ongoing challenge, but there are small victories being made along the way.

"Several months ago I had a flight with a student. We were operating out of a general aviation airport without a control tower. It was a one-runway VFR operation and we were holding short of the runway when an arriving Cirrus flew over the threshold. As the instructor pilot, I told my student to line up and wait, anticipating that the landing aircraft would exit the runway at the half way point of the 1500 meter runway.

This particular runway has a rise 500 meters from the threshold, and when an aircraft lines up, you cannot see the end of the runway. Now holding in position on the runway, we waited for the "clear of the runway" call from the Cirrus … and waited … and waited. Knowing that the aircraft must have cleared the runway by then, I told my student "go ahead and roll."

"Are you sure?" he said.

"Yes. Now roll."

"Roger."

As we approached rotation speed, concurrent with arriving at the top of the rise, we saw that the previous arrival, who had not cleared at the half-way point, was just exiting the runway at the very end, 1000 meters further down the runway.

My student, who I suspect was silently resisting the desire to say "I told you so," instead asked "is this a runway incursion?"

"Yes," I said, "now rotate."

I am relating this event not to show that instructor pilots make mistakes but as an example of how "safety is in the eye of the beholder" and to demonstrate the effect on how we try to measure safety."

As a former ATCO and regulator with the US FAA, I recognised this event as a textbook example of a runway incursion. Clearly, there were two aircraft on the same runway at the same time. If there had been an ATC control tower involved, it may have been a question of loss of separation, or not, depending on a number of rather complex rules.

From an aircraft operating perspective, however, and as the pilot in command of the flight, I saw no risk to the safety of either aircraft. As we rotated and lifted off, the previous arrival had cleared the runway. So was it safe? Did this single event derogate from overall system safety? What if there had been thousands of these types of events over time? What would that mean?

In a similar vein, let us look at it from an ATCO perspective. In the United States, as well as the rest of the world, there have been many examples of runway incursions of varying severity. As we all know, varying severity can mean various levels of safety.

There is one event I vividly recall since I was the tower (local) controller at La-Guardia Airport, one of New York City's three major airports. Arriving aircraft were landing on runway 22, and departures were using the intersecting runway 13.

There was a Cessna 172 waiting for a VFR departure from runway 22 intersection "G", which is half-way down runway 22. I had a G-2 on final for runway 22. My plan was to allow the C172 to depart after the G-2 had landed. For planning purposes, I asked "Cessna 123A, will you be able to take it out rolling?"

The pilot answered "roger, rolling!"

At that point, the G-2 was just over the approach lights. Meanwhile, the C172 started moving faster than I thought possible for a C172 on the ground. While I recognised that this was not going to be a pretty event to watch, I made the decision that the best thing was to do nothing except advise the G-2 of the traffic. Owing to the geometry of the runway and intersection and the speed of both aircraft, it turned out that the C172 lifted off just as the G-2

Aviation safety – an evolution of change (cont'd)

touched down about 1,500 feet before intersection Golf.

Was it a runway incursion? Yes. Was it a pilot deviation? Yes. Was it safe? Ah, a more complex question. Clearly it was not, but it is possible to argue that it was safer than trying to abort one take-off while sending another aircraft around with additional traffic overhead.

So again, we come back to the question of how we judge and measure safety.

The assessment of system safety from an organisational, or macro, level requires more than just one person's opinion or even one event. The determination of system safety involves a very complex mix of factors, including engineered assessments of runway distances and aircraft performance, weather conditions, the role of ATC, etc. In fact, too many to mention fully.

It also requires operational judgment, based on the experience of the operators and regulators of the system, to be factored into the safety equation. Determining the level of system safety requires a balance between the science of aviation engineering and the inclusion of the expertise of the human element within the system.

We must accept that not all mishaps are equal and even severity levels can reflect different levels of safety within the severity bands.

Several years ago, our industry started to look at the ATM system from a different perspective when we started to examine the degree of "risk" associated with an operation. In the United States, this was a significant change. Prior to that, we had focused principally on traffic volume and delays and how to handle as much traffic as possible. We looked at mishaps, or losses of separation as something to be avoided, and we judged the "safety" of an operation using our experience rather than a systemic approach to identifying and managing risk.

The framework of safety management systems, long applied in European operations, is still relatively new in the United States. While this move toward international standardisation bodes well for aviation, it still brings us back to how we measure safety. In the past few years, the SAFREP group within EUROCONTROL has been involved in the search for this methodology, and it has had significant successes recently.

One of those successes was the agreement that a new concept of representing safety data, called the Aerospace Performance Factor (APF), could allow an organisation to view data and make operational decisions on the basis of a combination of actual event data and expert judgment.

The APF is a graphical "translation" tool which can take the established key performance indicators (KPIs) for an operational unit, lay them out in a mapping mode to show the relationship of the KPIs to one other as well as their relationship within the larger system, develop weighting values for them, and finally use the 'balanced' data to populate the overall output of the system.

The mapping mode is referred to as the 'mindmap' and it provides a view of data elements included within the APF. In the case of the first EUROCONTROL APF, ESARR 2 data was used to

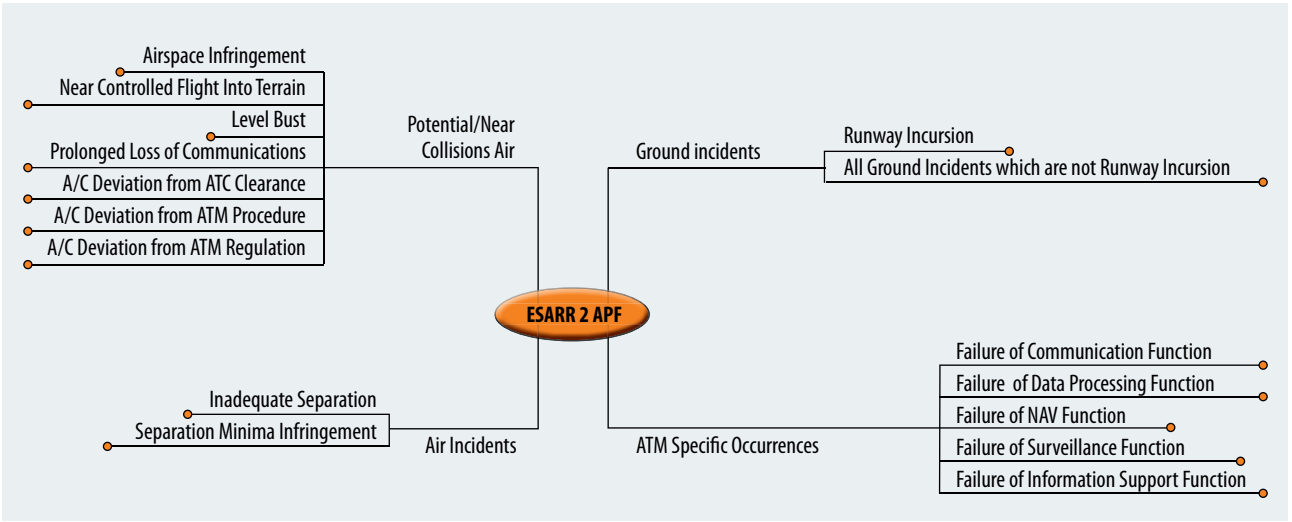


Figure 1

represent a macro level view of safety elements. Figure 1 shows the EUROCONTROL APF mindmap.

You can see on the figure that the "ESARR 2 APF" indicator for safety is influenced by certain elements; these are then influenced by other elements, and so on ... How can we calculate to determine the value for the indicator? We all know that in aviation, nobody knows better where the problems are and how big they are than the people facing them every day – the controllers, pilots, maintenance personnel, etc. This is why once the mindmap has been completed, subject-matter experts are asked to follow a structured process to aggregate their knowledge into a collective estimation.

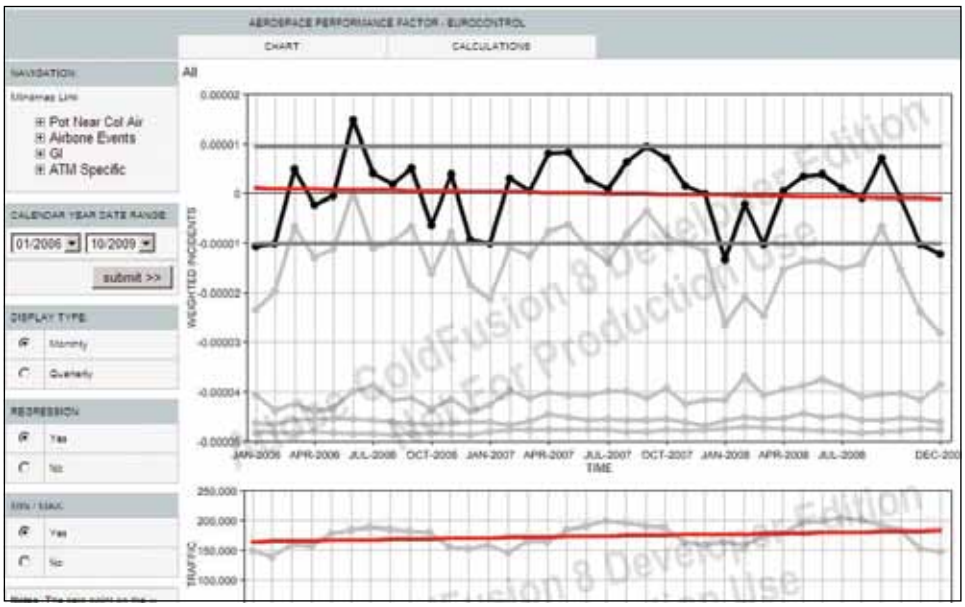


Figure 2

If one were to put the actual data on how often different events like "separation minima infringement" and "runway incursion" happen into the result of this aggregate expert view, then the result is an indicator like a stock exchange index.

If one were to put the actual data on how often different events like "separation minima infringement" and "runway incursion" happen into the result of this aggregate expert view, then the result is an indicator like a stock exchange index. This is pretty meaningless as a single measurement but capable of providing a very useful perspective as multi-criteria metric that offers a trend over time. Since the risk picture is changing constantly just like the view from a window onto a busy street, if you take a snapshot of the risk, it will not be the same immediately afterwards. APF allows the user to look at the busy street over time instead of constantly having just unrelated snapshots. Figure 2 above shows the initial EUROCONTROL ESARR 2 APF.

What, however, is the good of knowing that the risk is increasing if we cannot find out what the causes are and fix them? As we all appreciate, accidents in aviation are rare events, and one can more easily explain why it happened with hindsight (q.v.), but it is extremely difficult to predict where the next one is going to be.

APF helps by providing the ability to drill down into the data to determine what is causing a particular trend and, in time, may offer an ability to be predictive. APF output is user-specifiable. The graphical presentation shown in Figure 2 allows the user to see the overall performance (heavy black line) with a trend line showing the overall direction of change through the selected time period (solid red line).

Of course, the APF is not the "holy grail" of safety measurement, but it should provide a useful staging post in the continued search for that elusive goal, and specifically aid the development of a risk-forecasting tool to better manage the delivery of acceptable levels of safety.

Since the beginning of aviation, when the first safety measure was "did the pilot survive?" we have been striving to find tools to better measure, and thus manage, aviation safety. I believe that we are near the point where that breakthrough is possible, and I believe that this success could well happen in Europe because of the dedication of the joint efforts supported by EUROCONTROL's SAFREP team.

A Monday in October

By Bengt-Inge Hallberg

The traffic was standing still - an accident? The rain drizzled down the windscreen, but he did not switch on the wipers; he never did until the road ahead disappeared in a wet, dizzy scenario. It is like driving in an aquarium his wife told him, but he didn't care, it saved the rubber for the real rainy periods later...

Bengt-Inge Hallberg

Operational ACC-controller and Assessor at ATCC Malmö in Sweden. Previous teacher and course manager at SATSA (Swedish ATS Academy) and for ICAO in Jeddah Saudi Arabia.

This was his first operational shift for two weeks. He had been working as an Instructor at the ATC Academy for the last fortnight. It had been two great weeks with 8-5 work, motivated students, nice fellow instructors from other operational units plus the bonus of Christina in the Cafeteria, always looking good with a smile on her face.

The car park at the Centre was almost full. He had to walk more than fifty metres in the rain - the miserable conditions did not improve his mood.

The controllers entered the briefing room one by one, slowly, a few laughing but most of them quiet, very quiet. Although it was almost 2 o'clock in the afternoon they looked as if they had come straight from bed. Some of them probably had.

The supervisor started the briefing in his normal boring way: weather, runway configuration, staff situation. Finally he reminded everybody of some important and recent changes in local procedures. New ATS routes, new way points, changes in handover flight levels to the next FIR, updated software in the Centre's technical system etc.. "You can read it all yourself if you have not done so already", he said and closed his book in an unambiguous way. The briefing was over in less than five minutes and the staff left the room in the same sleepy way as they had entered.

Fortunately, he did not need to start working operationally immediately, instead he began to figure out all about the new procedures, especially the handover flight levels - he was always very careful to learn everything properly. Some of his colleagues just put a tick in the box without reading anything at all, completely inexplicable and certainly unacceptable he thought.

Changes in ATS procedures can be complex. But perhaps we should step back and look briefly at professionalism

The supervisor's voice came on the PA system; "open sector four", He discretely continued reading, an old controller trick to try to get someone else to work instead. He remembered a long time ago when he combined Tower and Approach; he told Tower he worked in Approach and vice versa. It worked until thirty seconds later, when the supervisor repeated the same message. He slowly made his way to the operational room, there was no alternative but to open up the sector.

He got a quick briefing from the sector three/four controller before the split was made. Suddenly, he got four aircraft on his frequency and then another one just airborne with three more waiting in the queue for departure. The first departure called, he cleared it to flight level 120. He instructed another aircraft to contact the next sector but there was no response, he tried again, but still nothing happened, another aircraft called instead. He turned towards the sector three controller "D-Line 868 is still on your frequency, send him here" He looked back at his screen. The departure was not turning.

Back in the coffee room he discussed what had happened with one of the other controllers; "Did you not know that the SID has been changed?", his colleague asked him. "Why did they not tell us?" he replied, "how could I know? I am just back from the Academy". A third controller joined in "It is always like that, how are we supposed to know all the changes?" When it's time to complain about management, controllers are unstoppable.

Two weeks later

There were five people in the room, three men and two women. The Chairman of the meeting, the Operations Manager for the Centre, exhaled loudly, stretched his arms high above his head and thanked the other four for their participation. "This airspace update has gone well, the changes have been smooth and efficient" he said and looked towards the others with the hint of a smile on his face; "Not a single incident report so far, congratulations everyone!"

Editorial comment

Of course, this story is about a common problem. Changes in ATS procedures can be complex. But perhaps we should step back and look briefly at professionalism:

- **Pre-shift briefings by Supervisors often seem to be intended to 'tick the box' themselves** - this one seems to have been like that….
- **Controllers, like pilots, arrive at work 'conditioned' by both large and small matters in their life outside work. In effect, they may walk through the door with a little personal 'baggage'** – a miserable autumn day may be enough to affect the attitude to work but it mustn't if you are 'fit for duty'
- **Controllers, like pilots, have a duty to keep up with changes that affect their work** - how can this be 100% ensured and professional helped with?
- **Controllers, like pilots, love to criticise their management, especially to each other** - nobody likes to blame themselves….
- **Managers must make sure that any issues or incidents which arise in the context of a change management process lead to lessons being learnt so that there is a much reduced chance of repetition** - it doesn't sound like that happened here…

(Probably) see and (possibly) avoid

By Stanislaw Drozdowski, EUROCONTROL and Harry Hutchinson, QinetiQ, UK

The *see-and-avoid* principle is as old as aviation and is rather straightforward: the pilot conducts a continuous visual scan of the surrounding airspace in order to detect hazards (principally other traffic) that might constitute a threat to his own aircraft. If a threat is detected, the pilot will then undertake an avoidance manoeuvre. This principle is applied successfully countless times every day, not only by pilots operating under VFR (Visual Flight Rules) but also when separation is provided by air traffic control.

See & Avoid

ICAO Annex 2 lays out 'The Rules of the Air', contained within which is the requirement that "An aircraft shall not be operated in such proximity to other aircraft as to create a collision hazard", and the statement that "It is important that vigilance for the purpose of detecting potential collisions be exercised on board an aircraft, regardless of the type of flight or the class of airspace in which the aircraft is operating…". The exercise of this vigilance, and the execution of any manoeuvres required for the purpose of avoiding hazards, is generally referred to as the 'See & Avoid principle'.

In this article we discuss the probabilities of the visual acquisition of other traffic and of successful avoiding action. The discussion is illustrated by a recent near mid-air collision[1] in UK airspace during which neither see nor avoid worked: the five crew members of a large military transport aircraft were alerted to the presence of a small single-engine aircraft but failed to see it; the pilot of the small aircraft saw the military aircraft but his avoiding manoeuvre did not prevent close proximity of the aircraft.

The terms "see" and "avoid" are habitually mentioned together. The implication is that the former leads inevitably to the latter: that a threat once seen will be successfully avoided, but this is not necessarily the case. "Visually acquiring" a threat does not guarantee that the threat can be avoided. For example: the threat may be seen too late for any successful avoiding action to be taken; an adverse manoeuvre by the threat may hinder the avoiding action; or a misperception of the relative position and motion of the threat may result in an ineffective avoidance manoeuvre.

Experience and anecdotal evidence suggest that the see-and-avoid prin-

TCAS

The Traffic Alert and Collision Avoidance System (TCAS) comprises airborne avionics that detects and tracks nearby aircraft through their SSR transponders. The relative position of these aircraft is displayed on a cockpit display of traffic.

- **TCAS I is a basic form of TCAS that provides Traffic Advisories (TAs) alerting the pilot to aircraft that may constitute a threat to his own aircraft. TCAS I is not mandated in Europe.**
- **TCAS II is a more capable system that in addition to TAs provides Resolution Advisories (RAs) telling the pilot how to regulate of modify his vertical speed in order to reduce the risk of collision with the conflicting traffic. In encounters between two TCAS II aircraft the sense of the RAs is coordinated. TCAS II is mandated for medium and large aircraft in Europe.**

ciple usually works successfully in the case of slow moving and low-flying aircraft, but that its application becomes more challenging in the case of faster and/or smaller aircraft. Due to their speed and size, these aircraft are difficult to see and visual acquisition may occur too late to allow for any successful avoidance manoeuvre.

The chance of visual acquisition (and therefore the chance of a successful avoidance manoeuvre) increases if the pilot is aware of the presence of the potential threat. This awareness may come from traffic information provided by ATC or from observing other aircraft on a cockpit traffic display such as those provided by TCAS equipment.

A recent study conducted by QinetiQ for EUROCONTROL quantified the chance of visual acquisition, by implementing a simple mathematical model. The model takes account of the geometry of the encounter (the aircraft speeds and the angle of approach of the threat), the size of the aircraft, the visibility conditions, and whether the pilot has been alerted to the presence of the threat. The probability of visual acquisition was calculated for numerous and diverse illustrative encounter scenarios and readers who are interested in the detailed results are invited to consult the study report[2]. The study was conducted in a specific context (viz. the introduction of very light jets), but its finding are universally applicable.

The study concluded that the TAs generated by TCAS I can undoubtedly aid visual acquisition, being most effective against large and slow moving threats. However, in head-on encounters against smaller threats (GA and light jets), or fast moving threats (military jets), visual acquisition is particularly ineffective: the small size and high closing speed of the threat mean that there is virtually no prospect of timely visual acquisition, even when aided by a traffic display. Furthermore, the effect of reduced visibility markedly decreases the prospect of timely visual acquisition in all encounter geometries (even when the visibility is above the threshold for VFR).

Paradoxically, the increased chance of visual acquisition afforded by TCAS I equipment can have a potentially adverse effect in some encounters. If the threat is TCAS II equipped there is a significant chance that an avoidance manoeuvre based on visual acquisition will be initiated at about the same time as an avoidance manoeuvre in response to an RA by the threat. In these circumstances there is no guarantee that the two avoidance manoeuvres will be compatible and they may hinder each other, thus failing to resolve the risk of collision (if both aircraft were TCAS II equipped then the vertical sense of the RAs generated in the two aircraft would be coordinated so that the aircraft execute compatible avoidance manoeuvres).

See-and-avoid is effective in the majority of cases. Because of that its inherent limitations are often forgotten. Any failure of see-and-avoid where it is the sole means of collision avoidance may have very serious consequences. While probability calculations provide mathematical insight into the efficacy of see-and-avoid, the analysis of an incident in the UK serves as an illustration of its limitations.

Stanislaw Drozdowski

is an ATM Expert at EUROCONTROL HQ in Brussels, working in the area of ground and airborne safety nets. Previously, he worked as a system engineer with Northrop Grumman and as an Air Traffic Controller in Poland and New Zealand.

Harry Hutchinson

is an ACAS expert at QinetiQ in Great Malvern. Harry trained as a physicist at the University of Bristol and moved to RSRE (which has since become part of QinetiQ) to work on semiconductor physics, before moving into the field of ATM research.

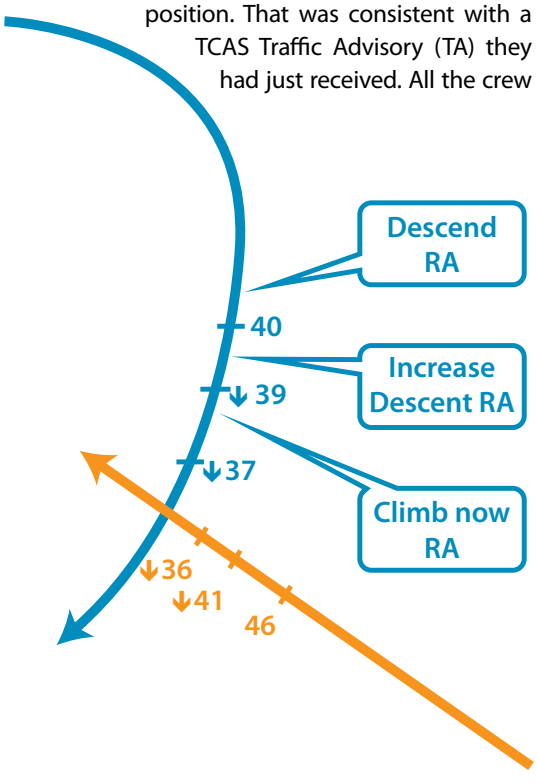
1- Near mid-air collision is defined in TCAS Technical Standards as an encounter in which the horizontal separation between two aircraft is less than 500 feet (0.08 NM) and the vertical separation is less than 100 feet. It is not defined operationally by ICAO.
2- The results of the Illustrative Probabilities of Visual Acquisition study are available from: www.eurocontrol.int/msa/gallery/content/public/documents/AVAL_Illustrative.pdf

(Probably) see and (possibly) avoid (cont'd)

The incident occurred during daylight in good weather conditions (scattered clouds, visibility 20 km) in Class G airspace. The events that led to the incident and the role of ATC are not described here, as they are not relevant for the topic of the article.

The aircraft involved were a single-engine Glasair RG flying under VFR and a large military transport aircraft, a C17 Globemaster III, on an IFR flight. The Glasair pilot was flying solo cross-country. His aircraft was equipped with a Mode S transponder but no TCAS. The C17 crew consisted of 5 people and the aircraft was equipped with TCAS II. The aircraft was painted in grey and had its high intensity strobe lights switched on.

The C17 was in a holding pattern at FL40, turning onto heading 220° at 230 kts, awaiting an approach clearance. The crew was advised by ATC of traffic 500 feet above in their 10–11 o'clock position. That was consistent with a TCAS Traffic Advisory (TA) they had just received. All the crew members started to search for the traffic. They were able to focus their visual scan to the relevant area by observing the target on the TCAS traffic display and having the benefit of ATC traffic information. Still, none of the 5 crew members saw the Glasair. Some 10 seconds after the TA, when the separation reduced to 2.2 NM and 500 feet a sequence of RAs was issued by TCAS II to the C17 crew: first "Descend", which strengthened to "Increase Descent" 7 seconds later, reversing after 2 seconds to "Climb now". At this point the separation was 1.2 NM and 200 feet.



If both aircraft are TCAS II equipped then the RAs are coordinated to ensure that manoeuvres are compatible

The Glasair maintained FL45, flying heading 307° at 170 kts when the pilot saw a conflicting aircraft for the first time. It was at his "one-thirty" position at a distance of 1–2 NM, crossing from right to left. He could not judge the exact distance as he did not know the type (and the size) of the other aircraft. The Glasair pilot assessed that the conflicting aircraft was in level flight at the same altitude. Being fully aware of Rules of the Air, he knew that it was his responsibility to keep clear of the other aircraft and he thought he had enough time to do so. He decided to descend, rather than turn, as he wanted to keep the other aircraft in sight. As he approached the C17 it started to descend in response to a TCAS RA and the Glasair was forced to increase his descent to high speed dive (over 3000 feet/min.) in an attempt to maintain separation.

During the RA manoeuvres the C17 crew continued their effort to acquire the traffic visually. It was only during the climb in the response to the "Climb now" RA that they saw the Glasair passing directly beneath them.

The subsequent investigation conducted by the UK Airprox Board[3] established that the separation between the aircraft at Closest Point of Approach was 26 feet vertically and 0.05 NM (92 metres) horizontally. To put these numbers in perspective: the height of a C17 is 55 feet and the wingspan is 52 metres.

In conclusion, the exercise of the see-and-avoid principle is part of good airmanship and should be conducted whatever the type of flight or equipage of the aircraft. The probability of acquiring the threat visually and performing a successful avoidance manoeuvre is influenced by the geometry of the encounter, visual conditions, and the size of the threat. Ironically, increased probability of visual acquisition of a threat brings with it an increase in the probability that the two aircraft will potentially perform incompatible avoidance manoeuvres (especially true if one of them is following a TCAS RA). If both aircraft are TCAS II equipped then the RAs are coordinated to ensure that manoeuvres are compatible. Model based studies and incidents such as the one discussed here highlight inherent limitations of see-and-avoid in certain circumstances, even when the pilot is alerted to the presence of other traffic and an avoidance manoeuvre is performed.

3- UK AIRPROX Report No 2009-044, available as pages 43-48 at: www.airproxboard.org.uk/docs/423/UKAB2009-09AssessedAirprox.pdf

Another war story

By Volker Stuhlsatz

It has been more than twenty years since IFR traffic sometimes deviated from the Berlin Corridors into the restricted airspace of the old German Democratic Republic when encountering severe line squall CB activity.

In those days, there were no direct ATC communication or coordination possibilities with our East German colleagues, but these intentional airspace infringements due to "build ups" were obviously the lesser of two evils at the time and fortunately did not have any further consequences.

More recently a younger colleague of mine flying a light aircraft learnt about the possible consequences of an infringement, in the same part of the country a couple of thousand feet lower, under VFR. He was involved in an unintentional and brief infringement of restricted airspace not far from a control zone (CTR) and in close proximity (only one nautical mile) to a compulsory VFR Reporting Point. Despite measuring only one and a half nautical miles in diameter, this rather small exclusion zone has proved to have great potential for infringements because of its problematic location. In my colleague's case, he had been distracted by receiving important traffic information, which required an attempt to identify a possible conflict whilst looking directly into sun.

This incursion of a couple of hundred feet for maybe less than one nautical mile, without any safety related outcome was thoroughly pursued by the appropriate legal authorities. Two questions came to my mind. Firstly is such a tough legal reaction a useful way of helping counter the increasing number of airspace infringements and secondly, could this happen to me too? I already knew the answer to the second question! - Yes it could - it already has on at least two occasions. The answer to the first question is not so simple, but certainly over-use of the legal sanction could promote the undesirable habit of 'radio silence' as a means to reduce the availability of evidence for both identification and a possible prosecution.

Anyway, it seems to be rather a question of "when" rather than "if" it is also going to happen to another GA pilot. The idea of VFR freedom is not always associated with boundaries to that freedom. It can, and sometimes does, all go wrong, and can do so quite quickly.

Many of us recognise that a negative side effect of GPS is that basic navigation skills may well be getting rusty

To me, there seems to be many contributions to the current rise in GA airspace infringements in my part of Europe. Certainly, having sophisticated GPS navigation systems on board does not automatically mean that one is using them appropriately. A great variety of GPS equipment exists and has quite a range of different interfaces and menus. There are some flight schools who manage to have a different GPS installed in each of their aircraft…. Some pilots bring their own GPS devices but neglect the basics and find that the batteries are fading on the way home. According to Mr. Murphy, this will probably happen at a time you need your GPS most. I have even seen what I might describe as 'GPS Techies' juggling simultaneously with three GPS systems operating simultaneously - the one fitted to the aircraft, a personal hand held and a brand new PDA with GPS software. Confusion almost guaranteed!

Of course, many of us recognise that a negative side effect of GPS is that basic navigation skills may well be getting rusty – or perhaps are never really mastered properly from the start, if our

Another war story (cont'd)

license has been gained since GPS arrived on the scene. I heard recently that the effect of an unserviceable GPS system recently led to a Club plane having a prolonged lag only in the local traffic pattern.Even with in flight visibility which was almost unlimited, no one dared to leave home base without a serviceable GPS.

Imagine the possibility that we might have suffered from a long involuntary absence from flying, perhaps due to bad weather, winter time, professional or private engagements or just financial constraints. Time pressure might have led to a sort of abbreviated flight preparation and last year's VFR ICAO chart still looking new (as they haven't been used so far) and therefore considered to be somehow 'up to date' -after all they are at least from this century….. GPS start-up messages are usual quickly confirmed (what was that data base expiry date again?). The long and "user friendly" latest NOTAM list information is on board (in case of an official check it is always good to have the papers on board). Unfortunately we did not have the time to read them prior to take-off, or if we did we didn't understand them. Are we still planning or flying and prepared for it?

In the GA community there is sometimes a lack of appreciation of how to obtain an airspace crossing clearance from ATC. Perhaps not making the request early enough or maybe with poor R/T practice and particularly insufficient proficiency in standard ICAO language. Sometimes, too, GA pilots feel that their 'failures' attract a 'negative attitude' from ATC. With colourful moving map displays, some pilots are tempted to fly far too close to restricted airspace lateral boundaries, getting into interesting discussions with ATC as to where the boundaries are. And a breach of a vertical boundary defining the base of controlled airspace is easily made if an incorrect altimeter sub scale setting is selected.

A cross track wind component stronger than predicted or constant "interference" from other occupants of your aircraft, especially other pilots, has often created infringement potential. Once FIS called "descend immediately!" having noticed a near miss about to happen any moment. It turned out later that this part of the Class 'C' Controlled Airspace was delegated at that time of the weekend to exclusive glider use and, in the opinion of the controlling ANSP, it is not legally possible to have gliders and other VFR traffic operating in the same airspace at the same time.

Differences in air law between different European countries can add more complications

Differences in air law between different European countries can add more complications. A slightly premature use of the most liked and used 'DIRECT TO" GPS function after a VFR night departure provided us the other night with a free lesson on the national air law of our near neighbour which forbids VFR night flying. Luckily the aircraft engine didn't notice the sudden change in the legal situation and we were able to continue and safely exit the restricted area with only a verbal admonishment from the controller.

Late requests for a VFR crossing clearance, sometimes, but not always, the result of a busy frequency often lead to a "stand-by" from ATC. The waiting which then follows sometimes also leads to infringements. Maybe the aircraft track is simply continued in expectation of the requested clearance. Probably, technical solutions on board the aircraft like area proximity warnings are only of limited help due to the many nuisance alerts (perhaps flashing warning lights or instrument flags) which pilots routinely see a lot of and consequently tend to disregard.

Lack of situational awareness in relation to restricted airspace can occur at times of high cockpit workload, maybe due to challenging weather conditions, it may follow misinterpretation of charts, inadequate timing of clearances from ATC or just misunderstandings.

Perhaps ANSPs could help by looking at possibilities to modify airspace design and structures where repeated airspace infringements occur? In other words a 'hotspot' response similar to the approach successfully used to reduce runway incursions through the action of Local Runway Safety Teams?

Automated FIS could provide the activation status of special airspace and more resources devoted to FIS around major TMAs could provide help to VFR pilots with traffic information and airspace de-confliction advice. Maybe there would a benefit in improved availability of updated weather information to VFR flights whilst airborne. Airspace awareness could be improved through information briefing campaigns making use of the internet. Maybe there is also an opportunity to enhance proficiency checks and periodic refresher training for PPL'ers so that more attention is given to navigation and radio telephony communication skills.

Possible consequences of airspace infringement range from the presence of high performance aircraft too close for comfort to one's own aircraft, a loss

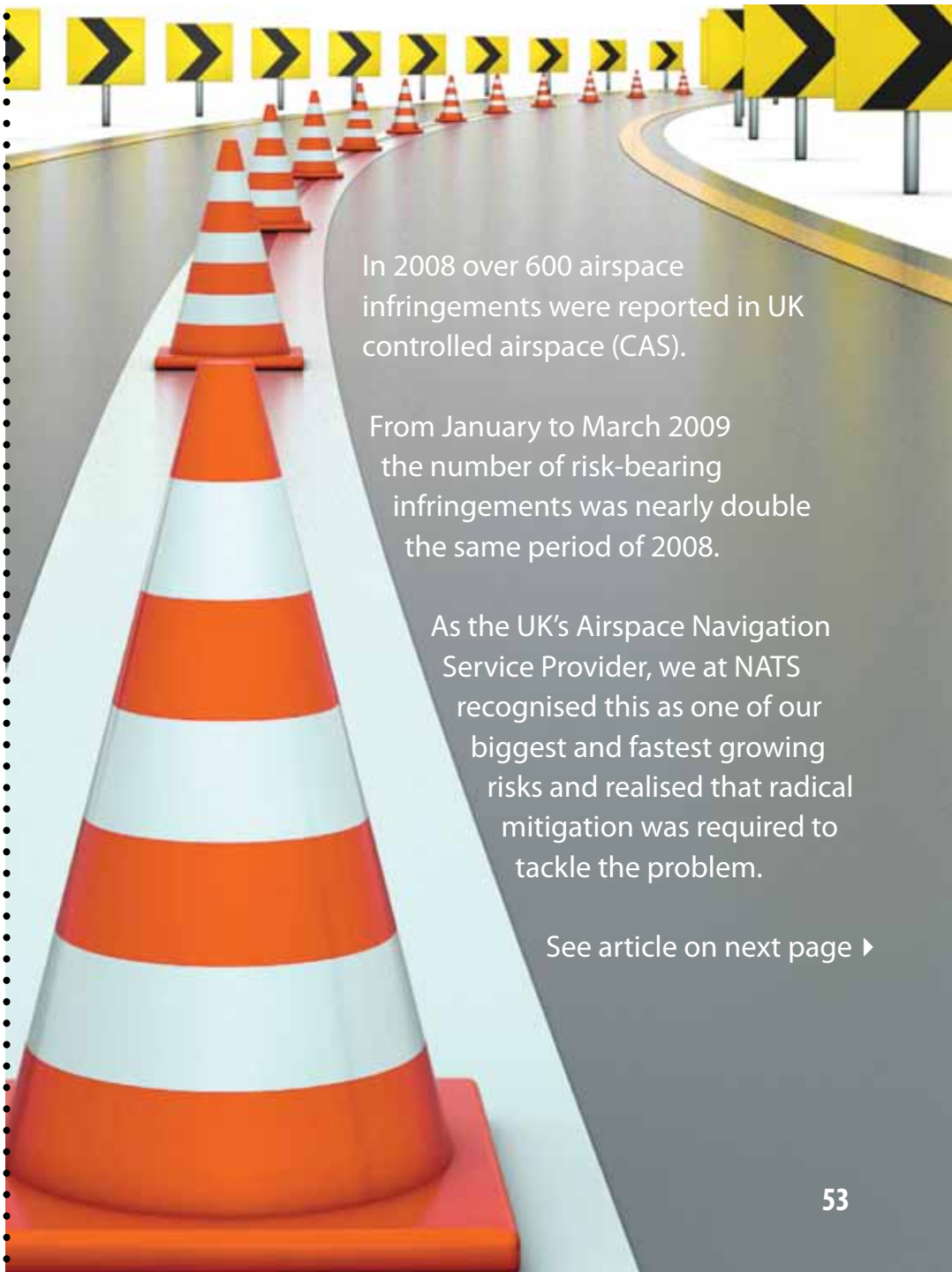
of separation, a disruption of flight operations with exposure to military hazards like firing and radiation, up to a mid air collision in the worst case. Consequences may also sometimes follow on the ground. There could be environmentally sensitive areas perhaps with the risk of serious hazard to vulnerable animals.

So we can conclude that improved navigation techniques and skills, whether map reading, radio navigation or GPS, the continuous use of transponders by VFR traffic and their continuous monitoring of FIS/ATC frequencies with the application of good radio telephony skills could all be important parts of the solution.

However, to deliver this, we need to have acceptable flight training standards amongst PPL Flying Instructors. A flight preparation offered by a Chief Flying Instructor at a local school to a touring group of his customers recently suggested routing right through an active parachute dropping zone, just outside the home base AT. A similarly poor example is teaching and demonstrating the use of A7700 as the international VFR squawk instead of A7000. And the still-encountered "old school" method of flying silently and invisibly with the transponder set to 'Off' or only to Mode A does not fit into our modern ATM world. And just when I think I have heard them all, it was suggested to me other day that it was possible "to fly exactly in the division of altitude between a CTR and a TMA at 2,500 feet", as this exact altitude would belong to neither of them……Unfortunately, there are too many people who believe in this kind of "war story".

Please try to remember some of the experiences of others before you… and have a safe and infringement-free flight with happy landings.

'Aware' - Preventing infringements before they happen



In 2008 over 600 airspace infringements were reported in UK controlled airspace (CAS).

From January to March 2009 the number of risk-bearing infringements was nearly double the same period of 2008.

As the UK's Airspace Navigation Service Provider, we at NATS recognised this as one of our biggest and fastest growing risks and realised that radical mitigation was required to tackle the problem.

See article on next page ▸

'Aware' – preventing infringements before they happen (cont'd)

The Controlled Airspace Infringement Tool (CAIT)

had already taken several measures to reduce the risk from infringements. Our Operations Analysts looked within the operation and beyond into the GA community to gain a picture of the needs and opinions of GA pilots. Our incident investigators focused on discovering some of the reasons behind infringements in UK airspace.

In the Terminal Control room, our researchers developed the Controlled Airspace Infringement Tool (CAIT) to assist controllers in detecting infringements by transponding aircraft. CAIT highlights an aircraft as soon as it infringes controlled airspace, and can display Mode-S data available for the aircraft. Our researchers worked together with operational controllers and specialists in human factors and safety to develop this simple yet effective tool that requires minimal training in its use. We have now developed this further by creating a primary radar multi-radar tracking version of CAIT.

Out in the community, we raised awareness of the issue of infringements within the UK CAA Airspace Infringements Working Group and within the Airspace Safety Initiative, which brings together representatives from NATS, the UK CAA, the UK Ministry of Defence (MoD) and GA organisations. We toured flying schools and attended instructor seminars and flying exhibitions, promoting an understanding of the safety implications of airspace infringements. In addition, we complemented these activities with a media campaign to communicate the issue, producing DVDs demonstrating the way to conduct VFR flights around the London TMA (which records the highest number of infringements in the UK) and best practice for GPS en route navigation.

Our research suggested that the two main causes of unauthorised airspace infringement were a loss of positional awareness and a lack of knowledge regarding controlled airspace boundaries and airspace changes. By March 2009, key people at NATS began to discuss a simple, low-cost yet potentially extremely effective tool to reduce airspace infringements; we could create a simple, affordable airspace alerting and positional awareness device for GA pilots. We believed that such a device, if used correctly, would help pilots ensure that they did not enter controlled airspace without being aware of its existence. Widespread use of such a device might prevent airspace infringements

at source, potentially averting serious breaches of safety and also reducing the need for costly mitigation in Terminal Control and at airports.

However this path would take the organisation out of its comfort zone and lead to our first endorsement of a commercial product. The partner that NATS chose for the development was Airbox Aerospace Limited, an innovative British company already making well regarded aviation GPS systems. Airbox were chosen both because of their experience and because of their shared belief in the value of improving GA flight safety.

The 'AWARE' requires minimal user input but gives a clear depiction of nearby controlled airspace relevant to the current altitude. It is a GPS moving-map device featuring clear audible and visible warnings of controlled airspace and other en-route hazards such as Glider launching sites and Parachute Drop Zones, relative to altitude and lateral proximity. The background maps used by the device are the standard ICAO 1:500,000 UK airspace charts which British pilots use when learning to fly. Airbox committed to selling the product at a modest price of £150 as a means of encouraging widespread adoption by pilots. Uniquely, NATS also committed to provide free monthly updates of the airspace definition to reflect changes to the UK Aeronautical Information Publication (AIP), ensuring pilots can keep their device up to date.

NATS and Airbox believe that by eliminating many of the perceived obstacles to buying and maintaining a GPS such as price and complexity, we have created a situation where pilots might ask not "why would I buy one?", but "why wouldn't I?" Information gleaned from customers at the point of product sale indicates that over 60% of customers were either not flying with any form of GPS or are flying with a GPS with an airspace warning more than a year out of date, prior to purchasing Aware.

Whilst NATS has pioneered this development with Airbox, and to a large extent created a whole new market segment for aviation GPS devices, it is NATS' firm intention to make the same airspace boundary information available to all equipment manufacturers in order to encourage up-to-date airspace information on all GPS devices to help reduce infringements.

NATS funded the product development but does not financially support the product manufacture or profit from any sales in the UK. We believe that the potential safety benefits delivered to us far outweigh the commercial opportunities to pricing the AWARE higher or charging for monthly updates. Ultimately, our core motivation is to improve safety by reducing infringements.

After approximately six months in development, 'AWARE' has been on sale since February 2010. It has achieved significant early sales success and created unprecedented interest within the UK general aviation community. Reviews in the aviation press and on-line forums have universally praised the product as a break-through for general aviation safety. The early signs are that our infringement numbers are down on last year's figures, and this is attributable to all of our initiatives. We believe that the AWARE has contributed significantly to this, both by maintaining the awareness of infringement avoidance with pilots but also by creating something new and innovative that is affordable and useful to them in actively avoiding controlled airspace. More information can be found at www.airspaceaware.com

Mark Watson

is head of CNS/ATM & Safety Research at NATS and has managed the development of several of NATS infringement initiatives. Mark is a Chartered Engineer and holds an MBA in Entrepreneurship & Innovation and has been with NATS since 1992, of which the last 12 years has been spent in R&D.

Kathy McColl

has been working in Safety Research for the last 4 years and is NATS projectmanager for the AWARE device, where she works in close collaboration with Airbox. Kathy has a background in software development at NATS and holds a Masters degree in Geographical Information Systems.

Jonathan Smith

is an operational London TMA controller and is NATS Infringements lead, involved in all aspects of NATS infringement prevention initiatives. Jonathan is also a private pilot, owning a Piper Cub, and it is his passion, breadth of experience and understanding of infringements, both from a controller's perspective and from a pilot's perspective, that helped shape the design of the AWARE device.

Supporting safety culture at MUAC with 'EUROSS'!

By Susanne Lanzerstorfer, Corina Buruiana, APAC GmbH

You are driving home and are in a hurry. It's quite late and the road is empty. But there are all these cross-roads with traffic lights, a safety measure which makes sense during rush hours when there is a lot of traffic...

You stop and obey the traffic rules, but you know that others simply look both ways to make sure it's safe, and then drive on. Since flashing amber lights would work better outside of rush hours, you're going to talk to the city planner about this. You are alone on the road and no one would know if you drove through the occasional red light... But you respect the rules. Why? Because you would know you were driving unsafely and unpredictably otherwise. You follow the safety rules not only because you must but because long ago they have became part of you and how you drive.

Everyone is expected to adhere to the rules in aviation and ATCOs, in particular, have quite a lot of safety rules and safeguards to follow.

But there is a difference between obeying because you must and between following the rules because you see why it's the safe and right thing to do. It's the difference between being part of a safety culture and a safety culture being a part of you – and the latter is the approach EUROSS (EUrocontrol Routine Observation Safety Survey) aims to promote.

This article outlines the main features of the EUROSS project based on interviews with the Project Owner, Mr Ralf Hölscher and with Mr Marco Kuelgen, one of the observers who has been involved in the Pilot Study, both of whom are from EUROCONTROL Maastricht where the Pilot Study has been running.

A lot has been done at Maastricht UAC to improve safety (investigations, occurrence reporting, safety assessments, safety promotion activities, etc.). EUROSS complements such initiatives with an ATCO-centric view of how to improve the safety culture: ANSPs need to make sure that all ATCOs are aware of their role and responsibilities in maintaining and improving safety. For example, they could try to improve themselves by observing best practices. According to Mr Hölscher, even re-considering current practices and challenging certain rules which might be obsolete may be of value to ANSPs. For ATCOs, the added benefit is that safety is increased and they have a lower risk of facing an occurrence or incident.

Background and methodology:

Similar projects throughout the aviation community exist already, but EUROSS is tailored to the specific needs of the controllers at Eurocontrol Maastricht (MUAC - Maastricht Upper Area Control Centre). It is based on the international NOSS (Normal Operation Safety Survey) standard and on UK NATS' own version of D2D (Day to Day observations). The project is supported by EGATS (EUROCONTROL Guild of Air Traffic Services) and by the organisational psychology department of the University of Duisburg/Essen.

Susanne Lanzerstorfer

has more than 15 years of experience in the area of aviation safety and SES, thus possessing in-depth knowledge of all aspects involved in ATM. She has supported EUROCONTROL, NSAs and ANSPs in the successful completion of multiple projects related to aviation safety. Ms Lanzerstorfer is a General Manager of the 'Qualified Entity' APAC GesmbH and a member of several working groups related to ATM.

Corina Buruiana

has supported EUROCONTROL in tailoring SKYbrary to its users' needs, thus gaining insight into the knowledge interests of ATCOs.

It is ATCOs themselves who developed EUROSS for ATCOs, in cooperation with the EUROCONTROL Human Factors group and the University of Duisburg-Essen. The latter contributed scientific knowledge and experience in this kind of project and Mr Hölscher added that they also acted as independent observers for work organisational aspects like coordination and communication. A specially designed observation sheet provided an easy-to-use framework / guide for Observers. To enhance the validity of the observations, a comparison was made to see whether pairs of two observers made similar observations (inter-rater reliability).

In practice, the working positions of a sector were observed in the OPS room for half an hour, during normal operations, by a team of 2 ATCOs and/or master students from the university specially trained for this purpose. The observed ATCOs participated in the project on a voluntary basis, and they could stop the observations at any point in time. The observers filled in the observation sheet which covered topics such as team interaction, working environment, information acquisition, and selected procedures.

Observation to avoid the need for Investigation

EUROSS is not a 'Big-Brother' exercise - it's an attempt to learn from ATCOs rather than just check whether they are doing anything wrong. The EUROSS pilot study benefited from an intensive communication campaign: announcements, posters, and especially personal communication. Even so, Mr Marco Kuelgen, based on his experience as an Observer, said that many ATCOs initially wondered what EUROSS was really all about, but after further explanations the project was well received. As a result, most of the ATCOs who were approached for the Pilot Study were willing to be observed and afterwards were very positive about their experience.

The collected data is kept confidential and de-identified results form the basis for a final report and for feedback to the ATCOs. Mr Hölscher stressed that despite the natural tendency to note errors, EUROSS focuses on positive aspects by using a scoring system to rate observations from 1 (lowest score) to 6 (best score). The objective is not to investigate deviations from the norms and rules, but to promote a 'cross-fertilisation' of good practices and an atmosphere of mutual learning.

Mr Kuelgen noted that the rating scale supported observers towards identifying positive aspects and good practices. The observation sheet used by observers contains figures and values to describe the behavioural factors, but the results of the observation sessions need frequently interpretation by the project team.. Mr Hölscher said that observations which, according to the existing procedures, may appear at first to be a poor practice, can, after interpretation, reveal that the related procedure actually needs to be reviewed...

Project Results and Outlook

The EUROSS Pilot Study is in its final stages. Although the full results were not available at the time this article was written, feedback so far has been positive from all parties concerned. The project team felt the study developed a valid and useful methodology, which was successfully tested. Feedback received from high-level management has also been very positive. The Head of Operations at MUAC, Mr Harald Matthes, expressed his appreciation for the fact that EUROSS has been developed from within the OPS team.

Mr Hölscher believes that EUROSS should be repeated in the future with the continued support of the University and extended to include other aspects such as OJT. The results of the Pilot Study will be presented to MUAC ATCOs and their feedback will be taken fully into account. EGATS intends to offer ATCOs a secure intranet forum as a place to share their views and learn from each other.

The EUROSS Pilot Study has helped to remind both controllers and management and the ATC community in general that they all have a common first priority: safety. The EUROSS has been an ATCO-centred project aiming to improve the safety culture among ATCOs with the help of ATCOs - truly a project by the ATCOs, for the ATCOs!

If you need to find out something about aviation safety, we suggest you go first to **www.skybrary.aero**.
It doesn't matter whether you are a controller, a pilot or a maintenance engineer, SKYbrary aims to have either the answer you are looking for or a direct route to it.

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Empty Field Myopia

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Definition

Empty field myopia (Empty space myopia) – a condition in which the eyes, having nothing specific within the available visual field upon which to focus, focus automatically at a range of the order of a few metres ahead. Detection of objects outside this restricted field of view is delayed and if an object of interest does enter the restricted field of vision, the determination of its size or range would be problematic.

Description

The normal function of the eye lens is to physically focus light from the object on the retina. To do this, the eye must be stimulated by an image. Empty field myopia manifests itself when the human eye is in a passive state of focal point adjustment, i.e. when there is no image (stimulus) for the eye to focus on, for example when the eye is either in complete darkness or looking at a bright empty field. If the eye lacks this stimulation, the lens shifts to a resting state.

Resting State of Accommodation of the Human Eye

In this condition, the eye is usually focused at an intermediate point (about 80 cm on average, although there are large variations up to few metres), thus the healthy human eye becomes myopic.

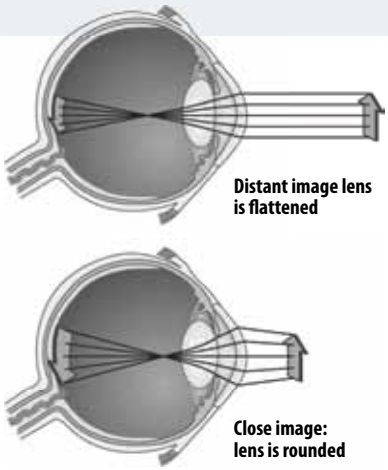

Figure 1. Adaptation of the eye - automatically reverses when whatever is being accommodated is removed. ***Image Source: Mosby's Dictionary of Complementary and Alternative Medicine. (c) 2005, Elsevier.***

Beyond the visual threshold the image of distant aircraft, whether seen in silhouette as a dark speck or relatively bright dot may thus be spread over a larger region of the retina and become an insufficient stimulus for the eye to focus on. Human factors studies show that a dot very close to the threshold size in an otherwise empty field could suddenly disappear because it was an insufficient stimulus to prevent the adjustment of the eye to assume its resting state.

Risk Scenarios

The higher risk probability is distributed among general aviation flights conducted outside controlled airspace (in airspace classes, E, F and G where VFR flights are not subject to ATC clearances), or any flights in such airspace and conditions with predominant see and avoid rules and where the ATC assistance to avoid loss of separation (LOS) is limited.

The list below consists of several identified conditions when the eyes often tend to revert to their natural resting state:

- in VMC, when the sky is featureless, visibility is 10 km or more;
- in very dark nights with no stimuli outside the cockpit to focus on;
- in hazy conditions when the optical properties of the atmosphere alter the appearance of aircraft and terrain;
- in bright light and glare when the flight is conducted in very sunny conditions over a cloud layer or due flight course set into the direction of the sun;
- flying over snow-covered and desert surfaces with predominantly featureless ground characteristics and over large bodies of water; the risk factor is especially high for low level inspection flights and military low flying assignments;

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- all the documents of the **Flight Safety Foundation Operator's Guide to Human Factors in Aviation**
- the largest collection of selected official **accident & serious incident reports** from around the world anywhere in one place online
- an expanding facility to **search ICAO document text.**

In future, we will be reprinting a **SKYbrary** article in each issue of **HINDSIGHT**. This time we have chosen something which can affect us all – **Empty Field Myopia.**

All of the above scenarios are associated not only with LOS but also with controlled flight into terrain (CFIT) risks. In these scenarios the visual detection of traffic and terrain could be hindered by empty field myopia and the healthy human eye can effectively become near-sighted. The danger could not become apparent until it is too late for evasive action.

To better illustrate the hazard of mid-air collision contributed by empty field myopia, it should be considered that the frontal area of the aircraft profile is small, an aircraft viewed directly from the front, especially flying a head-on collision course, shows little relative movement. This makes detecting the other aircraft by the pilot very difficult. See Figure 2.

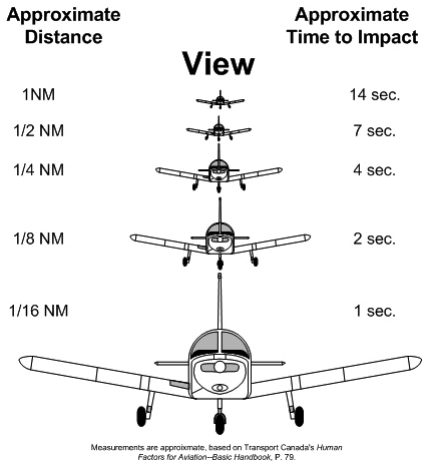

Figure 2. Relativity of distance and time to impact. Image Source: © 2007 David L. Parry, Langley Flying School

In addition an aircraft that has a high degree of contrast against the background will be easier to spot, while spotting one with low contrast at the same distance may be hard and sometimes next to impossible. (Figure 3)

Defences

To counter the weakened ability of the eye to maintain a distant focus, good practices are to:

- focus frequently on distant visible objects, on outlines of terrain at or near the horizon thus it helps to stimulate the eyes to establish long-distance focal points
- stimulate the eyes by focusing at own aircraft wing tips;
- consider flying above a haze/smoke layer if possible;
- It has been suggested than when scanning the sky for other aircraft use peripheral vision to detect movement. Peripheral vision responds better in terms of detection of weak stimuli associated with slight movement than the central vision.

Related Articles

- HF:Human Factors, Visual Illusions, Visual References.
- Loss of Separation: Loss of Separation (LOS), Collision Avoidance, Mid-Air Collision,

Further Reading

- Comments on Air to Air Visibility at High Altitude, M.J. Koomen, 1954, US NAVY, Naval Research Laboratory;
- Human factors in the training of pilots, 2002, Jefferson M. Koonce;
- Transport Canada's Human Factors for Aviation – Basic Handbook;
- Bennett and Rabbetts' Clinical Visual Optics, Ronald B. Rabbetts;
- Clinical Optics, Blackwell Publishing, Andrew R. Elkington, Helena J. Frank, Michael J. Greaney;
- FAA Advisory Circular 90-48C "Pilot's role in collision avoidance". Issued in 1983 but the content is still valid.

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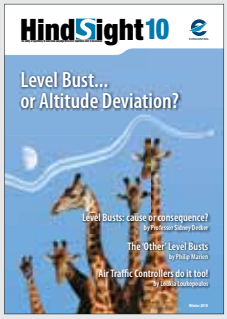

Next HindSight issue: Runway Excursion

EUROCONTROL

Putting Safety First in Air Traffic Management

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