HindSight 26

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

EUROCONTROL

SAFETY AT THE INTERFACES: COLLABORATION AT WORK

THE VOICE OF AN ANGEL
by Sidney Dekker

FROM EXPERIENCE REPORTS TO EXPERIENCE SHARING
by Erick Hoarau, Florence-Marie Jégoux and Sébastien Follet

COLLABORATIVE ADAPTATION IN A CONSTRAINED SYSTEM
by Don Gyles and Chris Bearman

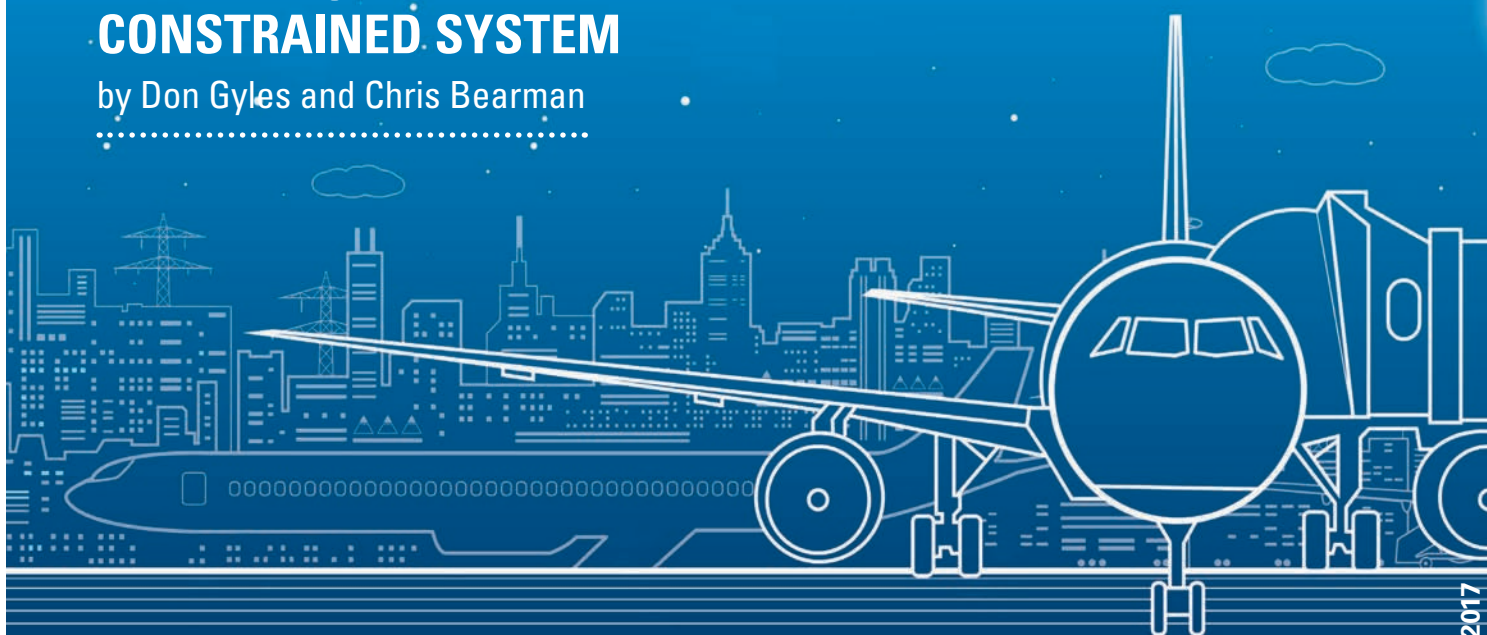## HOW FIERCE COMPETITORS JOINED FORCES TO MAKE OFFSHORE HELICOPTER OPERATIONS SAFER
by Gretchen Haskins

Plus much more on collaboration within and between organisations

Winter 2017

Dear readers,

The Network Manager works with 43 countries, over 500 airports and around 2,000 aircraft operators, as well as with the military and our aviation neighbours in other continents. So it is no surprise that collaboration is essential in everything we do. It's never boring, frequently surprising and often a challenge. However, it can be very rewarding to build the relationships required and then to see them result in practical steps to improve the performance of European aviation, something that is vital as traffic is now clearly growing again. We have seen record numbers this year, with nearly 36 thousand flights on a single day. Over the whole year, we expect to handle around 10.6 million flights.

In practice, this collaboration means maintaining effective working relationships with every Air Navigation Service Provider (ANSP) across Europe. We look at their performance, at their plans and at the forecast traffic levels; then we discuss how issues can be resolved, before they cause problems. Sometimes that means spending a lot of time with a particular country to see how to overcome a particular challenge. One example of this is the work on Greek island airports; here, the Network Manager, the local ANSP, airports and crucially, airlines all came together to address capacity issues that were causing significant delays in the summer months.

Airports are an integral part of the network now; 26 ACDM airports and 19 Advanced ATC Tower airports exchange data with the Network Operations Centre. We also, through the Airport Corner, have a much better understanding of issues coming up. For example, planned work on an airport tower, or on taxiways, may reduce the airport's handling capacity and that can have a network impact.

Airlines also recognise the value of collaboration and there are two dedicated staff seconded by airlines to the Network Manager. They attend operational meetings and briefings and make sure that the communication channels work effectively. This also helps build trust – they can see that we are working for the benefit of the network as a whole, impartially and fairly.

Aviation is a global industry and so the partners with whom we collaborate are not just European. For several years, we have exchanged real time operational data with North America – we can see a flight heading our way long before it even reaches the Atlantic, let alone our airspace. Making traffic more predictable helps us to make better use of capacity and we are currently putting in place data exchange with Brazil and the UAE; discussions on similar arrangements are also taking place with other countries/regions.

Collaboration has tangible benefits on a day-to-day basis but it really demonstrates its worth when problems arise. Where one country's ATC capacity is affected (for example, by industrial action) we regularly see neighbouring countries take action to make sure they have enough capacity to cope. The military also respond, postponing exercises to help out.

For larger disruptions, the European Aviation Crisis Coordination Cell may be activated – a body developed following the lessons learned from the Eyjafjallajökull volcanic ash crisis in 2010. Exercises are regularly held, both to make sure we have the systems in place and also to help build the relationships that are vital for getting things done quickly and effectively when problems arise.

I regularly meet with colleagues around the world and when I discuss with them the situation in Europe – with so much traffic across so many countries with different cultures and languages – many are amazed that we work together so well and so effectively. There is a lot of room for improvement, of course, but we should also recognise how well such a diverse and fragmented industry does come together through collaboration at an international level.

Joe Sultana
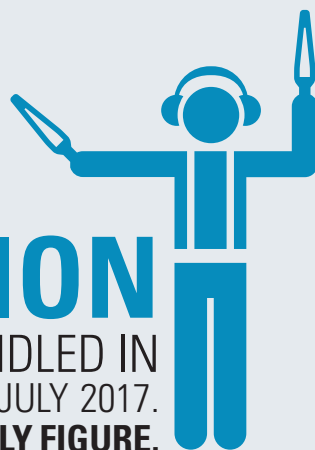**Director Network Manager, EUROCONTROL**

Joe Sultana is Director of the Network Manager Directorate.

He graduated with an Engineering Degree from the University of Malta in 1975 and joined the Air Traffic Services Unit in Malta in the same year. He obtained ATCO Licences in Aerodrome, Radar and Area Control and was a Watch Supervisor for four years.

In 1982, he was appointed Head of Air Traffic Services in the Maltese Department of Civil Aviation.

He became Director of the Network Manager in 2013.

IN NUMBERS

10.2 MILLION
THE NUMBER OF FLIGHTS IN EUROPE IN 2016.
THE HIGHEST ANNUAL FIGURE.

1 MILLION
THE TRAFFIC HANDLED IN THE MONTH DURING JULY 2017.
THE HIGHEST MONTHLY FIGURE.

18,000
APPROXIMATE NUMBER OF ATCOs IN THE NETWORK.

OVER 500 AIRPORTS
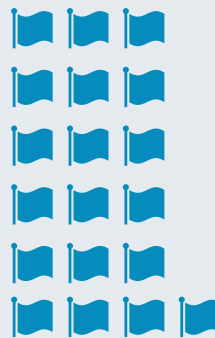## 68 NUMBER OF EN-ROUTE CENTRES
IN THE NETWORK.

41
EUROCONTROL MEMBER STATES

+2
COMPREHENSIVE AGREEMENTS STATES

28
MAXIMUM NUMBER OF AIRCRAFT MUAC CONTROLLERS CAN MANAGE UP TO AT ANY ONE TIME.

NINE €
IS THE AVERAGE COST PER PASSENGER IN 2015 (GATE-TO-GATE ANS COSTS)

4
THE NUMBER OF CONTROLLERS OUT OF **100** CANDIDATES TESTED SHOW THE ABILITY TO BECOME AN AIR TRAFFIC CONTROLLER AT MUAC.
OUT OF THESE 4, ONLY 3 WILL MAKE IT.

ON AVERAGE, AN AIRCRAFT TAKES OFF OR ENTERS EUROPEAN AIRSPACE EVERY **3** SECONDS,

&

WILL TRAVERSE THE AIRSPACE OF **3** COUNTRIES IN EUROPE.

ZERO
NUMBER OF ACCIDENTS WITH ATM/ANS CONTRIBUTION IN 2016, WHICH CONTINUES THE TREND SINCE 2012.

NO FATAL ACCIDENT
HAS BEEN REGISTERED WITH ATM/ANS CONTRIBUTION IN THE LAST DECADE.

TABLE OF **CONTENTS**

28 **Human-machine collaboration: fight or fly?**

70 **Collaboration in post-incident review**

74 **A conversation with Cormac Russell**

Steven Shorrock
Editor in Chief of HindSight

BONDING AND BRIDGING:
EXPANDING WHO 'WE' ARE

Over the past decade or so, my colleagues and I have spent a lot of time talking to people in 32 countries about safety. We have spent time with thousands of operational, technical, specialist, support and managerial staff. It has been a unique opportunity to get an insight into almost every job of work that makes up the world of air traffic management. The different roles and activities fit together like a sort of four-dimensional puzzle. Each of the pieces of the puzzle is a function, somewhere in the lifecycle of the air traffic management system. Having listened to thousands of you in person, and having analysed tens of thousands of completed questionnaires, we know that the most positive or favourable themes concern your perceptions of direct colleagues (including your direct managers). Your trust in your direct colleagues, and your interactions with them, is also the thing that you most often say is most critical to safety.

The relationships, trust and reciprocity (or 'give and take') between people in a social network come together as something called 'social capital'. Think of it as your 'social wealth'. It is what gives you that sense of connectedness, belonging and security. When this refers to a group of like-minded or specially related people – perhaps a profession, a team, or a family – it is called bonding social capital. This bonding is normally for the good. It gives that cozy feeling of 'us'; it looks inwards. In groups with strong bonds, people trust one another, help one another out, and look out for one another. If you are a controller or commercial pilot, it is most obvious in the relationship between you and your immediate colleagues in the Ops room or in the cockpit.

As controllers, you likely know one another – more so if you are on a fixed shift system or work in a small unit. If you were once in a fixed team, but have since become part of a flexible system more akin to a pilot's situation, you may have felt a sense of loss of fellowship or camaraderie that is more associated with a fixed team. Even so, as controllers, and as pilots, you share a profession, and will have confidence in your colleagues by virtue of their training and experience. Of course, you will adjust your trust depending on your experience of working with others. Even across the RT between controllers and pilots, those bonds seem to hold. Issues crop up, but it is rare that controllers spend much time in workshops talking about problems with pilots; there is an affinity.

But, as we have seen in recent years and throughout history, strong bonds within a group can also be for the bad. Faced with what is seen as an external threat, groups can dig in, lock down, and lock out the outsider, becoming isolated and disenfranchised. Even when there is no particular relationship problem, the interface between groups is often where we see safety problems, but also opportunities.

In organisations, we sometimes use the word 'division' to describe these groups, or the word 'department' (which, going back to the Old French departir, means the same: division or separation). It is curious that, when we present our organisations to the world, we often present an organisational chart of divisions (which does little to clarify the purpose, the flow of work, the product or service, or the customer!).

Indeed, when we look at the least favourably scoring items on the EUROCONTROL questionnaire, and when we ask you about your needs, these mostly concern interactions with other departments, or with senior management. Issues tend to sit at the interfaces. They have come up as issues of interaction between groups (most often in the same organisation), in a harder 'process' sense (e.g., involvement in the design of procedures and tools, action and feedback on safety issues, missing or faulty equipment, training) or in a softer 'relationship' sense (e.g., respect, recognition, and all manner of issues of communication). When these issues are not resolved, the effect is two-fold: relationships within groups are fortified, but so are the boundaries around groups. The result? Silo-isation.

Strong bonds within groups of like-minded individuals, professions, or teams, are not enough for a healthy organisation, or society. When you zoom out, what is needed is bridges between groups. This is the second kind of social capital: bridging social capital. This bridging increases trust and reciprocity with 'them'; it looks outwards. The bridges or connections enable us to tap into different perspectives and expertise that we may need to achieve our goals, whatever they are.

The thing is, bonds form quite naturally over time within like-minded groups. You work alongside each other. You go to coffee together. Maybe you meet outside of work. As you get to know one another through day-to-day exchanges, trust grows.

Bridges, on the other hand, need to be built. They don't build themselves. Contact between different groups is often not routine, and so you see less of each other. You also have different characteristics and different ways of seeing the world, so more effort is needed to build bridges.

Somehow, we need to make the boundaries around our various professions, departments and locations softer and more permeable, and build bridges between them. Organisations can help or hinder this bridge-building. The design of buildings and facilities, the conduct of formal and informal gatherings, the design of projects, the communication; these may separate groups, or bring them together. Similarly, we as individuals can help or hinder bridge-building. The invitations we send to informal gatherings, the associations and unions we form, who we choose to eat and drink with; these connections will reinforce or disrupt silos. We can all show up to help build bridges.

With Issue 26 of HindSight we hope to give some inspiration and ideas for collaboration across many interfaces, within and between organisations. It is a natural counterpart to Issue 25, on Work-as-Imagined and Work-as-Done. Collaboration helps to bring the two into better alignment.

We should cherish our bonds, but more bridges are needed to allow bonds to grow between groups. This is the only way to expand who 'we' are, and to improve safety at the interfaces.

Enjoy reading HindSight! ⑤

THE VOICE OF AN ANGEL

by Sidney Dekker

I have never jumped out of an airplane. My wife considers this a good thing. I have worn parachutes while flying airplanes, and still do so regularly. But starting a flight with a wing that wasn't proven to work before takeoff takes a courage I barely want to muster. What I have done, was to fly those who wanted to jump out of my airplane. For a couple of years, I took skydivers to many thousands of feet, often in three subsequent tranches (3,000 ft, 6,000 ft and then 10,000 ft). I could look back and see them tumble out and disappear through the big sliding door while the landscape below resembled that of a satellite picture. I always found it comforting to remain in the cockpit, yank the cord to get the door to slide shut, and nurse the engine and plane into a descent. My wings were already there, thank you very much.

But then…

Ah, but then, one day I was reminded of the critical need of a working engine to have those wings get me to any height or any meaningful distance. It was a Summer day, somewhere in northern Europe. The skydiving club had recently bought a Cessna 206, as a cheaper (non-turbine) platform for getting people up to 10,000 feet. This was also useful for the club's money-making tandem jumps, in which an instructor and guest would dive out hooked together. I had been flying the 206 for a couple of days. This day had been a glider pilot's dream, but had become a skydiving pilot's challenge. Big, foamy cumulus clouds thousands of feet in height had boiled up everywhere, threatening to overwhelm the sky. Flying among them, with permission only for visual flight, was like trying to circle up among skyscrapers along the streets of Manhattan. There was also the expectation, if not demand, for a visual final approach for the jump run (into the wind, thank you) so that skydivers could see the tiny postage stamp on the ground they had to land on.

These were pre-GPS days. And we were flying from a field without navigation aids. In front of me was only the so-called steam-gauge six-pack with an assortment of engine instruments and other dials around it. A map was in the pocket next to my left ankle. No nice moving map pictures, no wind arrows on a display, nothing of the sort. Flying skydivers is thirsty business for an airplane. Climbing through 8,500 feet, I decided it was time to switch tanks (as the 206 only drinks from one of its wing tanks at a time) to balance my fuel load better and make sure I would be able to conduct the rest of the flight without having to fiddle with it. I certainly didn't want to have to do it while trying to position myself among the cauliflower clouds to find a final jump run with skydivers who were aching to get out, impatient, and jacked-up on dopamine and adrenaline. Let me just say that you don't exactly make friends with skydivers if you have to do your jump run twice because you got the first one positioned wrong.

I switched tanks and the engine died.

Immediately I switched back and hit all the fuel pumps I could find switches for.

The engine didn't come back to life.

Somehow, I managed to get the airplane to fly its best glide speed, or thereabouts, and trim it. Then I turned my head and shouted at the skydiver in charge in the back that I'd had an engine failure and that they should probably get out while they could. He looked at me as if I was making things up. Then he looked at the others, and they all looked the same. Then the door flew open and the first few choose to take their own way down, wherever on earth they were at that point. The instructor with a first-time tandem jumper attached to his front shuffled to the door, glared at me with revulsion, and then they too were gone. I had no interest in the social niceties. I had bigger problems to attend to. I declared an emergency, explaining I had suffered an engine failure, and that I had already released six parachutes and was descending myself too.

According to the airspace and its procedures, we needed permission from ATC for all of that. Now there is nothing remarkable about flying a Cessna 206 whose engine isn't working (though your trust in the airplane as your friend is dented somewhat).

A shortage of fuel was not my problem. One problem, however, was my very limited experience on the airplane. I noticed that trouble-shooting in an emergency like that became not model-driven, but environment-driven. Simply put, instead of working off a mental model of the various systems and their interconnections to try to figure out what had killed the engine, I simply pushed what was out, and pulled what was in, switched to the right what was to the left and vice versa. At some point, though, you run out of things to push and pull and twist in a Cessna cockpit. And at that point, I was out of options.

Another problem with a dead engine is that you have little say in how long the flight is going to last. And if you're over a northern European landscape with lots of rocks, forests and lakes, then you might not like where you're going to end up. That was now my main challenge. I had no idea where I was any longer. I had been largely heads-in-the-cockpit while trouble-shooting. The clouds had completely boxed me in, and I was now in a descent among those Manhattan skyscrapers, still trying to avoid them as I was under visual flight rules. This meant a lot of turning with no recognisable glimpses from anywhere. It had scrambled my internal sense of direction. It would be so nice to find the field.

That was where my saving angel came in. In the Centre responsible for our airspace, a female controller had quickly taken my flight (or what was going to be left of it) as her priority.

"Centre, Victor Romeo, descending through 5,000 feet, you got vectors to the field?"

"Victor Romeo stand by"

Double click.

"Victor Romeo turn heading 170, should be straight ahead."

I turned 170, trying to keep the best glide speed, and was instantly looking up at a wall of cloud the size of Niagara, but then higher, much higher. Cloud base was still far below me, so going underneath was no option either.

"Victor Romeo, you have field in sight?"

"Stand by."

Silence.

"Negative, too much cloud."

Silence.

I yanked the plane around to stay in the clear. This was not a time to take the thing into the clouds. Instrument flying is fine, but with a heart rate that is slightly more normal and a plane that's actually got its instruments checked out and certified for it. I really didn't want to end up plummeting from the base of all that cloud in bits and pieces because of overstressing the airframe. And, by the way, how well was I going to find the field from inside the cloud?

"Victor Romeo, how are you doing?"

"Negative field in sight. Engine still dead."

Silence.

She may have given me more vectors. I don't remember. I do remember the sheer presence of her voice – of her – in the cockpit. The sense of not being alone while desperately alone, of having contact with another human with an extra pair of eyes to help me look out for that field, of being able to talk with someone who was clearly concerned for me: It was the best experience of the whole flight. And research shows that it's not just the feeling of not being alone. The relationship between controller and pilot, even if conducted through 'thin air' and across a large distance, can be so heartening because of a controller's ability to introduce a couple of key things to the conversation and the pilot's thought process. The first is candour. If the controller says you're descending through 3,000 feet in an area with terrain, then that's very likely true. As a flight crew, you may not have

been looking at the altimeter winding down right then, so it's crucial to hear it from someone who has. The second is purpose. A controller can help keep a crew focused on the purpose they've said they want to achieve, like finding and reaching that airfield. The third is rigour. An emergency can mess up a crew's response necessary to address it. A controller's prompts can help a flight crew keep track of what's done or what needs to be done. The fourth is collaboration and compassion. The crew has someone who is working with them in real time to address a problem, and someone who actually cares about the outcome, too.

"Victor Romeo, turn 230 now."

"230."

I did. Well, I didn't, because Niagara or one of its many brethren were still there, but I was able to fly around it, and then some more, and some more, and there, there was a glimpse.

"Centre Victor Romeo contact."

Silence for a bit. I like to think she exhaled. As if she, too, had been holding her breath. Then all she said was, "good."

And it was good. I was able to work out a high circuit around the field that would bring me in for a dead-stick landing. The skydivers were nowhere to be seen. I hadn't actually thought of them for the last few minutes.

"Victor Romeo, you good?"

"Affirm, got the field, should make it."

"That's good."

And then, and it still makes me all warm and emotional as I write this: *"Give me a phone call when you're safely on the ground."*

Bless that angel.
"Thank you," I said. I meant it.

There was something poetic about my callsign too. How I had been longing to be a Victor over the Romeo (a Cassanova-ish lover who, after all, ended up quite dead himself).

I switched over to the field frequency,

now having all but given up on the engine. Then I looked at the electrical fuel pumps. There was a normal one and a high-pressure one. Both were on. I reached over and switched the high-pressure one off.

And the engine came back to life. I instantly hated it.

I hated it for all it had got me into, and for all that it had made me, and others, go through. Not that I trusted it for a moment: I kept my profile so that I'd make the field independent of whether it would keep on turning or not. Later, I learned that on that model, switching high-pressure fuel pumps on at high altitude can flood the engine. After landing, I learned that the skydivers had ended up in an orchard and had been invited in for afternoon tea by the owner. I borrowed a phone and called the controller. We ran through the scenario again together, and I told her about the skydivers. I thanked her again for her help. Then she had to go back and attend to the needs of other pilots. The tandem guest had had the day of her life. She got out of the airplane at a lower height than planned, the instructor hated me for a moment, but she had ended up in a spontaneous afternoon tea! She probably went on to tell many others about it. I suppose that an experience is either good, or a good story. Then again, mine is perhaps both. Not because of a fickle 206 engine, or because of a hospitable ward for my skydivers. It was both good and a good story because of my angel; my angel in the sky. Thank you. ⌇

....

Sidney Dekker is Professor and Director of Safety Science Innovation Lab at Griffith University, Brisbane, Australia. Author of best-selling books on human factors and safety, he has had experience as an airline pilot on the Boeing 737.

SAFETY BEHAVIOURS
SAFETY FORUM POWERED BY SKYBRARY

29–30 MAY 2018, EUROCONTROL BRUSSEL, BELGIUM

THE 2018 SAFETY FORUM WILL BE DEDICATED TO SAFETY BEHAVIOURS. WE WILL BE LOOKING INTO WAYS TO IMPROVE AND PROMULGATE BEST PRACTICES ACROSS THE WIDE SPECTRUM OF AVIATION DOMAINS.

FLIGHT SAFETY FOUNDATION
independent • impartial • international

era
european regions airline association

EUROCONTROL

FOR MORE INFORMATION HOW TO SUBMIT A PRESENTATION OR PARTICIPATE IN THE FORUM VISIT SKYBRARY:
HTTPS://WWW.SKYBRARY.AERO/INDEX.PHP/PORTAL:SAFETY_BEHAVIOURS

COLLABORATIVE ADAPTATION IN A CONSTRAINED SYSTEM: GETTING THE BALANCE RIGHT

Controllers actively manage the traffic system, often collaboratively, by adapting processes and procedures. This ability to adapt and adjust in a collaborative way is critical to both safety and efficiency. But collaborative adaptation can come at a cost, in time, effort or specific risks. How can we get the balance right?
Don Gyles and Chris Bearman explore the issue and offer some practical advice.

KEY POINTS

1. **Controllers actively manage ATC safety, often collaboratively, by adapting processes and procedures.**

2. **Additional elements of coordination to enable an adaptive plan can add time, risk and uncertainty, and should give proportionate benefit.**

3. **A back up plan should be available in case collaborative adaptation does not work out as expected.**

4. **Global implications of local adaptations should be considered. Everyone affected by collaborative adaptation should be aware of how they are involved or affected.**

Imagine you have diligently completed your basic ATC course in a world-class training facility, complete with high fidelity simulation. You duly arrive for day one of your on-the-job training. You have learnt and been examined on all the necessary knowledge elements applicable to your chosen ATC role, have been coached and examined in the real time application of this knowledge and developed a sound foundation of competencies on which to build your capabilities during your allocated period of on-the-job training.

Day one of training on a radar surveillance approach position and you receive your first piece of incoming coordination. It comes from the adjacent controller with whom you share a common final approach centreline, regarding an arriving aircraft. The hotline opens and what transpires leaves you speechless. The other controller says:

"ABC is requesting change of runway 15 [was programmed for runway 21], *my separation with DEF* [one of your aircraft that would conflict with the new flight path proposed]*, stays with me with your concurrence* [the aircraft will transit through your airspace to track to the new runway]*, my coord with the Tower."*

This wasn't any variation on any coordination you ever received in your simulator training or ever saw elaborated in the ops manual. So how did all that theory and simulator-based training fall so far short of the mark in this instance?

This situation (which comes from a real example) is not uncommon in the Australian context. In our training institutions what we primarily focus on is the application of the basic rules, policies and procedures that govern air

traffic movement in a given jurisdiction. This is what Morel, Amalberti and Chauvin (2008) referred to as the elements of our 'constrained system'. In contrast, the controller initiating the coordination in our example has gone 'off-script' in order to actively 'manage' system safety outcomes. This is an example of ordinary operational collaboration of the sort that any controller will recognise.

Active management of the system is used to address anomalous system behaviour not thought of by the system designers or procedure developers, or to take advantage of opportunities to better optimise system efficiency. While this is often what makes our system work in practice, the problem for our trainee controller is that we typically don't formally recognise this collaborative adaptation, or teach people about it.

Historically, we have sought to manage risk in complex systems like air traffic control through the application of constraints, such as standardised rules, procedures and practices. This limits controllers' scope of action in order to protect against specific hazards. These activities have helped to establish a system that has a very high level of safety.

However, we may have been seduced by our 'success' with standardised rules, procedures and practices, leading us

We may have been seduced by our 'success' with standardised rules, procedures and practices.

to neglect how controllers are actively and collaboratively managing the system to ensure safety and efficiency. In our study (Gyles & Bearman, 2017), we found that nearly 1/3 of interactions between controllers were concerned with modifying standard plans in order to actively manage the system. While people can learn ad-hoc and informal ways of collaborating to actively manage the system during on-the-job training, is this really how

we should be managing safety? There is a need to identify and recognise these strategies in the formal system, but also to determine the limitations of these strategies.

From our observations we have identified a number of issues that can occur when people are actively, collaboratively and adaptively managing the system rather than executing the standard plans that form our formally constrained system. This is by no means exhaustive but helps to point out some of the most common issues, and solutions.

Negotiating with other controllers to modify standard plans can take time and add additional workload. Situations can unravel very quickly if insufficient consideration is given to the time required and resulting workload demands. Controllers should be aware of the potential time commitment, build in sufficient time, and always have a back-up plan or strategy to allow reinstatement of the standard procedures if it becomes clear that they won't be able to complete all the necessary negotiations.

When moving away from standard procedures everyone involved needs to understand the new plan. Many air traffic incidents have involved controllers making assumptions about what other people know. It is important

to actively ensure that everyone is on the same page when shifting to a more collaborative style of controlling where the emphasis shifts to achieving safety through managed rather than constrained activity. It is also important to reinforce the new arrangements over time as staff change. For example, once incoming staff have completed their handovers and settled into their roles, it's a good idea to reiterate the arrangement explicitly again via normal coordination channels.

Any gains from modifying the plan must be balanced against the increased level of uncertainty and risk that this can create.

There is also a temptation that we have observed on many occasions for controllers to try to over-optimise the system. For example, a controller might cancel a SID in response to a pilot request to provide minimal track shortening (1-2nm) and forego the protection of the SID height requirements (which facilitate separation with inbound traffic) to save the aircraft 30-40 seconds of time. Controllers often perceive procedures to be unnecessary, overly restrictive and a means of further removing the opportunity for creativity and the development of expertise. But modifying standard plans can remove some of the protections provided by the procedurally or structurally constrained system of operations and can increase uncertainty and risk. Taking an aircraft off an established air route requires the controller to actively scan for conflicts in a much more resource intensive manner than simply confirming that aircraft are on SIDs and STARs. But any gains from modifying the plan must be balanced against the increased level of uncertainty and risk that this can create.

Actively managing the system at a local level can also have dramatic negative effects on a global level that controllers may be unable to perceive. While it may seem reasonable at a local level to take an aircraft off the published route structure for track shortening, it might lead to an aircraft flying through an entire continental airspace off-route and four hours later coming into conflict

with another aircraft as they track inbound on an outbound route. As a rule of thumb, if a modification to the standard procedures will involve more than three people, it would be wise to seek additional supervisory support.

While we have discussed the constrained system and active management of the system separately up to this point, they are in fact two sides of the same coin. Constraint-based safety-related procedures and processes provide a framework for work – the scaffold within which people are able to manage the system. However, formal procedures (as the main artefact of our constraint-based system) need to be carefully crafted to enable people to manage the system actively within these constraints. The boundaries of safe performance need to be clearly delineated with an indication of the scope or range of acceptable adaptation, which helps us to better manage the potential pitfalls inherent in actively managing the system.

Summing up

In summary, controllers often actively manage the system rather than relying on standard plans. This is typically not part of the formal management system and can have implications for safety. Based on our observations we identify a number of pitfalls that suggest a list of simple considerations for better active management of the system:

- Acknowledge that you may be increasing risk and uncertainty.
- Make sure that the benefits are worth the increased risk and uncertainty.
- Make an accurate assessment of the time and workload requirements for the change.
- Make sure you always have a default plan to fall back on.
- Make sure everyone understands what the new plan is.
- If a modification to a standard plan or practice involves more than three people, consider supervisory support. ⤵

References

Gyles, D. & Bearman, C. (2017). Managing safety in the air traffic control terminal airspace. *Cognition, Technology & Work, 19*, 143-159.

Morel, G., Amalberti, R., & Chauvin, C. (2008). Articulating differences between safety and resilience the decision-making of professional sea fishing skippers. *Human Factors, 1*, 1-16.

Disclaimer

The views expressed in this paper are those of the authors only and are not intended to imply endorsement or consideration by Airservices Australia who enabled the research activity.

Don Gyles is currently a PhD candidate at Central Queensland University, Appleton Institute, Adelaide, Australia researching collaborative work practice in the Australian Terminal Approach environment. He has 37 years' experience as an Air Traffic Controller and operational supervisor working for Airservices Australia. More recently he works in an ATC Line Manager capacity with safety and procedural responsibilities for a Surveillance Approach Unit.

Dr Chris Bearman is a research fellow at the Appleton Institute and principle supervisor of the research activity.

SAFETY CULTURE DISCUSSION CARDS

Talk about safety and collaboration at the interfaces with the EUROCONTROL Safety Culture Discussion Cards.

You can use any number of the cards in workshops, briefings, TRM sessions, and in coffee areas to help discuss specific issues.

Download via SKYbrary at http://bit.ly/SKYSCCARDS

The cards can be printed as A6 or 10x15cm size cards. Currently available in six languages.

FROM EXPERIENCE REPORTS
TO EXPERIENCE SHARING

Pilots and controllers talk a lot over RT, but rarely in person. So when tensions and misunderstandings arise, these tend to remain unaddressed. In this article, **Erick Hoarau, Florence-Marie Jégoux and Sébastien Follet** argue that this needs to be addressed.
Can a focus on everyday experience help to resolve everyday friction, before things heat up?

It was a normal, calm and cloudy day. There was no more and no less traffic than usual on the approach. Everything was normal, yet the interface between pilots and controllers did not match.

This story begins while Airjet 123, a regional jet, is flying FL 240, before further descent, still in contact with the ACC. The crew is briefing for an ILS approach as given in the ATIS. They are instructed to maintain 310kt or more. Shortly after, they are transferred to the approach centre. On his first message, the approach controller instructs the plane to reduce 250kt and descend FL100. Further speed reductions and other changes occur in this Approach sequence figure.

KEY POINTS

1. **Pilots and controllers have different objectives, constraints, and expectations. They interpret facts differently, with their own filters.**

2. **Very few opportunities exist for them to meet and collaborate 'off mike'.**

3. **Exploring Safety-II, we could start by debriefing the 'friction situations'.**

Approach - Step 1

ILS approach prepared
Requested speed 250kt
Descending to FL100

ACC

Pilots preparing ILS approach
Requested speed 310kt or +
Steady FL 240

Approach - Step 2

ILS approach prepared
Requested speed 220kt
Descending to FL100

Approach - Step 3

RNAV approach prepared
Requested speed 180kt
Descending to 3000ft

Approach - Step 4

RNAV approach
Requested speed 160kt
Passing FL180, descending to 3000ft

Approach - Step 5

Cleared RNAV approach
Requested minimum approach speed
Steady 3000ft

Approach - Step 6

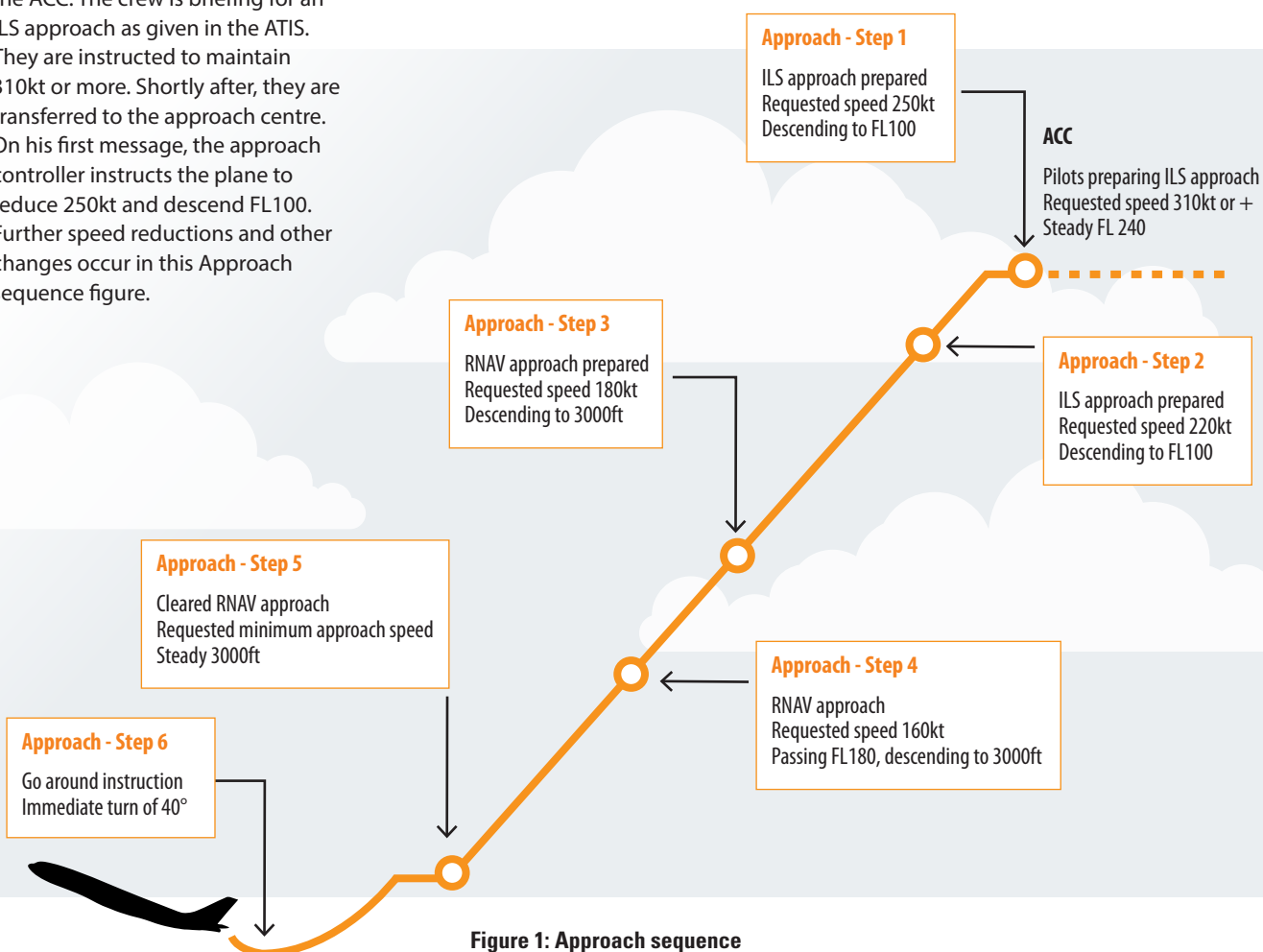Go around instruction
Immediate turn of 40°

Figure 1: Approach sequence

Now let us examine the situation through the eyes of both the controller and the flight crew.

	Approach controller point of view	Flight crew point of view
Step 1	[The controller does not know about the previous ACC clearance.] "I need to reduce the Airjet. I have to make it number 2." *"Airjet 123 Approach Hello. Descend FL100 via Standard arrival. Reduce 250kt."*	[The crew feels comfortable with high speed to be on time on arrival. his drastic speed reduction upsets them.] "Keep speed… Reduce… This is nonsense! Do they sometimes talk to each other?"
Step 2	"Aircraft of this company usually reduce early and descend fast… I need to cross them with transiting traffic. What are these guys doing with this slow decent rate? Why are they not reducing?" *"Airjet 123 reduce further to 220kt. Maintain FL100 upon reaching. Traffic 1000ft below your cleared level."*	"How do they want us to descend and reduce at the same time?" [In clean configuration the aircraft loses about 1kt per second in level flight and 1kt every 3 seconds in descent. Meanwhile the estimated track miles to touchdown and the distance to the preceding aircraft decrease rapidly.]
Step 3	"Okay… no more conflict ahead. The ILS is now inoperative. I will guide them now for the RNAV approach." *"Airjet123, due to ILS calibration, expect RNAV Z approach runway 34.* *Descend 3000ft QNH1023.* *Reduce 180kt for spacing."*	"Now we have to insert the new approach in the FMS, check for RAIM, get the RNAV charts, crosscheck all approach points… pffff!!!" [Below FL100 the only task of the PF (Pilot Flying) is to fly the plane on the correct track. All other tasks are devoted to the PM (Pilot Monitoring) who already manages radio communications, monitors the PF's actions, aircraft behaviour and the environment, and calls out any deviation. Instructions to modify the approach type below FL100 dramatically increase crew workload and may put the PM out of the loop.]
Step 4	"They are still flying above 200kt… These guys are impossible!!!" *"Airjet 123. Cleared RNAV approach.* *Reduce speed now 160kt.* *I do confirm 160kt!"*	"Now we have the anti-ice system on! This is not our day… Okay… Ice speed selected!" [Icing conditions just worsen the situation: Anti-ice systems collect hot air from the engines. As a result, engine idle power increases, impairing both aircraft deceleration and descent path.]
Step 5	"At last they have slowed down! Spacing should be sufficient now." *"Airjet 123, reduce minimum approach speed. You are number 2, 6Nm behind a Beech 200."* [The controller is used to seeing very low approach speeds on regional jets. Therefore he considers the situation as okay.]	"I don't know the speed of that guy ahead but we're closing in with our minimum approach speed of 143kt." [Minimum approach speed is not the same everyday for a given aircraft. It depends on its landing configuration, its present weight and the current weather conditions. Together, these factors can lead to an approach speed variation of up to 30 kt.]
Step 6	[While the regional jet starts its final descent, the controller notices with dismay that the distance between the two planes actually decreases and gets closer to the minimum radar separation.] "Damn it! It won't make it!" *"Airjet 123 cancel approach. Immediately, turn right heading 020, climb and maintain 3000ft, immediately."*	PF: "Go-Around… TOGA… Flaps 2!" PM: "Positive Rate…" - "Gear Up… Heading Mode! Set Heading 020!" - "Set !" - "Check !" - "Reset ASEL to 3000ft!" - "Set!" - "Check!" … [ATC non-standard missed approach instructions generate a huge workload increase in the cockpit. Go-around procedures are normal procedures. That said, an unexpected go-around and its associated startle effect may lead pilots to SOP violations (SAMSYS, Deutsche Lufthansa, 2015) and non-compliance with tracking, altitude and ATC requirements (Etude PARG, BEA, 2013).]
	The controller is very upset and frustrated. His best strategy to regulate the regional jet behind the calibration plane was defeated by those non-cooperative pilots, who did not comply with ATC instructions, leading to this inefficient and stressful mess.	The crew is very upset and frustrated. A normal approach turned to a fiasco because of this lousy controller who put them behind the slower one! …And they eventually landed way behind schedule!

Minimum radar separation is respected. This situation is not considered as a safety event by either the airline or ANSP.

Analysis

PILOT   CONTROLLER

Get shortcuts   Be efficient

Procedures   Respect rules

Save fuel   **SAFETY**   Respect
                                                         environment
Be on time   procedures
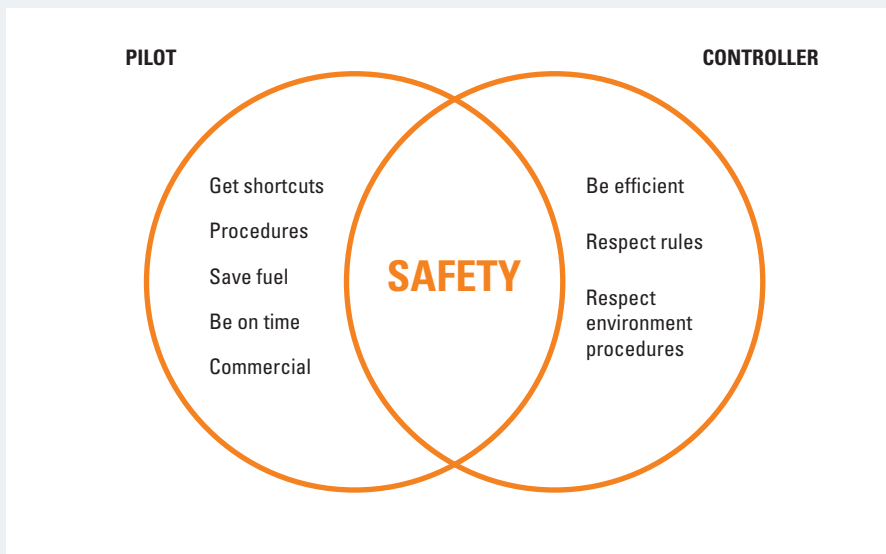
Commercial

Figure 2: Example of goals for pilots and controllers.

One event, two points of view, and people on both sides of the interface who do not understand each other and yet strive to ensure safety. For instance, when we think of 'performance', for a pilot, it might mean saving time and fuel all along his flight. For a controller, it implies a global efficiency, which saves time on the whole sequence regardless of some aircraft saving or losing more than others. These discrepancies in how we perceive goals and situations are not fully understandable for a pilot in the cockpit or for a controller in front of the radar screen, especially under time pressure.

To fulfil their seemingly individual objectives, pilots and controllers have their own needs, expectations and constraints.

In order to prepare and perform a safe and stabilised approach, a pilot needs time and anticipation. To save fuel, he needs an optimised descent path. To be on time, he needs direct routing and appropriate speed. This is what he might expect from controllers. His constraints are, among others, the weather (wind, icing conditions, build-ups, etc.), the current aircraft status (weight, performance, equipment, etc.) and the operational and commercial aspects of the flight (schedule, flight time limitations, connecting passengers, etc.). He would expect the controller 'sitting in the tower' to fulfil all his needs and understand all his constraints. In some situations, a control instruction that would disturb his plan might be perceived as a reluctance to help.

On the other side, to ensure safety and efficiency of the whole sequence, the controller needs the airplane to

comply with his instructions. She needs aircraft to turn or reduce when asked. Like pilots, she has lots of expectations regarding her own experience. For her, a regional jet of a specific manufacturer flying for a specific company should reduce at approximately this specific speed when told to fly at minimum approach speed. She also expects her requests to be immediately effective. She has other constraints: regulation associated with specific spaces, regulation for wake turbulence, for aircraft spacing, etc.

These differences of expectations, needs and constraints are not well known to the other party, in the control room or in the cockpit. This leads to misunderstandings, misinterpretations and assumptions on the other side's intentions and a dissatisfactory experience for both. When there is no safety issue at the end, no one will ask for explanation and both parties continue to work in silos without ever meeting nor getting answers. As a consequence, frictions occur regularly. It is no big deal, it is just friction with some local heating.

"VIC 77, please remember it's not a race...."

Consequences

But friction also means erosion. Sooner or later there will be areas where the heating process will increase so considerably that it will put safety at stake.

In our example, on the go-around, the controller asked for an avoiding action from an airplane configured for a final approach. The crew's answer was immediate and the turn was applied without delay. By a non-standard go-around instruction, the controller implemented a manoeuvre that could have been dangerous, although not ordering this go-around could have been even more dangerous. Ignorance of the other point of view could easily bring about risky situations.

Friction areas may also be seen as forerunner signs that safety might be downgraded. This type of friction has already led to overheating. The French national committee, which manages safety events (ITES), raised a specific topic that keeps on coming back: spacing gets infringed by aircraft catching up others. Different situations, but the same issue: the complexity of speed management, ensured by pilots as well as controllers, may lead to spacing infringement.

Solutions

What solutions can be found? Let's look at it from a Safety-II perspective.

Most aeronautical services only pay attention to Safety-I. Both airlines and control providers have their own reporting systems to get feedback and learn lessons from events. Operators (pilots or controllers) who have experienced an unsatisfactory event sometimes file a report to get answers. The reporting forms are collected and analysed by specific services of both providers. If safety is not at stake, the case is closed and none of the operators is contacted.

It may be time for organisations to get interested in Safety-II and in everyday work.

As a result, one operator never gets answers, and the other does not even know that someone else had a disturbing experience during a past interaction. So, the Safety-I perspective does not reveal the differences in experiences and perspectives. It may be time for organisations to get interested in Safety-II and in everyday work. One way to explore this huge number of situations would be to explore those 'friction' situations first.
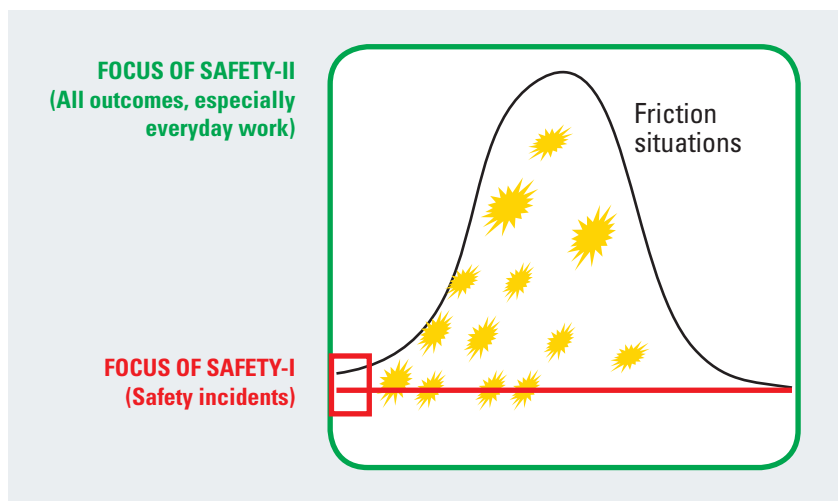
Figure 3: Friction situations in everyday work

really help to be more empathic instead of judgemental.

Our HF team started years ago to meet CRM pilots, and worked on different projects: we made a pedagogical film with instructional situations for both pilots and controllers. We did some HF and facilitation cross-training: CRM pilots came to our HF sessions, and we went to their CRM training. Along the years, we have solved many misunderstandings, some of them very significant, for instance why controllers would put sometimes 3NM spacing between two aircraft, and sometimes 8NM. The 8NM controller is not worse than the 3NM one. He or she just has a different radar, different technology, which means different regulations and norms.

Pilot-controller cross-training would be great, but administrative or financial reasons seem to prevent this from happening, to our regret.

Controllers and pilots collaborate not only via RT, but also in formal meetings, and informally, at the flying club pub, and on the internet. When pilots and controllers can share experience, magic will happen. We will improve safety. ⑤

It might be time also to build a system in which people can share their experience and have explanations instead of assumptions. People would make contact to discuss 'friction' situations. A few years ago, a French Internet forum was created in order to share experience and points of view: pilots and controllers used to discuss, share their knowledge, apprehensions, needs and expectations. Unfortunately, for different reasons (security, inappropriate messages…) the website was closed. But the idea remains. And it could be a good way to implement experience sharing: a neutral, fully moderated, Internet platform where pilots and controllers could discuss. Such a forum could be hosted by EUROCONTROL, in order to give the opportunity to operators from all over Europe to share their experience, instead of misunderstandings and sometimes grumpiness on the frequency.

Another option could be to organise regular meetings between pilots and controllers, or more generally between operators. Some initiatives are implemented locally:

- VFR meetings: VFR pilots and controllers share constraints, goals, and what they mostly have in common: their passion.
- 'ANS-ANC' meetings: conferences that gather pilots and controllers, to talk about problems of non-stabilised and non-compliant approaches.

On the French 'ITES', safety events are analysed by both ATC experts and pilots. It makes it very easy to recognise our assumptions, and ignorance of the other's constraints.

An HF reflection group is led by the French oversight authority, which gathers some CRM pilots, flight instructors, and HF experts, from many airlines, and some controllers: hearing and understanding the problems and questions from the other group can

Erick Hoarau occupies a position of First Officer with a French airline. He has been a CRM Trainer for 10 years and was nominated CRM Trainer Examiner in 2016. In 2015 he obtained a Diploma in 'Human Factors for the Conception of Human-Machine Systems' at the Paris V René Descartes University. He is a member of a focus group gathering pilots and controllers to address flight safety through human factors.

Florence-Marie Jégoux became a private pilot in 2000, a certified air traffic controller in 2004, and HF facilitator in 2009. She is also a coach and is trained in systems theory. She now works for an ANSP in their training department as a Human Factors coordinator and specialist. She passed an HF University Degree in 2017 in the National Polytechnic Institute of Bordeaux.

Sébastien Follet has been working as an Air Traffic Controller for the last 16 years. He has been an HF facilitator for controllers for the last 10 years and is currently instructor for controllers in his ATC center. Formerly, he has also worked on various safety studies to implement new equipment. He has a degree in Ergonomics & HF Basics from Paris Descartes University. This aviation enthusiast has been a private pilot for 16 years.

USING AIRCRAFT AS SENSORS **TO MEASURE RUNWAY CONDITION**

Many hull loss accidents occur on runways where braking performance is degraded by runway surface contaminants. Airbus and its subsidiary NAVBLUE is helping to enhance real-time awareness of runway conditions, via aircraft data shared in real time to better understand, anticipate and mitigate runway conditions. **Daniel Percy, Logan Jones** and **Fabien Moll** describe this new development.

KEY POINTS

1. **Runway excursions are a top cause of accidents; 35% occur on contaminated runways.**

2. **The way braking action is identified today is primarily via pilot reports, but such assessments can be difficult to make.**

3. **In 2018, Airbus and NAVBLUE will commercialise a new service that will address the request from national safety bodies for a viable technology to collaboratively and objectively measure and disseminate runway braking action.**

Background

In the world of commercial jets, it is well known that Runway Excursions (RE) are one of the top three causes of accidents. Airbus's own accident statistics show that RE caused 35% of hull-losses and 14% of fatal accidents between 1997-2016 (Airbus, 2017). Given this status, Airbus and other manufacturers are investing in the development of technology to reduce RE accidents.

Product features such as Airbus's ROPS (Runway Overrun Prevention System) are already in service and providing real time, energy and landing performance monitoring information to flight crews. However, with IATA identifying in their 2016 Safety Report that 35% of RE accidents occur on 'POOR' or contaminated runways (IATA, 2017), a clear case can also be made for the need to improve pilot awareness of runway surface conditions. Indeed, national Safety bodies including the NTSB of the USA and the UK AAIB have identified the need to develop "an operationally feasible airplane-based braking ability/ runway surface condition measurement and communication system" (NTSB, 2007, p. 13).

Today's means of measuring runway surface conditions

Today, there are typically three methods available by which runway surface conditions are evaluated:

- runway contaminant type and depth observations
- ground surface friction measurements
- braking action reports from pilots.

Contaminant type and depth observations are, in general, conducted physically by airport personnel on the runway surface. The conditions are assessed through a combination of visual observations and spot-checks. However, it can be a difficult task to consolidate what may be differing conditions across the entire width and length of the runway into a succinct runway condition report. In addition, during active precipitation and/ or freezing/melting conditions, the validity of the information may become outdated soon after it is issued

Ground surface friction measurements provide a more qualitative approach to taking measurements along certain points on a runway. However, as noted by the NTSB, they are useful for identifying trends in runway surface condition but are not recommended for use in predicting aircraft stopping performance. This is due to the lack of correlation with aircraft braking performance, as well as variability in equipment design and calibration (NTSB, 2007).

While the airport operator is responsible for generating the Runway Condition Codes for a runway, pilots are responsible for providing accurate braking action reports. Indeed, providing braking action reports is a significant role that pilots play in preventing runway excursions for all airplanes. Braking action reports contain the pilot's assessment of the manner in which an aircraft responds to the application of wheel brakes. The terminology for these reports is defined within ICAO Doc 4444 PANS, as illustrated in Table 1 below.

Reports should be provided by pilots whenever requested by ATC, or if the pilot has assessed braking action less than previously reported. ATC receives the pilot reports by voice, and will disseminate them to other pilots on

approach. ATC will also disseminate the current runway condition code.

If runway surface conditions deteriorate enough that two consecutive reports of 'Poor' conditions are received, the airport has to re-assess the runway conditions. If 'Less Than Poor' braking action is reported, the runway will be closed to further operations until the airport operator can improve the runway's condition.

These reports thus play an important part in the cycle of runway surface condition assessment and reporting.

Difficulties involved in making braking action reports

Aeroplane deceleration results from several forces: aerodynamic drag forces, generated by the airframe and in particular the ground spoilers; reverse thrust, if available; and, wheel braking.

In general, a braking action report should characterise the availability (or lack thereof) of wheel braking. The difficulty for a pilot is in differentiating in real-time which portion of the total deceleration is coming from the wheel-brakes. This difficulty is compounded by the typical use of autobrakes on contaminated runways. As the autobrake commands an overall

Pilot report of runway braking action	Description	Runway Condition Code (RWYCC)
N/A		6
GOOD	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	5
GOOD TO MEDIUM	Braking deceleration OR directional control is between good and medium	4
MEDIUM	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	3
MEDIUM TO POOR	Braking deceleration OR directional control is between medium and poor	2
POOR	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	1
LESS THAN POOR	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain	0

Table 1: Runway Condition Codes (RWYCC) as per ICAO Doc 4444 PANS

airplane deceleration rate, the pilot is able to detect a lack of wheel-braking when the target deceleration is not achieved, however it is still difficult to differentiate how much each component is contributing to the deceleration.

Once the aircraft decelerates to lower speeds (generally below 60kt), pilots often use manual braking and at these speeds the aerodynamic drag and reverse thrust forces are negligible. It is often in this zone where pilots are able to more easily 'feel' the runway by using the brake pedals to understand the braking action.

Given these complexities, making an accurate report can be a difficult task for a pilot, and braking report quality can become subject to differences of subjectivity between different pilots. To resolve this and provide objective and consistent braking action reports, Airbus has developed technology that will use aircraft data recorded during the ground run to identify the available braking action.

Using the aircraft as a sensor to identify runway condition

Airbus has been developing a new technology to address the need identified by the NTSB and other national aviation safety bodies, for 'an operationally feasible airplane-based braking ability / runway surface condition measurement and communication system'.

The fundamental principle of the technology is, post landing, to use the data recorded by the aircraft during its deceleration roll to identify the braking action level. By using the aircraft performance model the technology can differentiate the part of deceleration coming from either aerodynamic, thrust reverse, or wheel-braking. Subsequently,
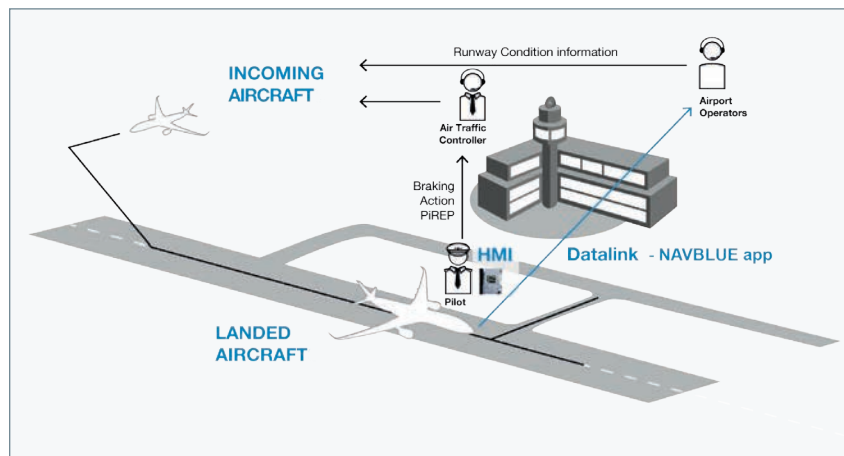

Figure 1: Principles of data connection providing runway condition reports to incoming aircraft from landed aircraft

by comparing the actual wheel braking performance to models of wheel-braking performance under different runway conditions, the algorithm can compare and determine the runway state that most closely resembles the experienced deceleration.

As illustrated in Figure 1, after landing the information is simultaneously disseminated in two ways:

- The result is displayed to the pilot to assist him or her in making an objective report, to be provided to the ATC
- The result is sent by ACARS message to Airbus subsidiary NAVBLUE, which will collect and display the results on a web-service platform for use by ATC, airports, and airline operational centres

This technological approach is collaborative by nature. It resembles the various mobile traffic applications which share traffic data in real-time to allow drivers to see and avoid traffic jams. Indeed, the goal of this new Airbus-NAVBLUE technology is to provide a platform where airspace users are

sharing reports in real-time to better understand how the runway condition is trending, and to allow the airport to anticipate and mitigate slippery conditions. The more aircraft that participate in the sharing, the better the real-time map of conditions becomes.

This technology has now been thoroughly tested via comparison with historical flight data, flight tests as with on board operational trials with participating airlines. Airbus and NAVBLUE have therefore launched the commercialisation of the function, details of which will be provided to the industry during 2018. ⑤

Daniel Percy is Head Of Safety Promotion at Airbus Commercial Aircraft, and has worked at Airbus's for 15 years in different roles. The Safety Promotion team is responsible for publishing Airbus's Safety First magazine, as well as Airbus' annual Accident statistics brochure.

Logan Jones is a runway safety specialist at NAVBLUE, an Airbus Company.

Fabien Moll is CORSAIR Project Leader at Airbus Commercial Aircraft. He is an Aircraft Performance specialist and was actively involved since 2007 in Aircraft development, testing and certification (A380, A400M and A320neo).

References

Airbus. (2017). *A statistical analysis of commercial aviation accidents 1958-2016*. Toulouse, France: Airbus.

IATA. (2017). *Safety Report 2016*. April. Montreal: IATA.

NTSB. (2007). *Safety Recommendation*. In reply refer to: A-07-58 through -64. Washington, D.C.: NTSB. www.ntsb.gov/safety/safety-recs/recletters/A07_58_64.pdf

COLLABORATION OVER THE NORTH ATLANTIC:

THE ROLE OF THE RADIO OPERATOR AND JOINT OPERATIONS

Over the North Atlantic, at the interface between pilot and controller is the radio operator, who acts as an intermediary for air-ground communications. This interface may not be well known to most controllers, but is known to pilots crossing the Atlantic, and is important to safety. In this article **Guðmundur Sigurðsson** introduces the role of radio operators in ISAVIA Iceland Radio, and collaboration between Iceland Radio and Shanwick Radio.

KEY POINTS

1. **Radio operators have acted as a critical interface between the controller and aircrew in the Oceanic FIR.**

2. **Collaboration between Iceland Radio and Shanwick Radio has helped to balance workload between the two sites.**

3. **Controller–pilot data link communication (CPDLC) is becoming the primary interface for sending and receiving messages over the North Atlantic, but specialised voice communication will have an important role for some time to come.**

4. **When automatic systems fail, aeronautical operators relay critical messages when needed.**

Air traffic control over the North Atlantic is collaborative by nature, and shared by a number of countries. Good communication and collaboration is therefore an essential part of air navigation in the North Atlantic. Unlike the usual controller-pilot interface, in the Oceanic FIR radio operators have acted as an intermediary between the controller and aircrew. Radio operators work within aeronautical communication centres in Gufunes (Iceland), Ballygireen (Ireland), Bodö (Norway), Gander (Canada), New York and Santa Maria (Portugal). Each has been allocated the responsibility to relay messages between air traffic controllers and pilots during trans-Atlantic flight, as well as airline

companies and meteorological stations.

ISAVIA Iceland Radio is the aeronautical communication service provider in the Reykjavik FIR/CTA. It is the second largest in the world with an area of 5.2 million square km. Iceland Radio (Gufunes) communication centre is located in Grafarvogur, a suburb of Reykjavik, about 10 km NE of the city centre. Approximately 40 flight information officers (FIOs), on eight working positions, divided into 6 shift teams, work in the Communications Centre. These FIOs – or 'radio operators' – handle air/ground communication on VHF and HF frequencies, with equipment that is located in Iceland, Greenland and the Faroe Islands.

VHF coverage is from east to west, providing a corridor across the Atlantic for non-HF equipped aircraft. VHF is line-of-sight, and to get as much range as possible, equipment is placed on high ground, getting a maximum range for up to 300nm for aircraft flying at 30,000ft. Iceland Radio operates 3 VHF frequencies, one of them as 'Shanwick Radio' on account of joint operations.

Iceland Radio monitors 13 HF frequencies 24/7. They are divided into 'families' and are a part of a high frequency network of operations in the North Atlantic area. HF radio is long range but is affected by variations in the atmosphere and solar activity, such as solar flares. When HF communications are difficult, communication via satellite phone is often used.

Iceland radio and their counterparts in Ballygirreen, Ireland (known as 'Shanwick radio') have been in collaboration for some time and are now in full 'Joint mode'. This means that flight data systems and voice communication systems are available at each site, and are shared depending on the traffic, radio propagation, etc. The idea behind the collaboration is that instead of dividing the traffic between

the stations according to the edges of the control areas, the traffic is divided so that traffic peaks at each station are minimised and workload is evenly distributed. In this way, the services can be improved and future expenditure lowered. The safety aspect is also a key factor. For example, if one station has to be evacuated, the other could step in and handle contingency operations. Also if the message switches fail, messages can be routed via the direct link. At the same time, the stations serve as alternative stations for each other, which lowers costs.

The idea behind the collaboration is that traffic is divided so that traffic peaks at each station are minimised

The information exchanged by radio operators includes:

- position reports at cleared reporting points
- pilot requests for changes in altitude, speed or route Air traffic control clearances from the area control centre
- weather information to and from pilots
- information provided to Airline Operations Centres (AOCs).

"We've upgraded our systems to the digital era, but we still need the human touch to manage the interfaces..."

A system used to remotely control communication equipment in various locations is the VCCS (voice communication control system). This system gives operators great flexibility and security in their work. Furthermore, Iceland Radio provides phone patch on request. The most common use for phone patch is when medical assistance is required for flights en-route.

In critical conditions such as severe weather or medical diversions, pilots will often rather talk to a real person instead of using automatic systems. Radio operators sometimes have to rely on their local knowledge of things

to quickly give pilots reassurance that things are being processed by ATC and also pick up on the urgency of the situation from the tone of the transmission, and follow messages up with a direct phone call to the controller.

With technological advancement, such as direct satellite data link communication between controllers and aircrew, demand for specialised radio station will gradually decrease. Many pilots can now make these reports via satellite links from the cockpit direct to the controller. Controller–pilot data link communication (CPDLC) is becoming the primary interface for sending and receiving messages, which are text-based instead verbal reports. This is part of a trend in aviation and society more generally. For contingency purposes, however, aeronautical radio stations and radio operators will be required for an extended period. Only when systems cease to fail and pilots become non-human, will specialised voice communication become obsolete. ⌐

Guðmundur Sigurðsson is the training manager at Iceland Radio with 16 years of experience as a radio operator. His interests are in the field of human factors and team resource management and he has attended several courses at IANS in Luxembourg in those subjects.

COMMUNICATION AND TECHNOLOGY AT THE INTERFACE

Communication in society has become increasingly mediated by digital devices. Similarly, technology in aviation is shifting the emphasis from voice communication to screens. What are the benefits, and what are the pitfalls of this new interface?
Marc Baumgartner describes developments at Geneva.

KEY POINTS

1. Thanks to 'old' new technology, such as CPDLC and Mode S EHS, we have improved safety at the interface in certain situations.

2. CPDLC has the potential to make communication more transparent and unambiguous.

3. Mode S helps controllers to read the mind of the cockpit.

4. We must stay alert to the possible unintended consequences of increasing automation at the interface.

Communication is one of the most important elements of air traffic control and air traffic management. It has its own international standards, procedures and requirements that formalise communication between the pilot and the controller. Communicating in a coded language, using aviation phraseology and sticking to pre-planned flight plan requests, reduces the need for interpretation of clearances and the need for further explanation, enhancing the successful communication at the interface between the ground and the air. This is all repeated many times during a flight for the pilot; simultaneously for up to 20 aircraft at any given time for the ATCO team in a busy sector.

But like any form of communication, there are challenges of interpretation and understanding, and this is affected by culture, language and technology. When communication is not clear, due to human, procedural or technological limitations, safety can be put at risk rapidly.

Two types of technology, in recent years, have entered the interface between controller and pilot.

CPDLC: Transparent and unambiguous

Nowadays in the Geneva ACC we are using a CPDLC system to transfer some information to the cockpit with some airlines. What we have noted since the use of CPDLC has become more frequent is that we have quickly adapted to this new interface between the ground and the air. Transit times can be from two minutes to 17 minutes and therefore a rapid, standardised exchange of information in a clear format is required. CPDLC has the potential to help achieve all this.

- **It is transparent.** When I send the message I see if the pilot has acknowledged the receipt of the message or if the message has not been delivered. If it does not work (e.g., too long transmission time or provider aborts) an error message is delivered to my controller work position.
- **It is unambiguous.** The information that is being transmitted corresponds to a format that is easily identifiable and corresponds to the expectations both the pilot and the air traffic controller will have in their respective working environment of the communication happening. "CLIMB TO FL330" is clear as a message.

MSID	Sel.Alt	QNH	VS	HDG	Roll	IAS	Mach	GS	Wind °/kt
ezs155d	15000	1015	+12	224°	R1°	172	0.288	176	239/8

As an ATCO, I have started to get an insight into the 'mind of the cockpit' via Enhanced Mode S Download Parameters.

Mode S: Reading the mind of the cockpit

How many times have you come across a situation where you say something to a family member, a work colleague, and you realise at a certain stage that your message was not clear for the receiver, or that the receiver had a different understanding of what your message was intended to say. In these cases, have you not sometimes wished you could read the mind of the other person?

As an ATCO, I have started to get an insight into the 'mind of the cockpit' via additional technology at the interface: Enhanced Mode S Download Parameters. Since a couple of years, I have seen what the pilot sees on his or her selection panel. Importantly, Mode S displays discrepancies between the selected onboard equipage and the clearance that I have entered electronically into the radar processing system.

From a communication point of view, we have benefitted a lot from the Mode S Enhanced Surveillance (EHS) download aircraft parameters (DAP). We can now read on our controller working position what the pilot has understood from our clearance, in particular when it comes to cleared flight level, speed and heading. Time latency for a monitoring alert has been defined as four seconds, meaning that I could correct a misunderstanding after four seconds (imagine this correction possibility in human relationships!).

Looking forward

In future, some of the communication and information exchange will be carried out via new technology that will allow for a reduction of potential misunderstandings, via harmonised and standardised interfaces between the ground and the air (Baumgartner, 2017). Technology is an increasingly important part of collaboration.

A new phenomena though, will be that communication will be more silent – and the so-called party-line effect might be biased or disappear completely. What effect might this have? Do we trust more a human voice, even if it is more error prone than a machine-machine interface? Will voice communication become as obsolete

Will voice communication become as obsolete as the switching rooms of the past?

as the switching rooms of the past? Another phenomena may be changes in the distribution of attention. Will we have more head down time? And then there is the possibility of changes to mutual understanding of a situation. Will controllers and pilots have the same understanding of what is going on in the sector? These are questions for human factors specialists, and for us as air traffic controllers and pilots. ⑤

Reference

Baumgartner M. (2017). DigiATMisation. Is a radical reform of the technological pillar needed? Or is it too late? *Controller magazine*, October, 6-7. Montréal: IFATCA.

Marc Baumgartner is an operational air traffic controller and centre supervisor in Geneva ACC. Marc was a member of the Performance Review Body/Performance Review Commission. For eight years until 2010, he was President and CEO of the International Federation of Air Traffic Controllers' Associations (IFATCA) representing more than 50,000 air traffic controllers from 137 States. Marc is coordinating the activities of IFATCA in SESAR and EASA.

HUMAN-MACHINE COLLABORATION:
FIGHT OR FLY?

The interface between humans and machines is critical in all aspects of work and life, and so it is in air traffic control and aviation. Rapid changes in technology require more of controllers than ever, in operation and in design. How should controllers approach this new age? **Giusy Sciacca** discusses some of the issues.

KEY POINTS

1. **Technology is here to stay, and will become increasingly sophisticated.**

2. **There is a need to address controllers' and other users' concerns about technology.**

3. **Technology and people are interdependent and need to work in collaboration.**

4. **The involvement of users in design and development via system integration is needed to optimise human-machine cooperation.**

In the last few decades, aviation has undergone a process of automation, which has transformed human work irreversibly and improved system performance, including both efficiency and safety. As a result, the topic of automation is still widely debated at all levels during conferences and workshops, and in many publications.

As for air traffic safety – the focus of HindSight magazine – we must continue to discuss the future of automation, including the impacts on users: air traffic controllers, pilots and other personnel. What do users and other stakeholders need from automation tools? How is automation designed and introduced? What is the reaction in the ops room when new technologies are introduced?

Often, in the process of introducing automation, reluctance and resistance emerge, along with general and specific concerns. In amongst these fears is the fear of unwanted changes to the job, and even fears of loss of the role of air traffic controller, at least in a form that we would recognise today. How can this be mitigated? The answer could be to help controllers overcome some of the myths related to automation, to dispel fears, and to underline the importance of the human role. This might help to move forward from polarised 'user-centred' vs 'technology-oriented' philosophies, toward a new paradigm.

The first question is, what is technology and why do we need it? "The word 'automation' as a noun captures a complex blend of technology interacting with human operators, each carrying out a wide range of tasks,

in support of human goals". This is how automation is defined in the UK CAA guidance document *ATM Automation: Guidance on human-technology integration* (2016). Complex technology is not just a machine. It is more like a living organism, which adapts to the context. It should not be seen as a tool to remove humans from the system, but instead to empower them, ensuring that controllers are always in the loop.

The digital revolution has changed our lives and the impact of technology has been disruptive. Just as Facebook and Amazon are changing the old business model, we could look at ATM in the same light. In the old days, air traffic controllers used to carry out their jobs using a clock, a pen and a piece of paper. Now, we are moving towards remote towers implementation, virtualisation, immersive technology and augmented reality, and intelligent approach.

The second question is, what is an operator and why do we need operators? The operator can be defined as a human being with technical and non-technical skills to utilise data (partly derived by technological systems) in order to accomplish the tasks of her or his job.

To operate these systems, the systems must be easy to understand and reliable. Operators should be able to understand not just how to operate technology, but also underlying system logic, functions, modes and design. This might involve customisation and adaptation in response to pragmatic needs.

In many cases it is not possible to think that one solution fits all. One suitable example could be radar surveillance interfaces or remote towers. When a radar interface is introduced, colours and labels play a significant role. During the remote towers live trials all over Europe, controllers reacted, conveying those adjustments and features they considered useful to work in accordance with their 'conventional' experience. Sometimes, for instance, the use of speakers to provide the sound of aeroplanes was considered helpful to enhance their virtual presence in an airport remotely located.

Technology and humans do not work alone and neither can work independently.

Understanding the mutual adaptation and interdependence between technology and controllers would help to overcome some of the myths about automation. Bradshaw, et al (2013) elucidate 'The seven deadly myths of autonomous systems':

- **Myth 1:** 'Autonomy' is unidimensional

- **Myth 2:** The conceptualization of 'levels of autonomy' is a useful scientific grounding for the development of autonomous system road- maps.

- **Myth 3:** Autonomy is a widget.

- **Myth 4:** Autonomous systems are autonomous.

- **Myth 5:** Once achieved, full autonomy obviates the need for human-machine collaboration.

- **Myth 6:** As machines acquire more autonomy, they will work as simple substitutes (or multipliers) of human capability.

- **Myth 7:** 'Full autonomy' is not only possible, but is always desirable.

Several of these are of particular relevance to collaboration. Technology and humans do not work alone and neither can work independently. They both perform collaboratively to the same purpose. No agent, whether machine or human, can perform all functions all of the time without implying some interdependencies with another agent. Automation changes the nature of work.

For instance, inevitably, automation fails at same point. In such 'extraordinary' situations, which tend to be unpredictable by nature, human reasoning and problem solving is irreplaceable. Through both technical and non-technical skills, the operator plays the role of a creative strategist who – within the regulatory framework – is able to provide the flexibility needed to keep the system going. During radar failures, which have occurred in Europe in recent years, controllers faced challenging moments with a remarkable effort and competence using all the means at their disposal to preserve safety.

Referring to Rasmussen's (1983) S-R-K theory of performance, human activity is based on skills, rules and knowledge. Our conceptual and physical performance at work is then based on professional education, continuous training, knowledge of codified procedures plus additional experience, deriving from our cultural and personal background, judgement and our non-technical skills (NTS). The human component of the system makes the system resilient. Via continuous interaction with the automated systems, operators employ both standard rules to achieve a level of standardisation in certain defined situations, and reasoning and cognitive strategies to manage variability through flexibility.

This is what we do every day in our operational rooms, where we operators face minor or major unpredictable events. Inaccurately, we tend to think about major failures only, disregarding the everyday adjustments and actions that we take. For example, if as a controller you work in a paper strips environment and your strip printer or the Flight Data Processor (FDP) breaks down during the peak of traffic,

you have to copy the flight data manually. Or in the case of bad weather conditions, predictive tools, such as mid-term conflict detection (MTCD) and tactical controller tools (TCT) may not be sufficient to solve potential conflicts.

Consider also the extended arrival management (E-AMAN) concept, developed as an automated sequencing tool, especially for busy terminal movement areas (TMA), relying on target times. Again, in bad weather conditions, such planned operations would be inapplicable in the operational reality. Likewise, operational opinion must be taken into account by the industry about the future optimisation of controller-pilot data link communication (CPDLC) in the effort to find a long-term solution to the issues of the current system based on Link2000+.

So, to reduce the distance between advanced automated systems and human operators, especially during out-of-the-ordinary situations, automated systems and interfaces must be understandable and accessible. An interactive and iterative cycle for software engineering and interface design is needed, involving manufacturers, engineers, users and also legal experts, with reference to legal liability. This must ensure that tools meet user needs. Only via cooperation between these worlds can the air traffic control system achieve optimum performance.

Interdependence is therefore needed, to encourage a cohesive approach where humans and automation are conceived holistically, as an integrated system engaged in joint activity. Our professional life is not immune to change, and indeed we need to adapt to the technological evolution in order to survive as controllers.

How can we face this disruptive change? The conventional approach might lead us to the perception of change as loss, and to resistance or passive acceptance. The alternative option is to see change as a continuous evolution of already acquired skills and the development of new ones. Such an approach is crucial in the process of technological implementation in ATM, because the active participation of operators enables innovation from regulatory, procedural and design (including human factors and ergonomics) points of view.

If we controllers are to survive as a species, we must help to co-design the human-technology collaboration through the design and development process, and play an active part in system integration. As Charles Darwin reminded us, survival depends on being responsive to change. **S**

"Another technician?! Put him into the hold!"

References

Bradshaw, J.M., Hoffman, R.R., Johnson, M., & Woods, D.D. (2013). The seven deadly myths of "autonomous systems". *IEEE Intelligent Systems*. May-June 2013, 54-61.

CAA (2016, February). *ATM automation: Guidance on human-technology integration*. CAP 1377. Gatwick, UK: Civil Aviation Authority. Available at: http://bit.ly/CAAHCA.

Catino, M., Coletto, D., Bianco Dolino, A., & Locatelli, C. (2015). *La professione dell'Air Traffic Controller: Operare in contesti ad alta affidabilità tra efficienza e sicurezza* [Working paper].

HALA! SESAR Research Network (2016). *HALA! Position Paper: State of the art and research agenda*, 25. Available at: http://bit.ly/HALASESAR

Rasmussen J. (1983a). Skills, rules, and knowledge-signals, signs, and symbols, and other distinctions in human performance models. *IEEE Transactions on Systems, Man, and Cybernetics*, 13(3), 257–266.

Giusy Sciacca holds a degree in Modern Languages and Literature and she is completing her professional education in 'Responsible Innovation' at Delft University. An active air traffic controller based in Milan Linate Tower, she is also Secretary General of ANACNA, the Italian association of air traffic controllers and ATS personnel. Giusy is actively involved as IFATCA representative at the Technical Sub-Group (TSG) of the Industrial Consultation Body (ICB) and Chair of the IFATCA RTO group.

DR JACKAL AND MR GIRAFFE

Effective collaboration requires effective communication. But how do we communicate, and how might we communicate in a way that each party's needs are heard, understood and met? One approach is known as non-violent communication. In this article, **Maciej Szczukowski** provides a practical introduction.

KEY POINTS

1. **All human beings share similar needs but the strategies used to meet them vary.**

2. **Hiding one's true emotions and needs may lead to problems.**

3. **Expressing vulnerability may improve communication.**

4. **Four elements of NVC are: observations, feelings, needs and requests.**

Collaboration in ATC is important, no doubt about it. It creates a community. It distributes resources and responsibilities. It protects from mistakes and bad decisions that we could have made if it were not for the person sitting next to us. When Gordon Dupont listed the famous 'Dirty Dozen' of conditions that may lead to a mistake or an accident, I believe there was a reason that 'lack of communication' got the first place on the list.

During the ATC or cockpit training we undertake, we usually learn that communication should be precise, concise and clear. But beyond the airwaves and coordination in the Ops room or in the cockpit, there always comes time and space for a talk, for a discussion. It may be between controllers during a break, between a trainer and a trainee during a debrief or between all of them and the management. Does 'precise and concise' policy really work here? Does it work in the traditional concept of hierarchy?

At some point, I decided to become a psychologist. For a year now, I have been gathering experience, working with clients in crisis, with emotional problems or being victimised. What is common in such work is that these people desperately need to have their needs heard, then met. When it does not happen, emotions grow, become heavier and may even turn into traumas. In the 1960s, Marshall Rosenberg began to develop a way of communicating called 'non-violent communication' (better known as 'NVC'). He said that every person can either become a Jackal or a Giraffe. The Jackal, a representative of violent communication, is a carnivorous, aggressive and dominant creature that often hides, looking for its next victim. The Giraffe, a non-violent owner of a large heart, represents the compassionate and sincere side of

communication. With its long neck and big ears, it sees and hears more, and thus is aware about the needs of individuals around it. In fact, with that long neck it also cannot hide as 'effectively' as a Jackal and it may be a bit more vulnerable. But is it really that bad?

> One of the purposes of NVC is to improve the exchange of information and, in effect, to resolve differences in respect to the needs of both parties.

One of the purposes of NVC is to improve the exchange of information and, in effect, to resolve differences in respect to the needs of both parties. This is possible when observations are not mixed with interpretations, when one's needs are expressed without judgments or criticism but with authenticity and respect. Only then can conflicts, which are an inseparable part of the process of collaboration, be discussed rather than avoided. NVC also emphasises the importance of responsibility. According to Rosenberg, the Jackal in us fails to accept responsibility for one's actions, concentrating on actions of others (*"I had to because he/she ..."*), external or abstract forces (*"He told me to ..." or "It was necessary to ..."*) or regulations (*"It is the current policy to ..."*).

Such an approach diminishes one's own power of decision and action and 'protects' the Jackal, keeping him in hiding, waiting for the chance for aggressive defence. Rosenberg once shared the story of his work with hospital administrators, who didn't want to present their ideas to the doctors. They were afraid. After some time, Rosenberg found out that the problem was not in fear of communication but in fear of admitting that they were

afraid. He wasn't surprised, knowing how many people cannot even imagine themselves showing their feelings at work. But he was able to convince one of the administrators to take the risk. The administrator communicated in a rational, consistent way, expressing his needs towards the doctors. It worked. He received understanding and support in his initiative. Then he also realised the value of his vulnerability, of becoming a Giraffe. It is understandable that vulnerability may be the biggest obstacle in an environment of high level of power or hostility, as is sometimes the case in a manager-employee relationship. But the literature suggests that it diminishes along with experience and training.

During NVC training, participants usually express that they need a structure (or a checklist, if it helps) of how to become a Giraffe. But the real turning point in learning NVC is the moment when one realises that it is all right to stop proclaiming and start to listen. Then a person is able to create an image of experiences, feelings and needs of the interlocutor. They are able to realise how differently people may see and interpret the reality around them, and thus how much their understanding may vary from what we believe in. Take a radar and non-radar rated air traffic controller. Compare representatives of two different airports. Or ask a controller and then a pilot about the very same situation. You will very quickly notice the differences in perspectives.

How to use NVC? Its model is based around four basic elements:

1. **Observations**
2. **Feelings**
3. **Needs**
4. **Requests**

Observations are facts that can be acknowledged by all parties. They are not interpretations. **Feelings** reflect inner emotional states. They are also not interpretations and exclude the influence of suspected motive of the other party. Therefore in NVC one can be angry or sad but should not *"feel like she/he did ..."*. **Needs** mirror the basic qualities required to lead a satisfying life. These needs can be for safety,

belonging, compassion, freedom, etc. And finally **requests** are doable, specific positive actions based in present time *("I'd like you to express your opinion on the new procedures and what can be improved in them?"* rather than *"You are obliged to report deficiencies in the procedures.")*. It is important to remember: when a request is not allowed to be answered with a refusal, or its denial is punished, it becomes a demand. We don't want that. (see Table 1.)

I remember when, a few months ago, while working Ground Control position, I heard an 'evaluation' by an airline pilot, unhappy with the fact that I had sequenced him after an aircraft with a shorter taxi time. Knowing my reasons for the decision (off-block time, taxi speed, intersections used, estimated time of landing of the traffic arriving for a crossing runway, routings, etc.), I just acknowledged the pilot's observations and expressions. In most situations, such as this one, we usually tend to get upset but accept them as reality. But an extra step allows almost anyone to do something more about it; to try to put oneself in others' shoes and invite others to do the same. Although it may seem a bit intimidating at first, it can also be very helpful.

Minutes passed. I observed the symbol of the aircraft on the radar screen and when the mode C read-out reached around flight level 200 I called my colleague from approach control. Seconds later, the pilot was back on my frequency writing down my telephone number. The next day we talked for about half an hour. For me, it was an example of NVC in action. Exchanging

	'Common' communication	**Non-violence communication**	
		OBSERVATIONS	
		ATCO:	When you say I am unprofessional ...
	You delayed us! It is **unprofessional**! Please note that there are no needs or request therefore I don't know what am I expected to change	**Pilot:**	When you delay me in a sequence ...
		FEELINGS	
		ATCO:	I feel discomforted and frustrated.
		Pilot:	I am surprised and upset.
		NEEDS	
		ATCO:	Because it is important for me to create trust between ATC and the crews.
		Pilot:	Because it is important for me to have a sense of equality between airlines.
		REQUESTS	
		ATCO:	Would you be willing to listen to the reasons of such sequencing?
		Pilot:	Would you be willing to inform me about reasons of sequencing when it is different than normally expected?

Table 2

observation and listening to our feelings we quickly learned our needs, with a request, on one side, to better inform about sequence reasoning. And on the other side to trust my decisions, which usually involve analysis of many elements, many of which are not visible to pilots' eyes. Today I recognise this pilot's voice and hear it often. But now, I can tell, it sounds different, regardless of the number in departure sequence. (see table 2)

Observations, feelings, needs and requests are inevitable elements of our lives. It is the first NVC assumption that all human beings share the same needs, but meet them differently. And respecting one's own needs, being a Giraffe oneself, is crucial (it is not by chance that "In case of a sudden drop of cabin pressure you should put your

own mask on first and then help your child"). In the demanding environment of an Ops rooms or a cockpit, there may not always be time for discussions. Also, with our rating training we expand our potential but, at the same time, we narrow our perception, concentrating on a designated part of the whole system. Meanwhile the equality within the team guarantees better quality of collaboration. Therefore would you be willing to invest your time in studying NVC and sharing your experiences with it? During the TRM session maybe. Or during the lunch break. ⑤

Recommended reading

Rosenberg, M.B. (2003). *Nonviolent communication: A language of life* (2nd edition). Puddle Dancer Press. (Available in over 30 languages.)

Maciej Szczukowski has been an Air Traffic Controller and OJTI for over 16 years in Warsaw, Poland. He has also been an aviation consultant and ground school instructor, working with pilots and cabin crew and a classroom instructor in local ATC training centre. He has experience as a private pilot. He holds an M.Sc. in Psychology and is currently undergoing training in integrative psychotherapy.

Table 1

How I am (expressing oneself)	**How you are (listening to others)**
OBSERVATIONS	
When I see / hear / remember ...	When you say / see / hear ...
FEELINGS	
... I feel / am (emotions).	... (do) you feel / are you (emotions)?
NEEDS	
Because I need / it is important for me ...	Because you need / it's essential for you ...
REQUESTS	
Would you (be willing to) ... ?	Would you like me / us to ...?

BUT WE'RE STILL FRIENDS?

Major organisational changes can have subtle but powerful effects on collaboration. Separation of ANSPs from regulators and airports, even reorganisations, create new interfaces, barriers and constraints. How can we minimise negative effects on collaboration? In this article, **Paavo Puranen** reflects on recent experience in Finland.

KEY POINTS

1. **Know your work and know your neighbours' work.**

2. **Building mutual trust between interfaces (different companies, professions and departments) is essential.**

3. **Remember to keep in touch to maintain trust and collaboration. This requires active effort.**

4. **Help people to see patterns and the flow of work as a whole, using TRM with mixed groups.**

There it was, in the news, just like that. It had been rumoured for years but hardly anybody really believed they would see the day. The separation of the Finnish ANS division was being planned with the start date of operation only three and half months away – April 2017. That felt like a short time to make everything clear. Of course everybody is separated in some way, already in the company, but we are interconnected to almost everybody and people rely on each other.

It felt like a short time to build a new company, not from scratch, but from an operative division. We heard that some people would move to the new company, but who would it be? That would be made public only in the end. A building phase with those people in the new company started. Those who had done a lot of work for and with the people leaving needed to rethink their work in this new situation.
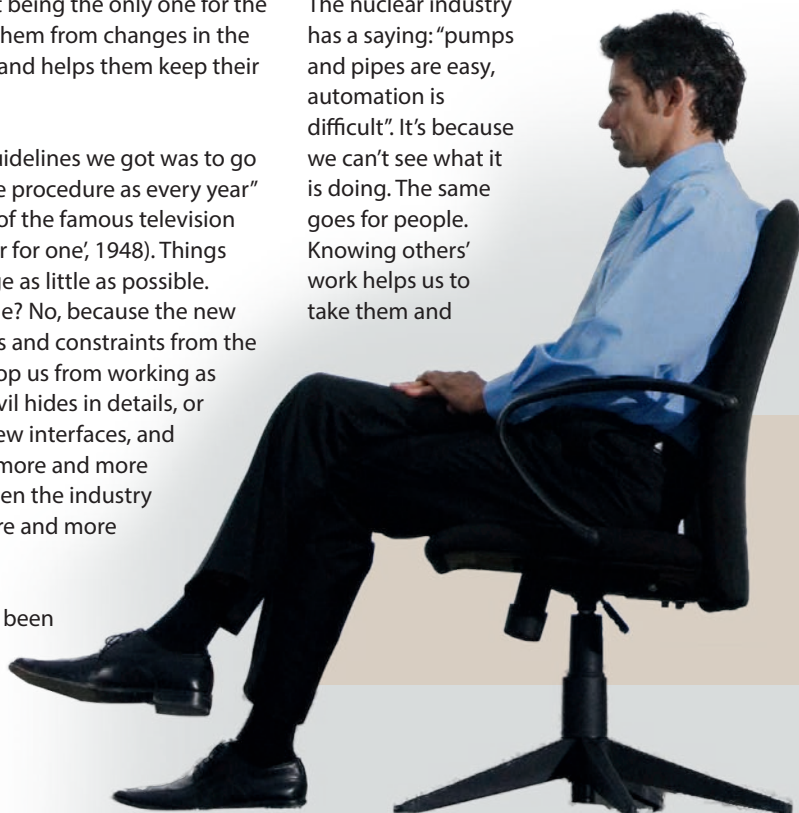
There are a lot of things a company has to do just to survive and usually these develop in an evolutionary way. It usually starts from a few generalists. Knowledge deepens and becomes more and more scattered. Many specialists emerge. Airports and ANSPs are both so complex and big that generalists have little room. There are just too many things to do.

As the organisational structure and communication channels grow, people become separated and have less time to talk to others about their work. Knowledge becomes tacit and specialisation grows. Some people can even feel that being the only one for the job protects them from changes in the organisation and helps them keep their job.

One of the guidelines we got was to go on with "same procedure as every year" (reminiscent of the famous television sketch 'Dinner for one', 1948). Things should change as little as possible. Was it possible? No, because the new limits, barriers and constraints from the separation stop us from working as usual. The devil hides in details, or in this case new interfaces, and we will have more and more interfaces when the industry becomes more and more scattered.

The issue has been discussed in HindSight many times. People save the day when systems fail by adapting to surprises and variations. Scatter makes it difficult by hiding the information we need to adapt safely.

How can we cope with such an organisational change? Here I offer four suggestions. They do not necessarily form a sequence, but rather interact with each other.

1. Make work visible

Organisational change such as separation or reorganisation of functions can increase the gap between work-as-imagined and work-as-done (see HindSight 25). To narrow the gap, we need a clear view of each others' work. We can be visible to others and we can help them and us to learn from our work-as-done.

The nuclear industry has a saying: "pumps and pipes are easy, automation is difficult". It's because we can't see what it is doing. The same goes for people. Knowing others' work helps us to take them and

their work-as-done into account, and to adapt our work to theirs. If we don't know what others are doing and why they are doing it, it is harder to adapt as needed. Think about handing traffic over to next sector. The main principle is 'on the terms of the receiving unit'.

2. Build psychological safety and mutual trust

Transparency requires mutual trust, and an environment where it's safe to open up, safe to explore, safe to make mistakes, safe to learn and safe to let go of your own expectations – your own work-as-imagined. Otherwise we can't be open enough and we stick with 'work-as-disclosed' instead of being open about 'work-as-done'; also known as 'P.R. and Subterfuge' (Shorrock, 2016, 2017). And make it possible and safe for others, too. Building that trust takes time and effort, but it is essential. This is a requirement on all levels of the organisation, because barriers will be built the moment one loses trust. Trust and transparency suffer when it becomes 'them and us' in the new company or reorganisation, and suffer even more when there are hidden agendas that separate us.

3. Keep in touch

Trust fades away when people don't see each other as often as they used to and when people change positions. Continuing 'business as usual' requires extra effort from everybody to keep in touch. When we were part of the same in-group, in large scale, we had the trust, we had the talks, we had the visits.

In our case, now I know I could have done better. How do I know? It's the talks I don't have any more. The new organisational model takes time to develop and in the meantime it is too easy to just concentrate on my work, nothing extra. That 'extra' is about the interfaces with other departments, professions, organisations. If people have the opportunity and motivation to keep in touch with others, in a relaxed way, they will do that. Usually it is pleasant and brings balance to normal work. It's just that it can take a little push to accomplish that.

A few years ago, the Finnish MET service provision was reorganised. The Finnish Meteorological Institute (FMI) got to take care of all observations, aviation, maritime and road weather. It happened a little after an observation automation project at airports. We used to have local observers or meteorologists and, especially at smaller airports where everybody knew each other, we talked to one another. Controllers from tower could talk to observers about changes in weather. Now the organisations talk via letters and high-level meetings. Even thought we were in different organisations – Finavia and FMI – everyday conversations developed the relationship between us.

4. Open up TRM

What can be done on an organisational level? One of the ways is to help people make sense of their and others' work. One of the tools is EUROCONTROL team resource management (TRM), implemented with mixed groups. It's not just talking, it's learning what the work of other's means for you, how you affect their work. It's a way to get a view from above.

Paavo Puranen works as a safety analyst and human factors specialist in Finavia's risk management. He has a controller background in the tower and approach environment. He is helping the company to develop by bringing light to data and helping units to build their way forward. He has a background in statistics and educational work research. He is also a certified coach.

This helps to build patterns. The human brain is skilled at pattern recognition and we use just enough information to recognise the situation and then act accordingly to the pattern. But specialisation prevents us from recognising patterns, including the flow of work as a whole. It might surprise you to find out how others with different backgrounds can help you to think, to build the patterns to draw from when needed. When building a new company, reorganising or changing operations, an explicit understanding of patterns and the flow of work becomes even more important than during normal operations.

So what we need is to build a chain of collaboration through the whole flow or work – the whole chain – from start-up to arrival. TRM events between companies, often between controllers and pilots, have given good results for those participating. The next step is to spread the word, make work visible and build patterns in everybody's heads for future use. The more we know about each other, the easier it is to know what others need, and to adapt, to help each other and improve how the system as a whole works.

After a separation, reorganisation or change in operations, we need to put effort into collaboration. We all are a part of our customer's journey and we all want it to be a good one. We're in it together. ⑤

References

Shorrock, S. (2016, December 5). *The varieties of human work* [Blog post]. Available at: https://bit.ly/TVOHW

Shorrock, S. (2017, February 6). *P.R. and subterfuge* [Blog post]. Available at: http://bit.ly/TAOHW6

INTERFACING NOTES FOR THE INCIDENT INVESTIGATOR

Incident investigators work at a particularly important safety interface in ANSPs – between operational staff and management. It is a role that requires not only skills in analysis and writing, but also in collaborating, relating and persuading. In this article **Sebastian Daeunert** lets us into his experience as an investigator at Frankfurt, and gives some advice that is relevant for anyone who has recommendations or suggestions concerning safety

KEY POINTS

1. A good relationship with the sharp end and the blunt end is a precondition for being successful in safety management. You have to understand both worlds.

2. You have to be able to understand the pressures and demands that are on the people whom you target with your recommendations and suggestions.

3. Honesty, credibility and transparency are vital if you want to receive information from front-line staff.

4. Safety recommendations and suggestions must make realistic and relevant demands. Do not hide out-of-place requests labelled as 'safety' in your reports.

When I changed from being an active air traffic controller to the role of incident investigator for our tower I had this gloomy vision. I had grown up with the old system. When I had my first loss of separation as a controller – a missed approach following a departure – the usual lines appeared in the investigation report: "The controller apologised and assured he would never do this again". I was ordered into the replay lab and played back my misdeed and told to never do it again. With a humble feeling I went back to work.

This was something I wanted to change. I did not want people to be scared when they had done something wrong. I wanted people to come out of that little replay lab feeling that we had improved something. As time went by and I attended a human factors study course I decided to put my new ideas into practice and wrote my first ever 'systemic no blame' investigation report. I told my boss, who was used to just signing these, that he had better read this one in detail as it was "something new". A loss of separation had occurred during a handover situation. My report portrayed how people had gotten under pressure due to the lack of a supervisor in the tower. A weather situation led to an overload. Things had been forgotten due to a rush to get ATFM measures up and running. Technicians were taking things apart during this apocalyptic setting, which was even more enhanced by a 'spotter' colleague who was taking photos of airplanes in the middle of it all.

I will never forget his words: "If what you write is true, we might as well shut this place down. It's a quagmire." He then continued: "However, I support your new approach, but you must help me with my superiors in explaining what the motivation behind it is."

This was one of the best moments I experienced in safety management, finding an understanding person who supported a new approach. Now these kinds of reports are standard, but at the time it was a revolution. It worked because my boss was willing to go through with it. So what is the key to a successful interface and what are the interfaces we have?

In investigations, but also when making safety recommendations or suggestions, there are two important connections.

The first one is how you interact with your controllers. Given the principle of work-as-imagined and work-as-done, it is of course an advantage if you have recently worked as an ATCO, or are now. It is all about trust and acceptance from your controllers. But to be honest, I see a certain time period where this trust can be maintained after going out of active controller duty, but one day you will turn into a fossil who will start to compare now with your days gone by. Investigators must always be aware of that fact.

Trust and acceptance are not 'givens'; they have to be earned.

Trust and acceptance are not 'givens'; they have to be earned. 'Your' controllers have to be sure you are on their side and you are doing what you are doing to help them live in a better, safer world. Your measures have to become reality; promises of a better world alone won't do the trick. Your role as an investigator and safety person is under no circumstances to whitewash anything. To the contrary, I had many unpleasant topics I had to bring up with controllers. But my experience is that when you explain why you see things this way and you are predictable and reliable you might get a discussion but no one ever leaves your office on a bad note.

Transparency can easily be reached by being present. We run twice yearly safety briefings but there are numerous other occasions where I explain what is new and what we are doing. A regular presence in the ops room – not as a spy but as a colleague – is also important. Interfacing with controllers for me is the easy part; all it needs is honesty, transparency and goodwill.

Another fine moment happened in 2015 when two controllers came to my office. They said they had just experienced an overload situation created by an over-eager colleague who had pushed them so far that one of them had completely lost the traffic picture. They had discussed this with the colleague

who felt he had done nothing wrong and so announced they would go to my office and tell me to investigate it, even though by definition it was not an incident. The accused controller replied that this was absolutely okay with him and he had no problem with it. In the end, we had a group session with a TRM trainer where we closed the matter.

Management is the other side that safety management faces. This is far more difficult as management itself is under certain pressures. You also want to bring things up that may not have been part of an incident and will be faced with the question of why you are bringing this up now when nothing has happened.

Therefore, here is some advice on what has what has worked for me.

Occasionally some of my colleagues try to repackage things into the 'safety gift wrap' proclaiming that this and that is a safety issue when it is not. It is something that controllers also like to do. This loses credibility for your request quickly as everyone knows it is just a way of trying to make it look more urgent.

A sure way to repel any positive reaction is what is known as the 'wet dog effect'. Come in wet from the field, shake dirt and water at everyone in the room and then be astonished why people back away instead of listening to you. This is what happens to the safety people who say that the entire situation is totally out of control. Structure is important. Make your points and separate them. Be precise. Be structured. What exactly do you wish to achieve?

Stay with the facts.
Be credible and consistent.

Stay with the facts. Be credible and consistent. Do not smuggle things you always wanted to have as a necessary measure into an investigation report. Be realistic with your recommendations. Convince management that changing a specific item will also be of an advantage to them. Do not just explain that a safe environment will be beneficial for them. Do not threaten by proclaiming that they will all go to

jail if this or that happens and they did not prevent it, or the other more subtle threats. Stay with your argument and the benefits that you see.

Be aware that even though you may feel something is really pressing, safety is only one piece of their mosaic. They are into financial obligations, productivity, even careers and politics. It is normal that not all recommendations are accepted or met with euphoria. After all, our dilemma is we can be seen to harm productivity; our recommendations cost money and yet we can never prove that an accident has not happened because of our recommendation.

Finally avoid getting into that gloomy human factors cloud. Some managers are very human factors minded (I am lucky that mine is) but many think it

is some kind of voodoo and you are some kind of priest who talks in weird words about vague things, totally disconnected from the real world. Always use the language that everyone understands and connect your human factors arguments to the facts that you want to bring across. If your management takes you seriously, you will be able to achieve a lot.

Another example is when I was able to communicate that we had a problem with complexity. My management agreed to a human factors initiative, which has now spread into our central safety management who are supporting us on the subject.
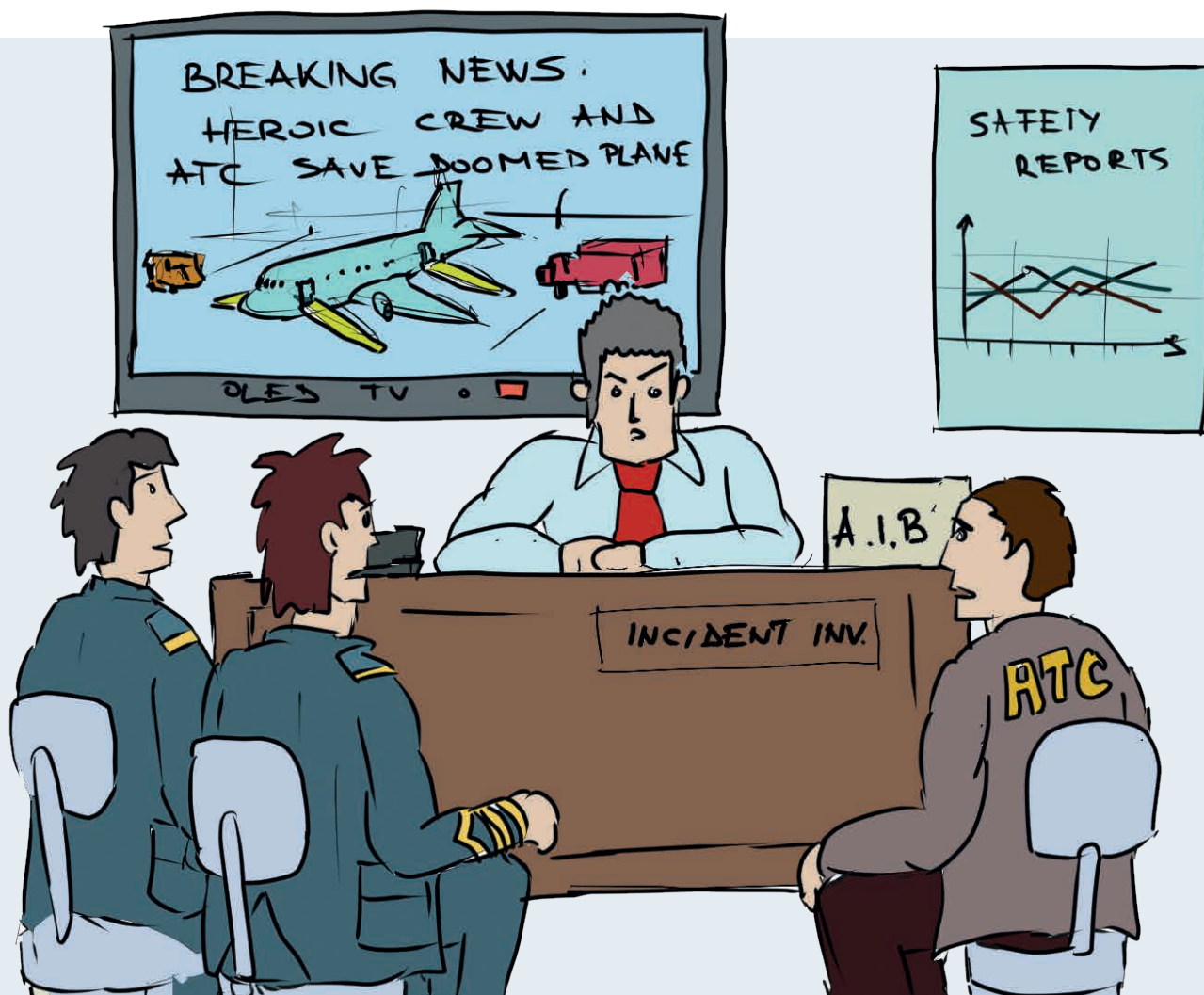
To sum things up, in order to reach your goals, be honest, transparent and fair and try to see the problems of

whomever you are collaborating with. At the same time, concentrate on the things that you find in the specific case you are investigating and the related recommendations that you want to bring across to your management or controllers.

If you don't succeed the first time round, be persistent and keep bringing the problem up until it is solved. S

Sebastian Daeunert is the incident investigator of Frankfurt Tower. He was an active TWR/APP controller for 15 years before getting into safety management and human factors. He participates in the EUROCONTROL/IFATCA prosecutor expert scheme

"You cooperated well, but the use of nonstandard phraseology
and procedures made it look like a very sloppy job..."

THE BRUSSELS AIRPORT LOCAL RUNWAY SAFETY TEAM:
COLLABORATION AT WORK

Safety problems usually look very different from behind a desk, compared to when out in the field. Safety problems are also perceived and understood differently by different people with different roles, goals and needs. In this article, **Davy Van Hyfte** recounts practical approaches to collaborating for safety at Brussels Airport.

Davy Van Hyfte started his aviation career as a military air traffic controller. He gained experience as a Tower, Approach and Area controller and participated in overseas missions too. He is now Head of Operations Compliance & Certification Unit and nominated Safety Manager at Brussels Airport, and is involved in auditing, incident investigation and human factors.

KEY POINTS

1. **When safety problems occur, wherever possible, multi-disciplinary teams should go out together to observe the situation, including the field experts involved (e.g., drivers, controllers).**

2. **Roundtable discussions with mixed groups can help to understand each other's respective goals and needs, and bring new insights and understandings.**

3. **Simulated reconstruction can be useful to help develop shared understandings of problems.**

4. **Multi-disciplinary groups should be involved in co-designing solutions.**

The day after my appointment as Safety Manager, I was asked by the Director of Operations what my ultimate achievement would be over the years. I could have picked many aspects from the broad SMS domain and for sure I could have answered that I would want to see continuous improvement of the level of safety in our KPI's applicable to safety at our airport.

This would be an answer from the book, when you would have a paper-based safety management system in place.

What my ultimate achievement would be is that business line owners, project managers or change leaders would contact the experts of the Safety Management Cell themselves and ask for a compliance review, or ask for support in drawing up a hazard identification and risk assessment. When operational leaders would contact us and ask to conduct an audit, ask to perform an investigation to identify the causes of process failures, discontinuity, and incidents. When operational staff, vehicle drivers on the manoeuvring area, wildlife controllers, ATCO's, and pilots would contact us expressing their concerns and suggestions. Or when they would ask for refresher training when feeling unsure, or tell us about discrepancies between theory of rulemaking and practical day-to-day issues.

Am I dreaming? I don't know. But what I see is that when you bring in safety management activities from this perspective, you avoid 'safety' being seen as something 'mandatory'; something relating to people who just come in and say how things should not be done but then do not say how it would be possible to improve. We wanted to avoid this way of working, where audits are seen as a one-day exam, after which everything can continue as per the day before the audit.

We wanted to avoid this way of working, where audits are seen as a one-day exam, after which everything can continue as per the day before the audit.

That being said, let's look at a real example. We received feedback from vehicle drivers from the maintenance department that, while approaching the stopbar on TWY C6 from Z, the holding position and stopbar is sometimes difficult to see in the turn. When they conduct a follow-me for their subcontractor convoy vehicle drivers, they must be focussed on applying correct phraseology with the tower, stay aware of what is going on around

them, and look after the convoy vehicle drivers. The limited visibility in the turn, amongst all these activities, can sometimes lead to late identification of the position they need to hold.

At the same place, we suffered some runway incursions (all ICAO CAT D classification) where aircrew crossed the holding position with stopbars illuminated, without being authorised, but nevertheless stopped some metres behind the holding position, without entering the runway itself. And next to the TWY C6 we had a TWY C5 giving entrance to the crossing of RWY's 01/19 and 07R/25L.

These observations and concerns were brought together and the Safety Cell invited members of the Local Runway Safety Team to go out and have a visual observation of the situation. Vehicle drivers were consulted and with them a reconstruction was simulated. Having in mind EASA Certification Specifications and Guidance Material for Aerodromes Design, we started to work in a multi-disciplinary group to work on infrastructural mitigation for this hotspot.

We decided together to define TWY C5 as a no entry taxiway and add to both C5 and C6 additional elevated stopbars and additional markings. The additional pair of elevated stopbar lights was turned slightly into the turn coming from Z to more easily identify this holding position. To the TWY centrelines leading to the holding positions of C5 and C6, we added the TWY enhanced centreline markings and mandatory instruction markings. This effort was intended to enhance visual identification of the named holding positions for both pilots and vehicle drivers.

Another collaborative initiative we organised brought people of the infrastructural department (both electro-mechanics, maintenance and construction) around the table with aerodrome operations staff, air traffic controllers and representatives of the safety management cell. The goal was to clarify terminology and definitions used within the framework of organising aerodrome works. All partners were asked to explain their insights, their respective goals and needs. Quite rapidly the aim of this initiative was met. People confirmed misunderstandings

and people started to say: "Ah, now I understand why you always ask this to me." "Ah, now I know why I need to call in works beforehand and need to ask for an end-of works inspection." "Yes, now I understand how limitations imposed by LVP have their effect."

Having ended two sessions now on this topic, people feel better understood again and have a better understanding of what other stakeholders require to be successful in their job and stay safe. The results of this effort are reconfirmed and aligned definitions that will be taken into a reviewed 'local aerodrome works regulation'. The next steps are to have the reviewed document integrated in a joint change case. When the new version of the document is published in the Aerodrome Manual, collaborative training is planned to be organised by means of a customised e-learning and on-the-job training. Do you think that misunderstanding 'PPR' (prior permission required) is not possible? Yes, it is: six different interpretations came up during the sessions.

Let's continue to work together and learn to understand each other's goals, working methods and concerns. Local Runway Safety Team Members are key for success and have, by means of an implemented SMS, the right tools to support collaboration. ⑤

"Those red lights... I heard something about keeping to the side of them from ATC, but which side?"

DO YOU TRUST YOUR SAFETY MANAGER?

How is your relationship with your safety manager? The interface between operational and safety staff can sometimes involve friction, as the goal of the safety department reflects only one of the goals of the operational staff. In this article **Maria Kovacova** reflects on her experience as a former safety manager, and invites safety managers and operational staff to better understand one another's worlds.

KEY POINTS

1. **Safety managers and departments and ATCOs should build trust by spending time together in each other's environments, and in workshops.**

2. **Concerns about safety processes and operational safety issues should be discussed regularly and informally.**

3. **Safety departments should provide relevant, timely feedback to ATCOs who report occurrences.**

Imagine a survey focused on the trust of operational employees in their safety managers. I think the results would surprise many safety managers. We safety managers believe that we run safety management systems within our companies with the best intention – to help operational people and management continuously improve safety. But is the view of operational people the same? Do they feel that the safety manager is there to support their work and system safety as a whole?

I was safety manager for several years and every day was a small battle to gain the trust of operational people. I learnt that many aspects contributed to the whole picture. One of the main contributors is the culture that you live in, not just the organisational culture but also national culture. It makes a big difference whether you are coming from post-communist times or you are a safety manager in a western European country. It also makes a difference if you have operational experience or not, if you are young or older, even male or female. None of these contributors is necessarily good or bad. They just mean that a safety manager might have

to take different approaches to the establishment of a safety management system. You have to communicate safety topics in a different way to different interested groups and parties.

Often, the safety manager is invisible to air traffic controllers and his or her activities and viewpoint may not be recognised properly. In my experience, it is very important to talk with operational people. Regular visits to all operational rooms and units and regular informal discussions are the basis for trust – on both sides. Operational staff will know that it is easy for rumours to spread around the Ops room. Line managers sometimes modify the position of the safety manager and present it in a way that "safety didn't approve it" or "safety found that it was in breach of the rules and now we have to take this action". It is true that the 'safety argument' can be abused by everyone. But the safety manager has the power to change this attitude and put information into the right context. The only way to do it is to go to wherever the work is done, and talk to ATCOs, supervisors, flow managers, technicians, etc.

I have had the opportunity to discuss this topic with safety managers from different ANSPs, airlines, airports, and military. What I have discovered is that communication and regular discussions with operational people are rare. Safety topics are often not communicated properly and can be misinterpreted.

In this area I was lucky for two main reasons. First, I studied at the same university as some of my ATCO colleagues, so I was not afraid to go to Ops room, grab a coffee and talk with them. I spent hours with ATCOs and supervisors, who explained what they were doing, why they have to work in certain specific ways, why the system is designed in the way it is and where is the potential for improvement. Second, I had the full support of the CEO and we started to use different ways of communication with operational employees so we could explain different safety topics properly.

Reporting and investigation is a critical issue. What do controllers imagine when they think of this? From my experience it was often the following: after a separation minimum infringement or runway incursion, I have to issue a safety occurrence report. My actions and potential mistakes will be the subject of an investigation and after a long time I will receive the report, which will not be in line with how I experienced the occurrence.

For this reason, I decided to talk to ATCOs about how investigations are managed – about why analysis, findings

and recommendations are formulated in the way that they are, and when they can expect feedback. After this experience and discussion with my team we decided to introduce an electronic reporting system. This was not just to help the process of reporting, but to give the opportunity to see what is going on with the report. We also introduced a mandatory procedure for investigators to let ATCOs read the final report and discuss it if necessary before the investigation report is officially issued. This procedure is highly appreciated and welcomed among controllers.

So do you trust your safety manager? Perhaps it depends also on their style. Tyler Britton (2017) described five types of safety managers. There is no 'good' or 'bad' type; each type is appropriate for different types of cultures, depending on the maturity of safety management and just culture within the organisation, as well as within the State. Here are the five types, according to Britton:

1 The Expert Safety Manager

Expert safety managers gain authority and respect via their expertise, including their understanding of requirements, best practices, and safety philosophy. This may be the easiest and most natural way to gain respect and support for the SMS program. However, it requires very strong knowledge of all aspects of safety, and ongoing learning.

2 The Amiable Manager

Amiable safety managers gain respect, trust, and support for the SMS program by having positive personal qualities. This type of safety manager is probably the best type of manager to help build a positive safety culture and sustainable risk management program. Such a manager can be highly influential, with strong following for a safety program. However, not everyone has these personal qualities.

3 The Top Down Manager

The top down safety manager relies heavily on his or her formal position and authority in the company. This can be very powerful to help keep the safety program in line. This kind of safety manager can use incentives and sanctions from outside of the safety realm to promote the safety program. This manager has a lot of authority and resources to be well organised and efficient. However, the safety program may feel like a 'management thing'.

4 The Disciplinary Manager

This type of management style relies on disciplinary action to control safety behaviour and has very clear rules regarding non-conformance. This is not sustainable for long-term management. However, in the short term, it may occasionally be necessary. This style can help in situations of open rebellion or resistance against change management. However, it can backfire, be very unpopular and hurt safety culture.

5 The Connected Safety Manager

The connected safety manager gains vital support for safety programs and camaraderie among upper management, which provides more resources for safety management and greater responsibility and status for the safety manager. However, the safety manager may not have the support of staff, and this style can have a tendency towards corporate cronyism.

Every organisation may need a different type of safety manager, also different styles at different times. The safety manager has an interesting, but difficult and sensitive role, including:

1. ensuring efficient SMS implementation
2. supporting operational employees in safety matters, concerns and safety improvement changes
3. acting as an advisor to line and top management to help in decision making and strategy
4. acting as a focal point to third parties, especially objecting to proposed solutions that adversely affect safety. (This is not an easy job, especially when you have to face different political interests.)

This has to be done amidst increasing 'faster, better, cheaper' pressure, and of course a tenfold improvement in safety…

So, next time you meet your safety manager, please have a coffee together and try to understand one another's worlds, so that you can support each other in the achievement of the common goal of all of us: safe aviation transport.

Maria Kovacova is an aviation safety enthusiast actively contributing to safety areas such as just culture, safety management gap analysis and proposals for safety improvements, introducing practical and efficient safety methods and tools to air traffic control. After her graduation in aviation engineering, she continued her mission to improve safety processes in air navigation services, supporting just culture within the Slovak Republic and providing training for different aviation stakeholders.

MY VERY SAFE NEAR MISS

When front-line staff inherit tools and procedures that are not fit for purpose, it is often because these are designed on the basis of work-as-imagined from afar, instead of work-as-done. How can we close the gap? Empathy and understanding is the first step of 'design thinking', but means getting closer to the work. **István Hegedus** describes one way to make this possible.

KEY POINTS

1. **It can be hard for those without an operational background to understand the experience of operational staff.**

2. **Practical experience in a safe environment offers a way to develop empathy with controllers.**

3. **Simulation can be of support not only to controllers, but also to managers, designers, engineers, project managers, airspace designers, and anyone else who has to think about the design of ATC work and equipment.**

A well-chosen ATC game can simulate relatively realistically at least one or two aspects of air traffic control.

I was managing both arrivals and departures in the rather compact control tower of Horn Airport. It is a facility serving mostly the domestic routes of some local airlines, flown typically by Q400's and ATR's of various lengths, complemented by few international operations during the day. Not much hustle, even a little boring at times. However, in the late afternoon, flights tend to want to land in little flocks, rather than one-by-one. And there are still some who want to depart.

I was carefully calculating time and distance in advance between a tourist-filled departing Airbus 319 taxiing to the only runway and an arriving ATR passing 8 miles on final. I asked the Airbus pilot if they were ready to take off immediately once they reached the runway, and the pilot confirmed. So I issued the clearance to line up and take-off from RWY 27. The nose of the jet was just moving over the holding point marking short of the runway when I looked at the ASMGCS screen. At that moment my blood froze. At a mere 1 NM from the threshold there was another flight on the final approach path, a Q400. It came back to me all of a sudden: yes, I had cleared this Q400 to land a couple of minutes ago. Then I became so preoccupied with sequencing the departure of the Airbus 319 and the landing of the ATR further out on the final that I completely forgot about the plane in between the two, cleared to land. I quickly instructed the A319 to stop and the Q400 to go around, and looking back over my shoulder I saw that my instructor had seen this too.

Luckily, all this took place in a simulator. I never was and never will be an air traffic controller – which I think is a considerable contribution to flight safety on my side. The story above is one short episode from the Air Traffic Control Basics course provided by Entry Point Central, which I attended a few years ago.

This course put me into many more situations where I, along with my course mates, encountered things that those who are not controllers can otherwise only hear or read about. I still remember the struggle, mastering the ATC position HMI, then a new HMI, radio problems,

feeling overwhelmed with traffic, planning and re-planning as a result of turbulence and thunderstorm reports, being fatigued, or visualising in 3D restricted airspaces that were just a flat shape on the screen.

My course mates included colleagues from fields such as airspace planning, project management, quality assurance, law, and myself from safety promotion. We all finished the course – nobody dropped out – with a much better ability to take into consideration the actual challenges that confront air traffic controllers, the ultimate users and targets of projects, development, regulation, training, and other manifestations of work-as-imagined, intended to improve safety or efficiency.

Along with the dozens of hours of APP, ACC and TWR simulation, accompanied by theory training, we also had plenty of opportunities to interact with the instructors, real air traffic controllers. They reflected on our performance and put our simulator experience into the context of real-life air traffic control, by sharing with us their work-as-done knowledge, comparing what we did to what would actually happen in the Ops room in Budapest. Thus, experiencing air traffic control in the simulator and being able to discuss it with 'original' controllers gave us a truly unique opportunity to explore for ourselves the core business, in order to be able to plan and create tools, solutions and regulation that are more convenient to use, and thus more likely to be effective. If you want to gain such experience, the ATC Basics course is probably the second best way to achieve this.

An ATC Basics type course requires considerable resources: many days away from the office, many hours of simulator and instructor time. Obviously, this restricts the number of employees who can go through this type of training. However, there are other, more time- and budget-friendly alternatives that have proven successful. A two-day ATC familiarisation course can also give the participants a taste of what air traffic controllers actually do. After a day of theory and another day of simulator practice with the help of an instructor, and an appropriate debriefing in the end, freshly enrolled colleagues

will go home not only with a better understanding of the core business, but also with increased empathy towards controllers. And if even the two-day course is beyond the capacity of your simulator and instructors, your organisation can still decide to run a 90-minute 'ATC in a nutshell' session, as part of your induction training, for example. You can do this by using a simple, easy to handle ATC simulation game following a short presentation of the control task and some basic separation rules and techniques. A well-chosen ATC game can simulate relatively realistically at least one or two aspects of air traffic control, such as working under performance pressure – with more flights than would feel comfortable.

Maybe you have seen, heard of or even used safety or efficiency enhancement tools that proved to be inefficient or counter-productive after implementation. A conflict alert function that gets deselected by the controller because it makes it difficult to visually follow the traffic scenario? Or an aural warning – either ATC or airborne – that is routinely disabled by the user because of the high number of nuisance alerts? You could probably come up with much better examples. The point is: learning-through-experiencing opportunities, such as the Air Traffic Control Basics course, a two-day ATC familiarisation course or even a 90 minute 'ATC in a Nutshell' session can help managers, designers, engineers, project managers, and airspace designers to think about the design of work and equipment, and perhaps help to produce designs that are welcomed by users, and not seen as another burden to consume time and attention, and to be quietly bypassed. ↄ

István Hegedus works as an ATM Safety Promotion Specialist at HungaroControl. Previously he was in charge of e-learning system implementation, e-learning course delivery and training development, and also has extensive experience in teaching aviation English to a variety of audiences.

SAFETY IS REAL ONLY WHEN SHARED:
UNDERSTANDING CONTROLLERS' AND MANAGERS' PERCEPTIONS

Controllers and managers have different responsibilities and viewpoints, and may think about safety in different ways. In this article **Florence-Marie Jégoux** reports on interviews with controllers and managers to understand their perspectives, and the gaps that might exist between them in thinking about safety. Perhaps mutual understanding of problems, and opportunities, is necessary for collaboration to flourish.

KEY POINTS

1. **Air traffic controllers and their managers may perceive safety differently.**

2. **There is a need for improvement in regulation-related risks.**

3. **There can be misinterpretations about communication between controllers and managers.**

4. **Organisational risk mitigation actions may improve safety and efficiency when posing problems differently.**

As a TRM/HF facilitator, I am used to hearing controllers talking about their daily life and about the problems they encounter. I also attend some managers' meetings, and then I see the same problems for managers. Often, I feel contradictions, divergence or misinterpretations between these two worlds. As both points of view sometimes do not match, for instance about safety events, risk mitigation actions may turn out to be inefficient, or even counter-productive.

That's why, while undertaking a university degree in human factors (HF), I decided to dig deeper into these differences, and try to explore the issue further. The aim of the study was to get a more accurate understanding of the values, objectives and constraints of controllers and managers in order to help fill the gaps that may exist between those two groups. It is important to note that the aim was not at all to put them in opposition.

The study involved semi-structured interviews with six ATCOs and six managers, who were asked about their jobs and what they thought about safety, risks, rules, communication, and lessons learned. The interviews were recorded and transcribed and the transcripts were analysed regarding different topics, which were counted by two people. Even though it represents approximately 104 pages of interview, it is not scientifically representative. Therefore the aim of this article is not to claim any truth, but rather to give some food for thought: How is safety perceived in my own group, in my own ANSP? Which risks are addressed? Which risk should perhaps be addressed

further? What is taken for granted? What can be improved? And by whom?

We will first see how controllers and managers perceive safety, then how they perceive regulation related risks, and finally how they perceive communication. I invite you to reflect on the findings.
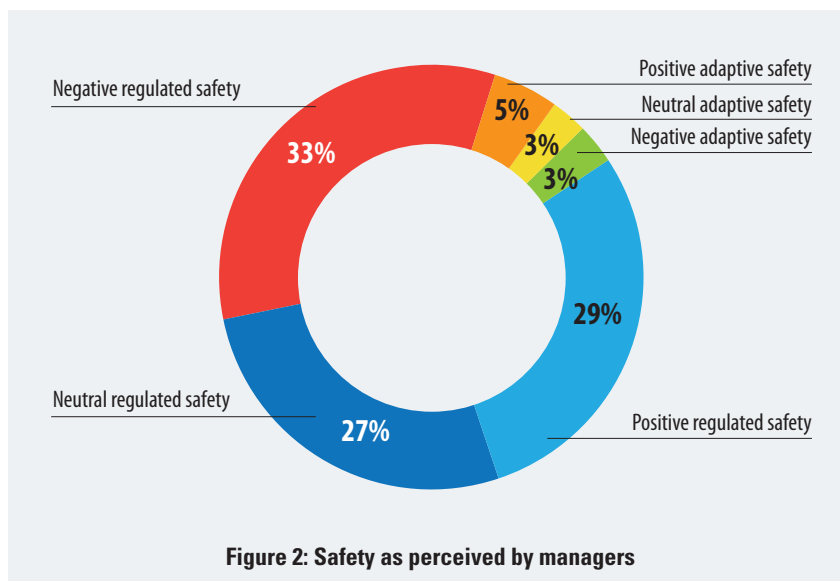
Do controllers and managers perceive safety differently?

In the previous issue of HindSight magazine (Jégoux, et al 2017), we described 'regulated safety' and 'adaptive safety', as part of safety as a whole. As a reminder, regulated safety comprises rules and norms in anticipation of situations. Adaptive safety acts responsively as situations arise. What are the perceptions of controllers and managers about that?

Figures 1 and 2 show the different parts of safety that controllers and managers talked about. In these figures, the word 'positive' means that safety meets expectations or works well. The word 'negative' means that safety that does not meet expectations or does not work well.

Figure 1 shows that the controllers talked as much about adaptive safety (49%) as regulated safety (51%).

When controllers talked about adaptive safety, they talked more about adaptive safety that works well, for instance: "We have to be ready to face this 'never'

Figure 2: Safety as perceived by managers

that will happen. To prepare ourselves for this 'never' that will happen, for this day when this 'never' happens. We can face the situation with a probably downgraded, but acceptable safety." "It was an unusual situation, then, it made us work on open-mindedness, on flexibility."

Sometimes, but less often, they talked about possible negative consequences of adaptive safety, like about handling uncertainty: "It's saying to ourselves 'oh, yeah, I'll fit this plane into the take-off sequence, it should be fine.'" "Coming back from holidays and going straight onto shift, even in summer. That's taking risk."
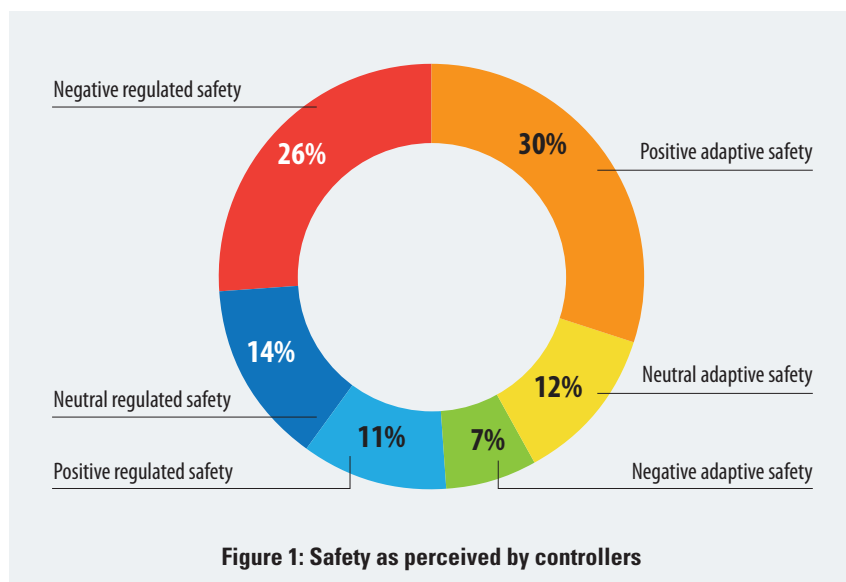
Controllers talked almost as much about regulated safety, but in a negative way:

"With regulation [in Class D airspace], you have no means to avoid that it [a conflict] continues, there you go. So it's the limits of the system." Sometimes they considered the positive side if regulated safety, e.g. "Safety means respecting rules and instructions." "We can't work without references, without limits."

Figure 2 shows that the managers talked much more about regulated safety (89%), compared to adaptive safety (11%).

Managers rarely talked about adaptive safety. In a positive sense, they considered what is important: "If there's a problem, it has to be taken care of immediately." In a negative sense, they sometimes talked about controllers' risk estimation: "it's also a risk, because their estimation is not always good." Managers sometimes talked about what is done by controllers to demonstrate their own performance to the detriment of safety: "Very often when people are on this sector, they keep one rack and a half [flight progress strip racks], and don't split the sectors."

Managers talked much more about regulated safety: "If we don't find any risk mitigation means to ensure normal operations on the field, we will take measures to limit operations, to limit risks." To a similar degree, managers talked about regulated safety in a negative way – when it does not meet expectations: "We say: here's what we're going to do, we decide beautiful

Figure 1: Safety as perceived by controllers

actions, but often, it's not implemented." "The way it's written … we have often difficulties to implement that in real life."

The key difference between ATCOs and managers is that managers emphasised regulated safety over adaptive safety

The key difference between ATCOs and managers is that managers emphasised regulated safety over adaptive safety. Although it is logical to have differences between two jobs, it may show a lack of understanding of, or connection with, adaptive safety. This may lead managers to disregard adaptive safety in risk mitigation actions. For instance, is training designed for adaptive safety as well as it is for regulated safety?

Another noteworthy commonality is the importance that both ATCOs and managers gave to negative regulated safety. This point will be discussed further by the next section about the perceived risks.

Do controllers and managers perceived similar risks relating to regulation?

Managers and controllers found different risks relating to regulation, but they agreed on the fact that sometimes, in some contexts, rules may bring about some risks.

For managers, the top risks mentioned related to high workload and time pressure, contradictions between rules and safety, and rules that are difficult to implement or are otherwise unsuitable. The most critical risk relating to regulation mentioned was workload and the time available to ensure rule implementation (e.g., "We're going to realise at the very last moment that, oh, no, we can't do it that way."). Managers also mentioned gaps or contradictions between regulations and safety, for instance when some rules are implemented: "There was a terrible gap between these rules and safety itself." "In absurd ways, we end up asking people almost to work the opposite way to how they used to work!" "There are contradictions that can be permanent or not. It can depend on the context." For controllers, two risks were especially

prominent. First, like managers, controllers also found contradictions between rules and safety: "Typically, Special VFR! This is typical, regulation, you know, you have some beautiful stuff, but in real life, it doesn't match at all!" Second, controllers thought that some rules can be unsuitable, depending on the context: "EASA rules, it's possible on big airports, but we see that those rule people thought about big airfields, not about medium or small airfields, and it can't at all be adjusted to!"

Controllers and managers found a contradiction between rules and safety to be one of the biggest risks relating to regulation

Both controllers and managers found a contradiction between rules and safety to be one of the biggest risks relating to regulation, along with unsuitable rules. Both also found it difficult to give feedback to rule writers about the contradictions that controllers and managers experience, and to have this feedback taken into account. Controllers said that when they report contradictions between rules and safety, they are told that rules have to be implemented, no matter what the consequences are on performance and safety. As this goes against their operational culture, sometimes they just stop applying rules and stop reporting (e.g., about a new system implemented for ATIS: "Sure, they won't make a new ATIS every minute!").

After this study, recommendations were suggested. One relates to the need for 'regulation deflation'. As stated by Morel (2016), this regulation deflation movement started a few years ago. Some countries implemented rules to decrease the number of rules, simplify and update them, and give better consideration to the end user. Possible negative consequences of rules were also studied.
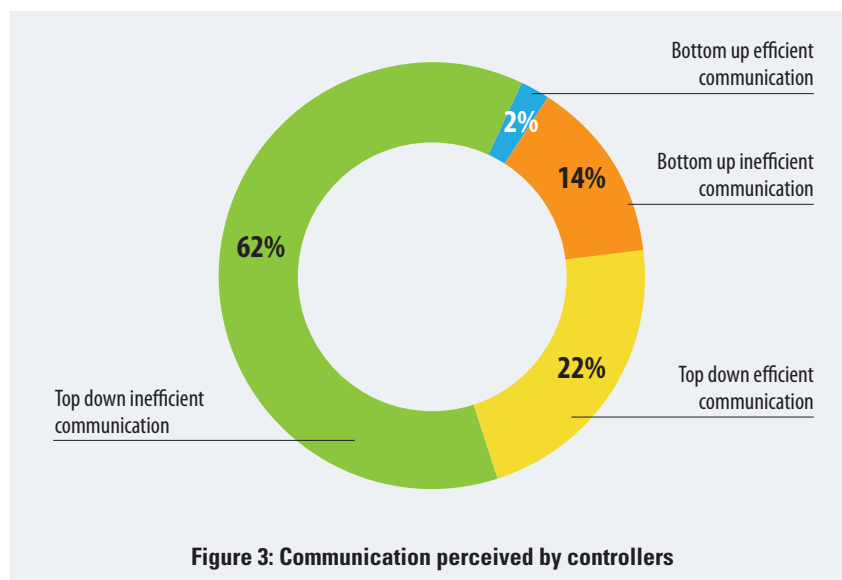
Pilots and controllers need a formal system in which they can give feedback to regulation writers about the problems they encounter and in which their feedback is properly considered.
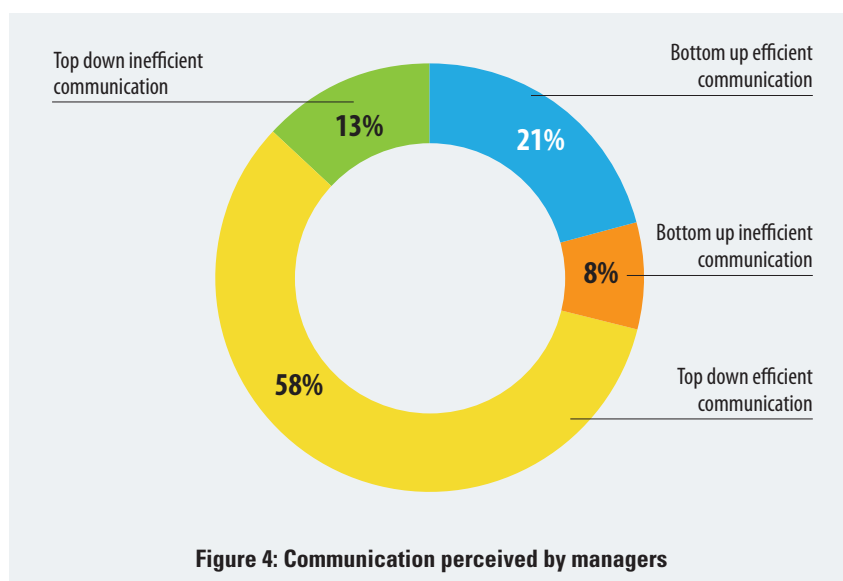
Do controllers and managers evaluate communication differently?

Figure 3 shows how controllers perceived bottom up and top down communication.

Controllers perceived communication as a whole as inefficient (76%). They also talked much more often about top down communication (84%) than bottom up communication (16%). Regarding bottom-up communication, controllers said that it is difficult for them to give feedback up the hierarchy.

Controllers said that a part of top down communication is efficient: "It works pretty well for the upper level management." But they more often spoke of top down communication as inefficient, sometimes perceiving it as

Figure 3: Communication perceived by controllers

Figure 4: Communication perceived by managers

judgemental: "They always come to see us saying 'you did wrong. There is always that judgement, that re-assessment, which is felt like re-assessment of our skills." "If we're out of the norm, they're going to point that out, but there is no recognition when we do a good job." "For us it's very far away, it's like a farmer in a field with Brussels bureaucrats." "We are controllers. We could be car assembly-line workers, I have this feeling that we would almost have the same management." "It's only written communication, pffff, there's no dialogue." "Reports or minutes, it's not as efficient as discussing! I think that we don't talk enough, we don't talk enough!"

Figure 4 shows that when managers talked about communication, they mostly talked about top down (71%) rather than bottom up communication (29%). And they mostly spoke about communication between them and controllers as efficient (79%).

Concerning bottom up communication, managers said that it is mostly efficient: "Some like to discuss after filing a report. To explain more about what they just wrote." However, managers also experienced negative comments from controllers: "When did you last touch a mike?"

More was said by managers about efficient top down communication: "We have briefings. It's really a place for conversation." "There are many meetings – navigation chiefs, heads of tower – where we communicate." Some of the top

down communication is perceived as inefficient: "It's not a done deal, it's not sure it's going to end up to the controllers."

The fact that the two groups emphasise top down over bottom up communication suggests there may be room for improvement. Field experts may need to be more considered in a concrete way, in actions. Divergence between managers and controllers on efficient communication (79% for managers, versus 25% for controllers) shows the gap between them, and therefore the risk of inefficient or even counter-productive organisational mitigation actions, when communication is needed.

Posing problems in a concerted way

Theillard de Chardin said (translated) "Solving problems is not the most difficult, it is rather posing them." Usually, we spend very little time to understand issues deeply and collectively, and much more to act, whether or not these actions are relevant. Posing problems differently may help organisational risk mitigation actions to improve safety.

Problems do not lie in elements, but in interfaces between elements

Knowing more about these points of view associated with job differences may help to fill in the gap by paying more attention, more curiosity, more questions, from each side. As said in systems theory, problems do not lie in elements, but in interfaces between elements.

The aim of this article is not to put a judgement on the ANSP or centres where it has been done, but rather to give pause for thought on these essential aspects of safety in one's own centre or company, in order to find solutions that are joint, concerted between field operators and managers, and relevant for everyone. After all, safety is real only when shared.

References

Jegoux, F-M., Mieusset, L., & Follet, S. (2017). Safety is in the eye of the beholder. The "put-yourself-in-other's-shoes" concept for safety culture. *HindSight, 25*, 14-17, Brussels: EUROCONTROL.

Morel, C. (2016). La notion de règle parcimonieuse et adaptative pour mieux maitriser les risques ('The idea of lean and adaptable rules to better control risks'). *20th Congrès de maîtrise des risques et de sûreté de fonctionnement*, Saint Malo, 2-5 October 2016 Institut de Maitrise des Risques.

Florence-Marie Jégoux became a private pilot in 2000, a certified air traffic controller in 2004, and HF facilitator in 2009. She is also a coach and is trained in systems theory. She now works for an ANSP in their training department as a Human Factors coordinator and specialist. She passed an HF University Degree in 2017 in the National Polytechnic Institute of Bordeaux.

THE LUTON SAFETY STACK

Organisations, such as ANSPs, airports and airlines, are part of a wider system, and so are affected by safety issues in other organisations, or at the interfaces between organisations. So there is a need for collaboration between organisations. But in practice, how can organisations work together on safety? In this article, **Barry Kirwan, Siân Blanchard** and **Sarah Flaherty** outline the approach at London Luton Airport.

KEY POINTS

1. **Organisations are interdependent and safety issues in one organisation can have implications for others.**

2. **Organisations in a shared place, such as an airport, have the opportunity to meet to discuss problems and opportunities.**

3. **The Luton Safety Stack provides an example of a working collaborative initiative to help manage safety across interfaces, based on safety practice development and safety intelligence sharing initiatives between 15 organisations based at the airport.**

In 2015 an EU-funded project called Future Sky Safety was launched. One of its main aims was to adapt the EUROCONTROL safety culture approach, already used in air traffic organisations in more than 30 European countries, to the airline and airport side of the aviation operation. This was seen as strategic for safety, since there is significant cost pressure on the industry at present.

The work began with a detailed survey of a European airline followed by a safety culture survey of more than 7000 European pilots, which made the national and international press. But the most interesting and promising work so far has been at London Luton Airport (LLA), with what has become known as the Luton Safety Stack.

The idea is simple. At an airport there are many organisations who have to work together to enable smooth and safe airport operations for passengers, freight and business users. Such users range from airlines, air traffic control and ground handlers, to de-icers, fuel services, baggage handlers, caterers and cleaning services. They are all connected. If one of them has a problem, then they all do. They need to work closely together, and they already do, so why not have them work together on safety?

10 minutes of your time, a lifelong impact on aviation

The work began in late 2016 with six independent safety culture surveys of key organisations at London Luton Airport. This was the first time this had been done, and it was interesting to see the differences. Each organisation had a detailed snapshot of its safety culture and its strengths and opportunities for development. It could have ended there.

The six organisations met and decided to share information on each other's surveys

But what happened next was both surprising and exceptional. The six organisations met and decided to share information on each other's surveys. Not the detail, but where they were doing well, and where they needed support. And they decided this was not a one-off. Rather, they formed a group of (currently) 15 organisations, all based at the airport, called the LTN Safety Stack, led by London Luton Airport (LLA) and assisted by EUROCONTROL, who lead this particular Future Sky Safety project. It's called a 'stack' because the original concept used a vertical representation of the companies, from the ground upwards, and used this word to describe it.

The Stack members are developing harmonised procedures for all operators at LTN, and for each operation
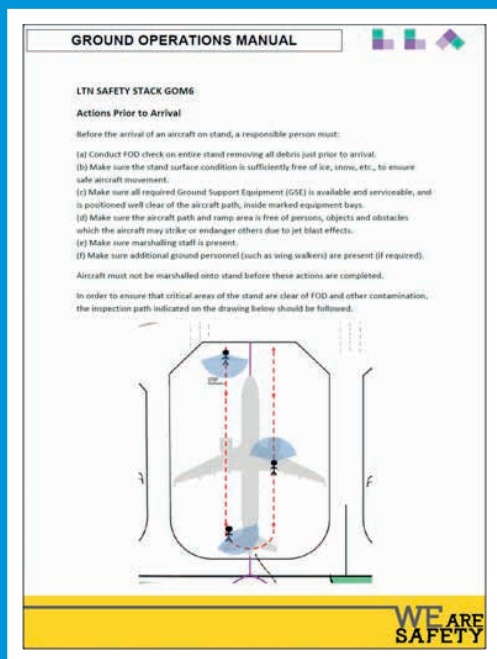

What does the Stack do? Since January 2017 when it was formed, there have been four meetings, which always include a workshop element. The most tangible outcome so far has been the work on Ground Handling. At LTN, as at many airports, there are several ground handling organisations and a number of airlines. The way operations are carried out, such as preparing for aircraft arrival, chocking an aircraft, or cone placement around an aircraft, can vary between the handlers and the airlines. This variability can lead to inconsistencies, which could allow hazards to appear, or lead to delays. The Stack members are developing harmonised procedures for all operators at LTN, and for each operation, creating a simple one-page procedure with diagrams, to keep it simple and safe. This initiative has already created national and international interest through the UK CAA GHOST and IGOM programmes.

From the very first meeting, the Stack wanted to encourage sharing of safety information, including incidents and any kind of near miss. LTN organisations, as at any airport, have their safety management systems and reporting responsibilities, and meet regularly to discuss safety performance. But the

way the regulations are framed at the moment, it is as if to say that if each organisation looks after its own safety, then all will be well. The Stack sees this as a limited vision. It proposes that it would be better if organisations, even competitors, would help each other, by saying, "look, we had this event yesterday, it could happen to you". Again, this isn't pure altruism. It makes business sense, because at an airport, if one organisation fails, then everyone takes a hit.

To make this real, the LTN Safety Stack is developing a common safety dashboard, where each organisation will contribute its main current and upcoming concerns. This is not meant to be a tool just for safety managers, it will also be in the crew rooms and on an app that people can download on their phones. As one Stack member put it, everyone has a phone, so why not put the information there?

There are other Stack initiatives. One is called 'A day in the life at LTN', and will result in a short LTN-specific video covering all the different roles that make an airport work safely and efficiently. There are 'Walk in my shoes' opportunities, where people from different jobs can see what it's like to be

a pilot, a controller, a ground handler, a de-icer, etc. This isn't just for fun. The more connected organisations understand each other at the operational sharp end, the better, and the safer those operations will be, because they will understand each other's constraints and pressures, and will be better able to help prevent anything going wrong, or quickly bring it back under control if an event starts happening. There are also reward initiatives ongoing in several Stack organisations, for the best safety 'catch', so there is a focus on positive safety, reinforcing what to do, and not only what not to do.

The Stack comes under the UK Aviation Industry brand 'We are Safety', a strong affirmative statement intended to foster an identity linked to safety. It is expected that those who adopt this banner undertake a commitment that will lead to better safety awareness, and safer behaviour. This is safety culture in action.

The LTN Safety Stack aims to share safety intelligence, and in this spirit, if any other airport is interested in hearing more about this approach, the LTN Stack will be happy to share.

Barry Kirwan is a human factors and safety specialist who has worked at EUROCONTROL for the past 17 years, primarily in the area of safety research and safety culture assessment. He has been managing the EU-funded OPTICS project for the past four years, evaluating the impact of European aviation safety research, and is currently leading one of the EU-funded Future Sky Safety projects concerning organisational risks, which has led to the LTN Safety Stack work.

Siân Blanchard leads the Health and Human Performance capability at easyJet, supporting all parts of the aviation operation from flight operations, engineering and maintenance, ground operations and cabin services. She has worked as a human factors practitioner for 14 years in aviation, rail and defence. She is an accredited Aviation Psychologist with the European Association for Aviation Psychology and an Associate Fellow and Chartered Psychologist with the British Psychological Society.

Dr Sarah Flaherty is a human performance specialist with 25 years of experience across the aviation (civil aviation and military), rail and petrochemical industries. Sarah has provided consulting, coaching and training to operators, regulators, manufacturers, ground service providers and airports. She is a member of the British Psychological Society, the Chartered Institute of Ergonomics and Human Factors and sits on a number of EASA, Royal Aeronautical Society and industry working groups.

HAVE YOU LISTENED TO YOUR NEIGHBOURS LATELY?

The interface between ANSPs is one that requires collaboration on operational and management levels. This has always been important but becomes even more so with Functional Airspace Blocks. In this article, **João Esteves and Antonio Guerrero Compas** discuss their experience in the South-West Functional Airspace Block, drawing on the experiences of controllers to improve safety.

KEY POINTS

1. **Collaboration between units is important to fill the gaps at the border.**

2. **It is important to improve the system through the opinion of controllers, since they know their work better than anyone. Their involvement makes the work safer, and improves their confidence.**

3. **Letting controllers know the opinion of controllers in interfacing units is a good way to help improve safety.**

4. **Joint initiatives must be set up for safety monitoring at the FAB level.**

João Esteves is currently working in NAV Portugal's Safety Department as the person responsible for the safety surveys programme, including normal operation observations, and for SMS training. His operational background encompasses both ATC and AIS/AIM functions. Besides the operational side, throughout his career he has experience in training and quality management functions. He has a degree in Social Sciences (Sociology) and a post-graduate qualification in Data Analysis in Social Sciences.

Antonio Guerrero Compás is currently working in ENAIRE's Safety Unit as head of safety promotion and safety culture department, responsible for safety surveys process, SMS training and involved in HF integration in SMS. He is member of the Safety Human Performance Sub-Group since 2011. He studied Aeronautical Engineering at Universidad Politécnica de Madrid.

Air traffic controllers talk to each other regularly. They also talk to their neighbour controllers regularly. But do they listen to their neighbours about their difficulties and working problems, some of which may be a consequence of their own working methods and routines? Maybe not so often…

The Single European Sky legislative package, Regulation (EC) No. 1070/2009, states that the Functional Airspace Block (FAB) is based on a provision of air navigation services and related functions. It is performance-driven and optimised through enhanced cooperation among air navigation service providers.

Within this framework, NAV Portugal and ENAIRE (the Portuguese and Spanish air navigation service providers) are responsible for air traffic management in the South-West FAB.

Both organisations decided to launch a joint targeted safety survey on the coordination and traffic transfer process between Lisboa and Madrid ACCs. The aim was to better understand ATCOs'

perceptions on the process itself and the adequacy of the Letter of Agreement between the two ACCs.

This was achieved through a common questionnaire developed for the controllers with en-route endorsement in both centres, based on a preliminary analysis of the Letter of Agreement and some ATM occurrence reports.

This analysis led to a selected set of topics, as follows:

- Transfer of traffic departing from Porto Airport and flying via Transfer Points ADORO and BARDI – transfer levels FL280 or FL320.
- Adherence to, and adequacy of, procedures for verbal coordination on cases of failure in the OLDI automatic coordination process.
- Coordination failures in cases of traffic flying with strong tailwinds – lack of coordination message and/or alert concerning revised ETAs for these flights.
- Sector configurations – perception by ATCOs of the adjacent configurations.
- Transfer of communications vs transfer of control – need for simultaneous actions (or not).
- Language (use of English).

The questionnaire was available in both centres during one month. The level of participation was slightly above 20%, which was considered reasonable enough to draw some interesting conclusions.

The survey revealed some very positive things about the current model of operation, such as:

- The recognition by controllers that the coordination process is, in general terms, very good. It is felt that there is an easy collaboration among Portuguese and Spanish controllers, and that there is regular observation and application of the Letter of Agreement provisions by both sides.
- OLDI performance is seen as very positive, since this is an essential tool for automatic coordination.
- Verbal coordination is generally used whenever found more suitable than automatic coordination.
- Operational limitations regarding specific waypoints (level restrictions) are perceived as useful and important for risk mitigation.
- The identification of the sector with which the controllers have to coordinate transfer of traffic at a given moment is generally perceived as easy.

Some areas of improvement were identified, on both sides. Some of the more relevant aspects identified were:

- Current separation minima established in the Letter of Agreement should be re-evaluated, in order to allow better accommodation of high volumes of traffic.
- Controllers should moderate the number of requests for tactical changes, since these significantly increase workload on the collateral side.
- Controllers should reinforce the use of English language in verbal coordination.
- Verbal coordination should be done between planners, whenever possible, to avoid overloading executive controllers with these tasks.
- Controllers should adhere strictly to agreed level restrictions on specific waypoints.
- Identification of active sectors, although generally perceived as easy, can be improved through a variety of information mechanisms (e.g., Supervisor notification, creation of a table with structure of frequencies).

- Automatic update of ETA/ETO, in situations of strong tailwinds, would be an important advantage.
- Inclusion of specific waypoints in the Letter of Agreement, where transfer of communications would imply delegation of control, is also seen as an advantage.

Besides the answers given on these aspects, controllers from both sides presented many comments and suggestions, which are important to improve working methods and to mitigate safety risks.

In light of this, both ANSPs agreed that future coordination meetings would be desirable, as a way to improve both the Letter of Agreement provisions and the global coordination process.

to present possible solutions to ease the coordination process.

This study turned out to be a very interesting experience, which has provided a lot of valuable information that can be used to improve safety.

We have been able to analyse things that are done in the day-to-day work (work-as-done), compare it with written procedures (work-as-imagined and -prescribed), and we have seen how resilient the system is.
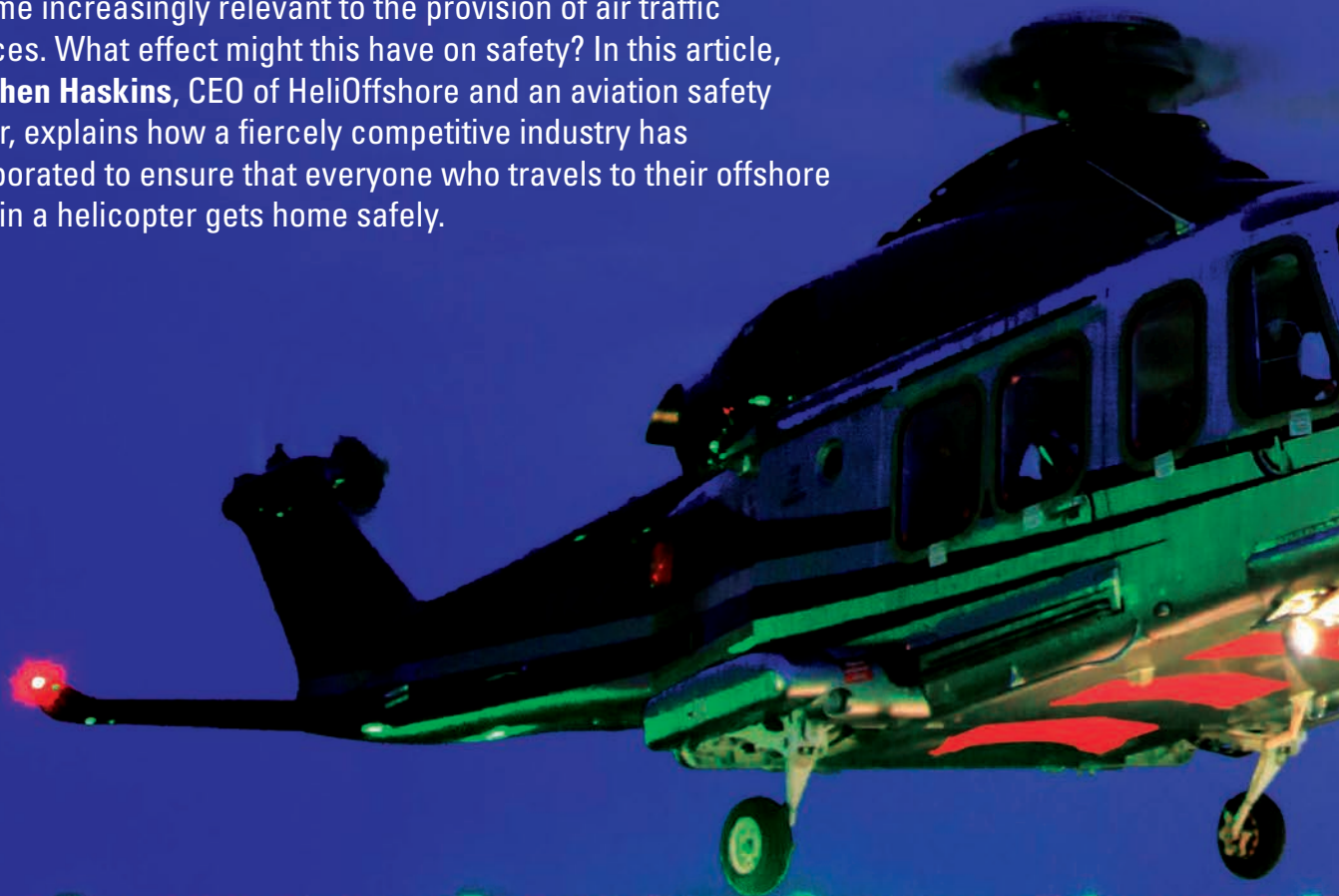
At a safety management level, we have learned about the way the safety survey process is carried out in each organisation, enriching the process. At an operational level, a joint survey allows the improvement of the system through the opinion of those who work within it daily. ⑤

This is one of the most important goals of this study: to create awareness of each side's difficulties and problems, and to present possible solutions to ease the coordination process

As a normal outcome of this activity, a number of recommendations were produced by both ANSPs, and these were addressed to the responsible managers. Also, the results of this survey will be presented to controllers, so that they may become aware of each other's opinions. This is one of the most important goals of this study: to create awareness of each side's difficulties and problems, and

HeliOffshore
Safety Through Collaboration

HOW FIERCE COMPETITORS JOINED FORCES TO MAKE **OFFSHORE HELICOPTER** OPERATIONS SAFER

Over recent years, competition and commercialisation have become increasingly relevant to the provision of air traffic services. What effect might this have on safety? In this article, **Gretchen Haskins**, CEO of HeliOffshore and an aviation safety leader, explains how a fiercely competitive industry has collaborated to ensure that everyone who travels to their offshore work in a helicopter gets home safely.

KEY POINTS

1. **Breakthroughs in safety performance are more likely through collaboration.**

2. **Focus on results in the frontline, and areas that will make the greatest difference to saving lives.**

3. **Shared collection and analysis of day-to-day operational activities are key factors in setting and achieving measurable safety goals.**

4. **Translating operational performance improvements into business benefits helps to achieve buy-in from senior stakeholders.**

5. **As per ICAO Annex 19, every organisation and country should have a safety performance improvement strategy. There should be a common framework for this strategy, which aids collaboration across organisations.**

At face value, it might seem a tall order to get fierce commercial rivals to put their differences to one side to collaborate in pursuit of enhanced safety. Try doing that when the market in which these companies compete is going through a sustained downturn of almost existential proportions, and you might well be tempted to give up. But this is the story of how HeliOffshore came to be and how, three years on, the offshore helicopter industry is achieving tangible, life-saving results.

Back in October 2014, the chief executives of five leading helicopter operators—Babcock Mission Critical Services, Bristow Group, CHC Helicopter, Era Helicopters and PHI jointly launched HeliOffshore. Based on an understanding not to compete on safety, they agreed to strive for shared best practices and to work towards more common standards by sharing data and pooling resources to achieve safety goals that save lives.

Today, the group has more than 100 members globally, including helicopter operators, aircraft manufacturers, equipment and services providers, as well as a growing number of oil and gas companies. From the outset, I was convinced of the potential that the group has to achieve a major step forward in offshore helicopter safety and I've been able to apply safety strategies developed during my time in the US Air Force, at the UK air traffic control company NATS and the UK Civil Aviation Authority.

Collaboration is absolutely integral to all of our work, which is focused on four key areas:

- **System Reliability & Resilience** – improving the combined human/machine interface to reduce single points of failure that can cause accidents.
- **Operational Effectiveness** – developing and implementing technology, training and procedures that make all stages of flight safer.
- **Safety Enablers** – harnessing leadership, data sharing and analysis, and safety management measures to ensure sufficient capability to enhance safety.
- **Survivability** – ensuring that flights happen in suitable conditions with adequate plans and equipment in place for passengers and crew to survive an accident.

These core sets of safety goals are developed, championed and implemented by HeliOffshore's workstreams, which consist of seasoned frontline safety leaders from across our member companies working in tandem with the organisation's small full-time staff and a select group of specialist consultants. Together, we develop best practices and guidelines and then work with member operators to get these implemented at the frontline.

Essentially, HeliOffshore (http://helioffshore.org/) has created a 'safe space' in which commercial rivals can put their differences to one side in a common pursuit of enhanced safety. We have created a clear set of safety priorities, goals and implementation timelines based on what makes accidents occur and what are the best measures to prevent these happening.

Gretchen Haskins is CEO of HeliOffshore Ltd., a company dedicated to global offshore helicopter safety. She has served on the board of the UK CAA as Group Director of Safety, and as Group Director of Safety at NATS. Gretchen previously worked in nuclear certification and safety of intercontinental ballistic missiles, joint airworthiness trials for military aircraft, and as an expert advisor to NATO on human performance and safety critical systems. She has flown jet and piston aircraft in the U.S. Air Force.

A whole-industry safety management system

Shared data and learning are critical to achieving these goals. This is why we established our HeliOffshore Space and InfoShare portals to allow companies to constructively work together through their operational experience and knowledge. In effect, we are a virtual company with a mission statement to enhance safety. What we've created – and continue to progress – is a giant safety management system for the whole offshore helicopter industry. In common with the air traffic management community, we're looking to both minimise safety risk and improve performance. In our safety performance model (http://bit.ly/HeliOffshoreSPM) we've articulated 'what good looks like' and we're trying to get the industry to achieve a safer system from that consistent framework. This model looks at the threats and creates a set of accident prevention goals based on actions that we have to be good at on a day-to-day basis to make offshore helicopter operations safer in a sustainable way. For example, if you want to avoid obstacles, you have to be good at seeing and avoiding them. If you want to avoid loss of control, you have to be good at flight path management. Once we have clearly articulated these accident prevention goals, we are better placed to examine the cost benefits of the various solutions that different organisations can offer to improve safety performance.

Our collaboration has widened to include aircraft, engines and avionics manufacturers, as well as specialist service providers across the industry. One of the beauties of our collaborative approach is that it helps to work at every level of the supply chain, tapping a collective investment and effort to get the best possible safety outcomes. This is important because design is a key factor to help improve human performance.

HeliOffshore members understand that investing in safety is crucial not only to saving lives, but also represents a sound value proposition that is repaid several times over by cost savings. We've created a collective business case for key improvements, linking costs to safety performance benefits and making the case for investing in safety both across companies, as well as within them individually.

One of the key challenges for any industry is that you can't just create a company to 'do safety' for everyone. You need people who are busy doing their frontline jobs to make safety work relevant and see that it gets implemented. Participants need to have sweat equity in the shared work rather than just writing cheques to get the safety monkey off their backs.

Ultimately, success depends on having the people for whom safe operations is a day job to lead the conversation across the industry about how to design the road map for better performance. This is how we came up with the concept for HeliOffshore's workstreams and how they focus on achieving breakthroughs in safety performance that reduce the causal factors of accidents.

For successful collaboration, you need to have senior level buy-in and we are very fortunate to have this among our member companies. We've been able to agree clear strategic priorities to ensure that we are focused on deliverable activities that will provide safety benefits. Consistent leadership from the top has allowed our stakeholders to align their safety priorities around work that has the most potential to save lives. This approach is delivering best practices and ways of measuring safety performance in a consistent way so that we can identify the degree to which further action may be required.
We've been pleased by the extent to which this approach encourages safety breakthroughs in performance and a commitment to shared improvement. Safety issues faced by one stakeholder are often best resolved through the experience of another stakeholder. This is a very interdependent industry. Quite apart from operators themselves, aircraft, engine and systems designers can make operations safer, and training companies can too. Shared data gathered and analysed in a consistent way is a true foundation for this holistic approach. This 'Safety Intelligence' enhances our ability to focus on weak signals of potential issues, and to measure the potential and actual safety benefits of safety improvements, giving people across the industry the ability to make more data-driven decisions.

Lately, we've been very excited by opportunities to step up our collaboration with offshore helicopter operators' customers – the energy companies. The International Association of Oil and Gas Producers is aligning its strategy with our own and has indicated a willingness to contribute to the shared investment in safety. We also work in close alignment with the regulators and with other safety advocates, such as the Flight Safety Foundation so that we're all heading in the same direction. The first three years of HeliOffshore's mission have confirmed our conviction that only through collaboration is there a viable prospect of achieving our industry's ultimate goal of ensuring that everyone who travels to their offshore work in a helicopter gets home safely. **S**

HELIOFFSHORE SAFETY ACHIEVEMENTS

- Approach Path Management guidelines
- Establishing the InfoShare portal to allow operators to share information about safety incidents
- Collaboration on technologies to help with obstacle avoidance
- Best practice guidelines for health and usage monitoring systems
- Pilot eye-tracking research to support the development of Evidence Based Training
- Research resulting in new guidelines to avoid helicopters landing on the wrong decks
- A series of training videos to show flight crew how to make best use of automation in the cockpit
- Promoted collaboration between aircraft manufacturers and operators to produce Flight Crew Operating Manuals to encourage standardisation of operating procedures
- Progressive introduction of a safety intelligence data sharing programme (a first for the helicopter sector) that will drive key improvements in technology and operating procedures

HOW DOES COLLABORATION IN SESAR ENABLE SAFETY ENHANCEMENT?

The SESAR Joint Undertaking is an example of collaboration at the highest level. In October, the European Commission published the final evaluation of the SESAR1 programme and an initial evaluation of the SESAR2020 programme. The evaluations are positive, but where is SESAR now? Where is it heading? And how does collaborative research support safety? **Conor Mullan** provides us with his thoughts.

KEY POINTS

1. **An independent evaluation of the SESAR Joint Undertaking found many positives.**

2. **The SJU has learned from SESAR1 and is applying those lessons in SESAR2020.**

3. **Collaboration across borders is expediting local development and deployment.**

4. **Greater involvement of operational staff is leading to a greater understanding of how safety needs to be incorporated throughout the development lifecycle.**

SESAR has been with us for some time now. The original definition phase, managed by EUROCONTROL, started more than a decade ago. This led to a high-intensity two-year period during which the industry analysed the state of play of ATM and proposed new performance goals, an operational concept and the underlying technology that could support modernisation. The key deliverable of the definition phase was the first ever edition of the European ATM Master Plan – a blueprint for ATM modernisation.

The SESAR Joint Undertaking was created in 2009 and charged with the maintenance of the Master Plan and management of the R&D programme required to develop the underlying operational concept and technologies – the so-called 'development phase'.

A lot has happened since 2009. The first part of the development phase is complete. SESAR1, as it is now called, ended in 2016. It included over 300 projects and 350 validation exercises leading to 63 SESAR solutions. These

include the most exciting developments in ATM today, for example:

- **Time Based Separation** – this illustrates how new control paradigms (adjusting the minimum spacing according to the speed of aircraft) can lead to sustained throughput on strong winds.
- **Extended AMAN** – this illustrates how ANSPs can work together at the operational level to deliver additional benefits of airspace user through cross border coordination.
- **Remote Tower** – this offers the possibility to completely revolutionise ATC at airports by freeing controllers from the need to actually see the aircraft they control.

Beyond these solutions, the real success of SESAR1 is the partnership created through collaborative work.

Partnership is important in collaborative research. SESAR projects are an improvement on their predecessors simply because the greater involvement of operational staff is leading to a greater understanding of how safety needs to be incorporated throughout the project lifecycle and properly validated at each stage.

The success of SESAR1 emboldened the Commission to make two further commitments to the SESAR project: the extension of the SESAR Development Phase (by renewing the SJU Mandate) and the launch of the Deployment Phase (by creating the SESAR Deployment Manager).

The extension of the SESAR Development Phase is known as SESAR2020. It includes a refresh of the membership – mostly the same

players but the interesting addition of research organisations (DLR and NLR) as full members is worthy of note. It includes a new work programme and a more integrated working method designed to build on the partnership approach achieved in SESAR1 and put greater focus on maturing SESAR solutions. It includes a greater emphasis on validation including the specific Very Large Demonstration projects, which will help narrow the gap between R&D and deployment.

Launching SESAR2020 was not without complication. The evaluation report makes it clear that the imposition of the new Horizon 2020[1] rules on SESAR was a retrograde step. These rules are not well adapted to managing large collaborative programmes where it is necessary for the members to steer the direction of research not only on their own results but also due to external factors – such as changes in traffic demand and new threats and opportunities such as cyber security and drones.

However, after perhaps 18 months of too much politics and not enough work, SESAR2020 is now definitely up and running and accelerating towards the speeds achieved in SESAR1.

The other positive step taken by the Commission was the creation of the SESAR Deployment Manager (SDM), in 2014, to manage the Deployment Phase and, in particular, to provide a collaborative structure for the use of Connecting Europe Facility (CEF) funds to support SESAR deployment as defined in the Pilot Common Project – an effective mandate for the widespread deployment of 27 of the SESAR solutions developed in SESAR1.

With the SJU and SDM both up and running the SESAR Project is able to reach its full potential.

Initially, the SESAR phases were seen in terms of a classic 'waterfall methodology', with the definition phase defining the 'need' in the ATM Master Plan, the development phase delivering the necessary 'solutions' (concepts and technologies) and the deployment phase 'implementing' them. The economic crisis in 2008 and subsequent fall in demand quickly highlighted that the ATM Master Plan would need to be steered by both R&D results and, perhaps even more importantly, external factors – including the emerging views of the Network Manager and Performance Review Body. This was to ensure a coherent single planning document for all bodies supporting the implementation of the Single European Sky and hence achievement of the (perhaps infamous) high level goals of halving costs, tripling capacity, a tenfold increase in safety and 10% reduction in environmental impact.

The SESAR programme, much like the validation methodology it uses, is now very much expressed as a 'continuous', iterative ATM modernisation lifecycle – very similar to the modern 'agile' development lifecycles so favoured by the SESAR JU and members with all their 'scrums' and 'sprints'. The point is to ensure that the programme is steered by evidence towards the most useful outcomes.
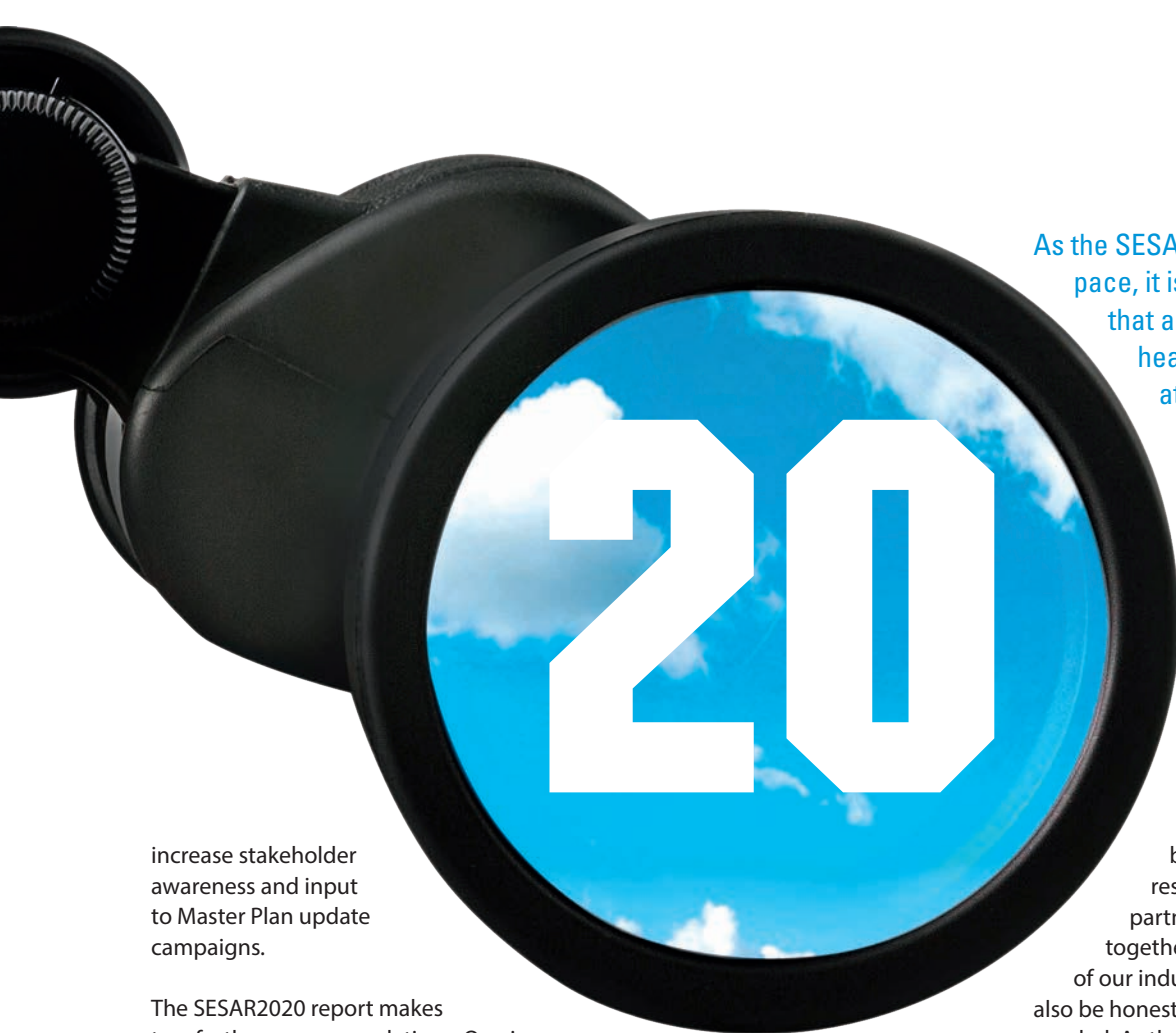
The recommendations in the two evaluation reports focus on actions that are designed to support the 'continuous' nature of ATM modernisation lifecycle. The SESAR1 recommendations are to:

- strengthen links with research, academia and innovative SMEs to ensure that new ideas are fed into the mix
- strengthen Master Plan maintenance to ensure new editions are relevant to all ATM stakeholders
- strengthen the use of enterprise architecture in steering the project and monitoring deployment.

It is only by working in integrated teams that operational issues can be identified and corrected

Encouragingly, the SESAR2020 report makes it clear that in evaluating lessons learnt from SESAR1 and designing SESAR2020, the SJU and Members identified and addressed similar issues. The links to academia are significantly strengthened through increased budget for and integration of 'exploratory research'. The new Master Planning Committee is specifically designed to

---

1- Horizon2020 (H2020) is the European Commission's biggest ever EU Research and Innovation programme and includes transport programmes such as SESAR2020, CleanSky2 and Shift2Rail.

increase stakeholder awareness and input to Master Plan update campaigns.

The SESAR2020 report makes two further recommendations. One is about streamlining H2020 collaboration and financing rules so that they support the partnership approach rather than hinder it. The other is a more interesting recommendation about evaluating additional approaches with the aim of closing the gap between R&D and deployment. This final recommendation really highlights where we are with SESAR and what more we can do.

The views of SESAR have not always been rosy. SESAR1 felt painfully slow in the early days, with success measured in projects launched and people involved rather than results. As SESAR1 matured annual SESAR releases were introduced and there was a focus on SESAR Solutions. The benefits of partnership and collaborative research, where controllers and pilots can work alongside researchers and system developers, became clearer. It is only by working in integrated teams that operational issues can be identified and corrected, ensuring that safety is a key project objective.

In simple terms, success for SESAR1 is the list of solutions deemed ready for deployment (contained in the wonderfully titled 'Solution Catalogue', reminding me of childhood days picking birthday presents from a store

We should be encouraged with where SESAR is now. We should recognise the benefits of collaborative research and of industrial partnerships

catalogue!) and the initial deployments themselves – time based separation at Heathrow, point merge in Dublin, extended AMAN and so on. Some will claim that we may have achieved these implementations locally or nationally anyway were it not for SESAR, but this would dismiss the nature of air traffic management development and implementation as a global issue.

Success for SESAR2020 has to be more. It needs to close the gap between R&D and implementation. Future success should be measured in terms of reducing the time it takes to mature a solution from initial concept to actual deployment. That is really what SESAR was created to do. It was, after all, borne from the frustration of 20 to 30 year development cycles for Mode S, VDL2, MLS, GBAS – a list that goes on and on. Investment in SESAR2020 should be rewarded with improved performance for ANSPs and

airports but also in new products for the industry partners that have a global market.

We should be encouraged with where SESAR is now. We should recognise the benefits of collaborative research and of industrial partnerships. We should work together for the betterment of our industry. But we should also be honest and critical where needed. As the SESAR Project gathers pace, it is even more essential that all stakeholders are heard, particularly those at the coal face that will work with the new solutions.

And that final recommendation on SESAR2020? What it really acknowledges is that the first implementation of an ATM solution can cost a lot more than subsequent implementations. By doing the first one correctly, by using formal validation techniques to gather evidence for the safety case and correct implementation issues and by sharing those experiences, we can support the safe rollout of new systems and procedures and at the same time reduce the cost of subsequent implementations. That is the real benefit of closing the implementation gap. ⤴

Conor Mullan is Managing Director of Think Research. Conor is co-author of the E-OCVM – the validation methodology used in SESAR1 and SESAR2020. Think Research were one of the most active SME in SESAR1, contributing to 21 projects for airports, TMA, En-Route and Network.

EUROCONTROL:
CONNECTING PEOPLE FOR SAFETY

EUROCONTROL is an intergovernmental organisation that helps its 41 Member States and 2 Comprehensive Agreement States run safe, efficient and environmentally-friendly air traffic operations throughout the European region. But what exactly does it do for safety? **Tony Licu**, head of the Network Manager Safety Unit, gives an overview of some activities that are relevant to air traffic controllers, pilots and other aviation professionals.

Working collaboratively at the interfaces with stakeholders is at the heart of what we do in the EUROCONTROL Network Manager Safety Unit. It is the most challenging but also most rewarding job. There are many different organisations and people with a variety of goals, needs and constraints. There is always a new issue that pushes us and our ANSP partners to find new ideas, new solutions, and new relations with other players in the aviation industry.

But what is it that we do, to help you the reader, and the safety of ATM and aviation more generally? In this article, I will describe some of the main activities of the Safety Unit, and how we interact with ANSPs, airlines and other stakeholders.

SKYbrary

SKYbrary (https://www.skybrary.aero) is a collaborative initiative open to the aviation safety community with the aim to *"Build and maintain the single point of reference for aviation safety knowledge in partnership with key aviation safety stakeholders".* The progress towards the achievement of the SKYbrary mission, to *"Organise aviation safety knowledge and make it universally accessible and useable",* attracted the interest of aviation organisations such as ICAO and the Flight Safety Foundation (FSF), who became SKYbrary partners at launch. The SKYbrary partnership was later extended to include the UK Flight Safety Committee, IFATCA (International Federation of Air Traffic Controllers'

Associations), CAST (US Commercial Aviation Safety Team), IFA (International Federation of Airworthiness) and SM ICG (Safety Management – International Coordination Group – ICAO & FAA & Transport Canada).

SKYbrary provides a single point of reference for aviation safety knowledge and is freely accessible at www.skybrary. aero. Visitors can browse portals and categories of information, or access a growing bookshelf of reference documents, including accident & serious incident reports. It includes practical tools that you can use, such as SKYclips, toolkits, e-learning modules, videos, posters, cards, and presentations. The safety knowledge base adopts the concept of MediaWiki products – anyone can comment or propose modification to an existing article or submit a new one. However, a robust pre-publishing content control process ensures the needed quality, impartiality and consistency of stored safety data. Over the years, SKYbrary has become the largest aviation safety library in the world, and contains validated content, derived from credible sources.

IN NUMBERS
SKYbrary has:

- over 7,700 pages
- over 5 million page views per year
- over 22,000 registered users

Just Culture

Just culture is about the necessary balance between safety and sanctions at the level of the national criminal judiciary as well as the corporate level. It is a culture where "front line operators are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated." It is now part of the EU legal order through EU Regulations 996/2010 (accident and incident investigation) and 376/2014 (occurrence reporting). At a pan-European level, States have committed themselves to implement EU legislation and apply the JC principles at national and corporate level.

In 2012 the EUROCONTROL Provisional Council unanimously endorsed two practical just culture deliverables: The promotion of a national aviation prosecution policy and the establishment of a register of high-level aviation experts that will be available for a prosecutor. The EUROCONTROL Just

Culture Task Force, together with IFATCA and the ECA, has worked hard to produce these deliverables.

Air traffic controllers and pilots know that nobody can claim criminal immunity in any civilised country. But it is equally true that a small, but highly visible, number of cases raise questions on the relevance and motives of some criminal prosecutions and court cases. A relevant question is, who will determine whether a mistake was made by a qualified professional acting in a responsible manner, or whether this was a clear case of gross negligence, wilful misconduct or criminal intent (to use just a few of many legal terms for criminally reproachable behaviour)? That cannot be a chief pilot or a control room supervisor. Such a call can only be made by a professional in the judiciary: a prosecutor and ultimately a court of law.

Rather than trying to stifle the judiciary, the EUROCONTROL, ECA and IFATCA initiative has initiated a dialogue between the national authorities concerned – collaboration at the interfaces between justice and safety, accountability and learning. A better understanding of the consequences of a judicial inquiry must be the starting point. In most States, national criminal legislation provides prosecutors with a level of discretion as to how to apply those laws. A clearer appreciation of the associated safety consequences may influence the application of those laws.

Find out more:
- SKYbrary website. Category: Just Culture. **http://bit.ly/SKYJC**
- EUROCONTROL website. Just Culture. **http://bit.ly/ECTRLJC**

Safety Culture

The EUROCONTROL European Safety Culture Programme began in 2003. It is a survey based on a validated questionnaire, followed by workshops to identify both areas of strength and needs for improvement across eight aspects of safety culture. EUROCONTROL manages the programme and oversees each survey, along with independent scientific and practical support.
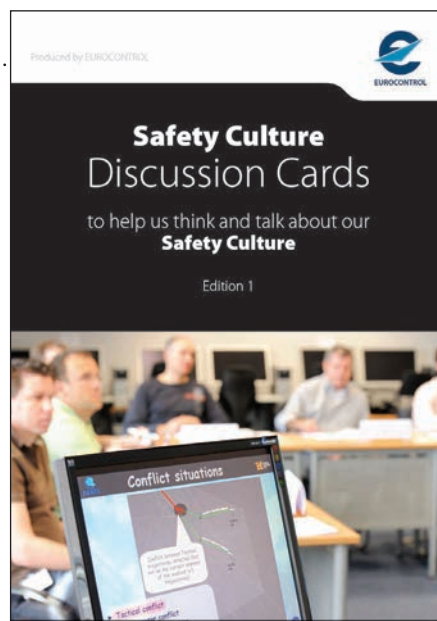
EUROCONTROL safety culture surveys have been performed for the ANSPs in 33 EUROCONTROL Member States, and the process has been used in several other states. Some ANSPs have performed multiple surveys. The EUROCONTROL Safety Culture Survey is voluntary but ANSPs see it as part of their commitment to safety and part of how they manage safety.

The EUROCONTROL programme helps ANSPs and Functional Airspace Blocks (FABs) to understand how they consider operational and organisational safety

in the context of other priorities such as cost-efficiency. The survey focuses on everyday work as well as unusual situations and events, both what works well and what needs to be improved.

Each workshop is facilitated by a minimum of one controller and one human factors specialist or psychologist. The results are a mix of concrete operational issues, organisational issues and cultural issues. A small set of recommendations or needs is highlighted along with a discussion of what staff believe is working well to keep the organisation safe. Workshop attendees tend to value the experience of taking time to talk through some of their ideas and concerns. As an independent survey, the conclusions are derived solely by the data from questionnaires and workshops, and recommendations are informed by the conclusions and relevant good practice in the European Network.

As part of the programme, a set of safety culture discussion cards has been produced, which are available in six

languages. These provide an introduction to the many aspects of safety culture, and provide a tool to help facilitate conversations about specific issues.

Find out more:
- SKYbrary website. Safety Culture Discussion Cards (EN, FR, ES, PT, HU, FI). **http://bit.ly/SKYSCCARDS**

EVAIR (EUROCONTROL Voluntary ATM Incident Reporting)

EVAIR is the first voluntary ATM incident data collection scheme organised at a pan-European level. It was set up in 2006 in response to a request from EUROCONTROL's Provisional Council. Within the EVAIR mechanism, ATM incident reports and related feedback are provided on a daily or monthly basis with an aim to learn from low-level incidents and help prevent accidents and serious incidents.

The EVAIR project started with full support of the EUROCONTROL management, airline associations, at first IATA, followed by IACA, ELFAA, and AEA. During the trial period, EVAIR started with 10-12 airlines, which grew to 334 companies so far. I am very proud when looking back to think of what the team has achieved in the past 10 years:

- EVAIR receives ATM safety reports from 130 to 160 different Air Operators yearly. They come from the whole world but all of them fly regularly through European airspace. All European ANSPs SMSs plus those who are bordering ECAC airspace

cooperate with EVAIR and participate either in providing preliminary reports, or in delivering feedback on occurrences reported by the airlines' Safety Managers.

- Within ten years of EVAIR we have collected 22,300 airline occurrence reports and 22,200 reports from ANSPs. ANSP reports encompass feedback, call sign similarity and specific ANSP reports without the involvement of the air operators.
- All reports have been analysed and uploaded in the database by the EVAIR analysts who are ATM experts, mainly air traffic controllers from EUROCONTROL Member States. Within a decade, almost 30 people have worked on EVAIR activities, at the same time bringing back home lessons learnt. Besides air traffic controllers, we involve in the process of incident analysis experienced pilots and engineers for specific type of occurrences like TCAS RAs.

Find out more:
- SKYbrary website. EUROCONTROL Voluntary ATM Incident Reporting System (EVAIR). **http://bit.ly/SKYEVAIR**
- EUROCONTROL website. EVAIR (EUROCONTROL Voluntary ATM Incident Reporting). **http://bit.ly/EVAIR**
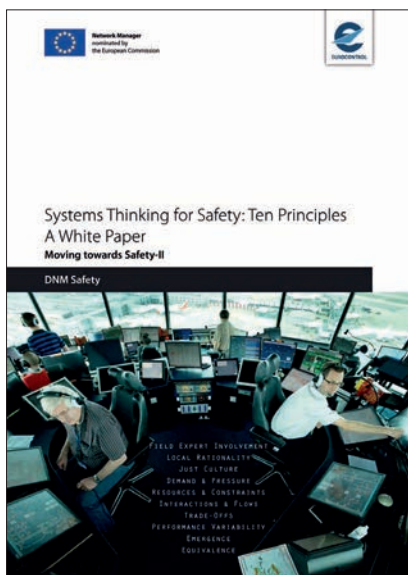
Safety-II and Systems Thinking

Safety can be seen from two perspectives, through two lenses. One focuses on things that go wrong (or could go wrong), which has been termed 'Safety-I'. The other focuses more generally on how things go, which has been termed Safety-II (EUROCONTROL, 2013).

According to Safety-I, people are viewed predominantly as a liability or hazard. So we try to respond when something happens or is viewed as an unacceptable risk. We eliminate causes or improve barriers, or both. This approach is fine as far as it goes, but it does not tell us much about how things go on an everyday basis to ensure that things go right – or what to do to keep it that way or stop it going 'into the red'. It tells us about unsafety, about what occasionally goes wrong, and what to avoid.

From a Safety-II perspective, people are a vital source of flexibility, creativity and resourcefulness in the system as a whole. Rather than only reacting to failures and risks, the Safety-II approach emphasises the continuous anticipation of developments and events. This includes understanding 'how things go' (and how they usually go right) as a basis for explaining how things occasionally go wrong.

Systems thinking is a way of seeing a system (a sector, a unit, an organisation, the aviation system…) as a purposeful whole, not simply as a collection of parts. Systems Thinking tries to understand and optimise the interactions between human, technical, information, social, political, economic and organisational components. It means acting on the system, with careful attention to different interfaces and interactions at all levels.

All of this is done with stakeholders and friends (including DFS, NATS, DSNA, Austro Control, NAV-Portugal, IAA, ENAIRE, Belgocontrol and many others) that are at the forefront of new developments within Safety Human Performance Sub Group (SHP-SG) of the Safety Team.

IN NUMBERS

In 2016, EVAIR collected

- **105 Air Operators submitted occurrence reports.**
- **6144 ATM occurrences (3.28 ATM per 10,000 flights).**
- **447 ACAS RAs reports (average 0.6 per 10,000 flights).**
- **86 RPAS/drone reports and 494 GPS outages.**
- **3,347 callsign similarity reports (from the callsign similarity deconfliction tool).**

Systems Thinking for Safety: Ten Principles
A White Paper
Moving towards Safety-II

DNM Safety

Find out more:
- EUROCONTROL (2013). From Safety-I to Safety-II: A White Paper. Available at **http://bit.ly/ECTRLSii**
- EUROCONTROL (2014). Systems Thinking for Safety: Ten Principles. A White Paper. Available at **http://bit.ly/ST4SAFWP**
- EUROCONTROL (2014). Systems Thinking Learning Cards. Available at **http://bit.ly/ST4SAFETYCARDS**
- SKYbrary website. Toolkit: Systems Thinking for Safety: Ten Principles. **http://www.bit.ly/ST4SAFETY**
- EUROCONTROL website. Systems Thinking for Safety HUM-SYS] Classroom Course. **http://bit.ly/ST4SAFETYIANS**

Safety Team and its Subgroups

The EUROCONTROL Safety Team aims to drive safety management improvement throughout the provision of Air Navigation Services in ECAC States. As such, the Safety Team:

- Promotes, develops and supports effective European safety management.
- Provides a focus for improvement of ATM operational safety.

The Safety Team is a specialist advisory body, established within the framework of EUROCONTROL, providing a direct channel of consultation between all stakeholders. The Safety Team oversees the EUROCONTROL Safety Unit's work programme through various sub-groups.

Safety Improvement Sub Group (SISG)

- **Purpose: Support the Safety Team in driving operational safety improvements in the provision of air navigation services in ECAC states.**
- **Members: Senior safety investigators and safety managers of civil and military ANSPs in the ECAC region, mandated to speak on behalf of their organisation.**

Safety nets Performance Improvement Network Sub Group (SPIN SG)

- **Purpose: Support the Safety Team in the development, implementation, use and evolution of specifications and guidance material for ground-based safety nets and for ACAS Resolution Advisory (RA) Downlink; and a coordinated, overall concept for airborne and ground-based safety nets.**
- **Members: Experts in ground-based safety nets in ATC and the potential implications of airborne safety nets on ATC in the ECAC region, mandated to speak on behalf of their organisation.**

Safety Human Performance Sub Group (SHPSG)

- **Purpose: Support the Safety Team in driving safety human performance improvement in the provision of air navigation services in the ECAC States.**
- **Members: Senior operational, engineering, safety practitioners and human factors experts of ECAC civil and military ANSPs.**

Safety Management Tools User Group (SMT UG)

- **Purpose. Ensure that all SAF Management Tools are continuously reviewed and improved; fostering the harmonised use of the SAF Management Tools irrespective of the organisation a user belongs to.**
- **Members: Users of the Safety Management Tools (Risk Analysis Tool (RAT), TOKAI (TOolKit for ATM Occurrence Investigation), APF (Aerospace Performance Factor) and ASMT (Automatic Safety Monitoring Tool).**

Call Sign Similarity User Group (CSS UG)

- **Purpose: Develop and support the implementation of Callsign Similarity Management Cell (CSMC), supported by service and detection/de-confliction tools, to be operated by NMOC.**
- **Members: Aircraft Operators (AOs) and air navigation service providers (ANSPs) with understanding of call sign similarity issues (safety, operational, engineering as necessary) and the potential implications of call sign similarity detection and resolution on ATC.**

Network Manager Safety Management Tools

The Network Manager Safety Management Tools help ANSPs to balance risk management and decision-making between subject matter expertise and data. Today we have about 60 ANSPs from all over the world that use our tools: (Risk Analysis Tool (RAT), TOKAI (TOolKit for ATM Occurrence Investigation), APF (Aerospace Performance Factor) and ASMT (Automatic Safety Monitoring Tool).

We are trying also here to shift from counting numbers to telling stories. These are, of course, at the heart of HindSight magazine. If you follow an event from start to finish, you begin to understand why and how it unfolded that way. The flow of a story helps us understand causes and influences between parts of the story. It turns a collection of facts into a compelling and memorable narrative. Well-structured stories help to learn lessons in a way that facts often do not. That's why we've been telling stories for so long. They are excellent tools for passing knowledge from one person to another.

HindSight Magazine

Last but not least, we produce the magazine that you are reading as we speak. HindSight is a magazine for the safety of air traffic services. The concept is based on carefully balancing the style, content and scope around:

- Air traffic controller points of view, balanced against others' points of view (pilots, airport personnel, engineering, safety specialists, etc.).
- Lessons from the past and what happens in the present, balanced against what may come in the future.
- Presenting 'official' positions (policies, standards, guidelines, EUROCONTROL Safety Alerts), balanced against discussion and expression of opinions.
- Practical 'do's and don'ts' for everyday practice, balanced against reflecting on theory and giving the floor to researchers, developers, manufacturers and scientists. **S**

Find out more:
- SKYbrary website.
  HindSight – EUROCONTROL.
  http://bit.ly/HindSightMagazine

Tony Licu is Head of the Safety Unit within the Network Manager Directorate of EUROCONTROL. He leads the deployment of safety management and human factors programmes of EUROCONTROL. He has extensive ATC operational and engineering background, and holds a Masters degree in Avionics.

BUILDING 'HEALTHY' TEAMS:

MULTIPROFESSIONAL TEAM TRAINING FOR THE OPERATING THEATRE ENVIRONMENT

Healthcare is perhaps the most complex of industries, with many interfaces between professions for each patient, and therefore many opportunities for problems to arise. Team training has to span these many staff groups. In this article, **Bryn Baxendale** describes the experience of implementing a team training and improvement programme for multi-professional teams working in the operating theatres at Nottingham University Hospitals NHS Trust.

KEY POINTS

1. Safe and effective care in the operating theatre relies on skilled surgeons, anaesthetists, nursing staff and other theatre professionals working together as a team and adapting to dynamic, complex situations.

2. Relatively little attention is paid in daily practice to highlighting and strengthening the team skills and behaviours that support effective performance, as these tend to be regarded as 'routine work' by the staff involved.

3. 'NUH TEAMS' is an evidence-based team training and development programme that is being implemented in the operating theatre setting and that brings these team-based capabilities into clearer focus.

4. Organisational resilience will be strengthened by teams actively engaged in improving their performance and by enabling them to highlight systems-level issues for senior management.

Healthcare is delivered by multi-professional teams that rely on collaboration to provide the safest, most effective care for patients. Surgical care and the operating theatre environment is a high-profile area of practice where teamwork and collaboration throughout the patient's 'care pathway' (the sequence of interventions by professionals for a patient with a specific clinical problem, partly analogous to a flight plan) is fundamental to the delivery of high-quality care. However, this collaboration is not always recognised by team members in their routine work, where the emphasis remains on technical skills and productivity. Deficiencies in teamwork or ineffective communication are often highlighted when serious patient safety incidents are investigated.

The current safety paradigm in healthcare emphasises the importance of learning from infrequent events where the patient has suffered serious harm or death. In the UK, the concept of 'Never Events' has strengthened the focus on a pre-specified selection of 'avoidable' events that can cause serious patient harm or death (NHS Improvement, 2015). The resulting investigations tend to include recommendations that highlight the need for better teamworking and communication between staff, or with patients and families, or both.

It should be remembered that, as in aviation, healthcare practitioners working within teams usually perform very effectively the majority of the time. This is regardless of whether these teams are co-located or distributed in time or geography along a patient's care pathway, and regardless of whether they work together regularly or are formed specifically to deal with a particular situation. The teams work in complex and messy environments characterised by ambiguity, incomplete data, time pressures, resource constraints, potentially serious consequences from error or failure, deeply engrained professional and organisational cultures, and many policy edicts at a local and national level. This may sound familiar to some readers in the aviation industry. So how can we promote better teamworking and communication, especially if we do not want to unravel some of the capabilities and qualities that already exist, and that help create the resilience and adaptability within the system? Similar to aviation, team training (similar to team resource management in ATC) has developed as a way to improve teamwork. This article describes our experience with implementing a team training and improvement programme ('NUH TEAMS') for multi-professional teams working in the operating theatres at Nottingham University Hospitals NHS Trust in the UK, and its potential future development.

There is now much research on the specific skills and behaviours of high performing 'expert' teams. This literature is drawn from many different domains of work, but a common set of underpinning elements feature consistently (Salas et al, 2005; Baker et al, 2006):

- Team leadership
- Team orientation
- Mutual performance monitoring
- Back-up behaviours
- Adaptability

These core elements are supported by specific attributes that can be observed in high performing teams, namely:

- the presence of mutual trust
- the ability to develop and sustain shared understanding of current and future requirements of the team
- the use of specific communication methods in routine work.

Where structured team training is in place, there is now evidence of:

- improved safety-related behaviour in individuals and teams
- improved clinical processes and effectiveness (reduced delays and time to treat)
- improved patient outcomes, including reduced harm or death.

Structured team training does this by influencing perceptions and attitudes amongst staff toward patient safety in daily practice (i.e., safety culture) (Thomas et al, 2013). TeamSTEPPS[TM] is a validated evidence-based teamwork training model (Figure 1). It has a tested, systematic and quality-assured approach for successful implementation (AHRQ, 2014). It applies a range of tools and techniques within a structured team development programme. This is based on 20 years of research and lessons learnt from the application of teamwork principles within many different high-risk industries and areas of professional practice, including healthcare.
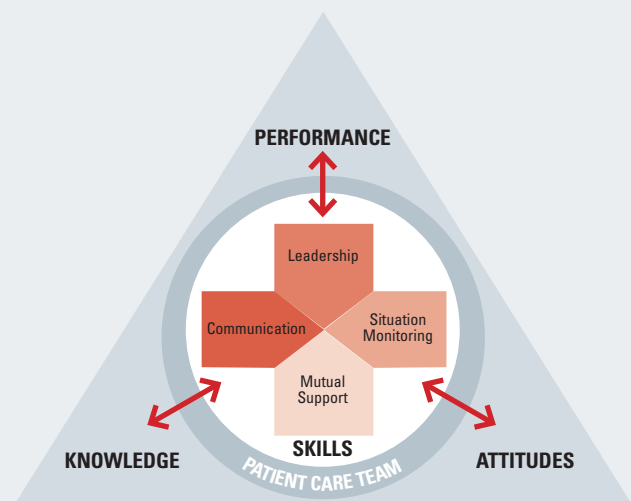

Figure 1: TeamSTEPPS[TM] model for developing expert teams

At Nottingham University Hospitals (NUH) NHS Trust in the UK, we have implemented a multi-professional development programme called 'NUH TEAMS'. This helps to develop and embed these key skills and behaviours within the routine daily practices of our operating theatre teams. The NUH TEAMS programme is based on the TeamSTEPPS[TM] model but with some changes to help successful implementation in the NUH context.

How it works

Effective team training depends on a structure and processes to support implementation and sustainability. Figure 2 gives an overview of the NUH TEAMS Programme structure and processes. The role of each element of the NUH TEAMS Programme (white boxes) is outlined below.

- **NUH TEAMS Operations Group**. The programme co-ordinator is an experienced theatre practitioner, who has administrative support to help communicate progress with more than 20 different theatre specialty teams, based on multiple hospital sites.

- **NUH TEAMS Faculty.** The programme co-ordinator liaises with a pool of designated NUH TEAMS faculty (teaching staff). These are experienced practitioners from different professions and staff groups who have progressed through an established faculty development programme. This programme provides them with deeper background knowledge and coaching capabilities to enable them to support the teaching and improvement programme.

- **Education workshops.** The basic educational content is shared with theatre teams on a specialty basis in a classroom setting where possible in the form of a half-day interactive workshop. The workshop enables the team to identify and discuss issues that are most relevant to their own performance, and to consider how best to apply and refine the skills, techniques and practices identified in NUH TEAMS to the context of their practice. The workshops are backed up by access to web-based electronic learning resources.

- **Theatre Improvement Groups (TIGs).** Specialty based TIGs comprise a small number of representatives from different staff groups within each specialty theatre team (including surgeons and anaesthetists). The main function is to identify and promote improvement ideas within their own team practices, challenge and overcome local barriers for improvement, and report progress to the overarching project group. TIGs are coached in improvement methods by the NUH TEAMS faculty. The TIGs have a limited amount of protected time to meet regularly. Networking between the TIGs is encouraged by the NUH TEAMS Operations Group to help the sharing of improvements and solutions.

- **Team performance dashboards.** To demonstrate improvements in quality of care and staff well-being, existing quality data are collated and made accessible to the project team and the TIGs. In turn each TIG is encouraged to develop and refine its own specialty team performance metrics. These are shared with all team members as a 'dashboard' to help strengthen good practice and promote improvement where appropriate.

- **Simulation exercises.** Faculty follow up on key issues by using simulation exercises and feedback in practice where possible. This helps to embed specific skills and behaviours in the workplace.

- **Coaching in practice.** The NUH TEAMS faculty support improvement by role modelling and influencing behaviour change via coaching in practice.

As a multi-professional programme, NUH TEAMS requires the engagement of various professions and staff groups involved in the duration of a patient's surgical procedure (including ward admission, anaesthesia, surgery, recovery and postoperative care). This is helped by having visible involvement in the programme design of senior managers and clinical colleagues from each profession. Placing the quality of patient care as central to the team training programme helps to provide a focus for collaboration within and between different teams involved along the end-to-end 'patient care pathway', especially when some feel 'less visible' as their work is more 'behind the scenes'.
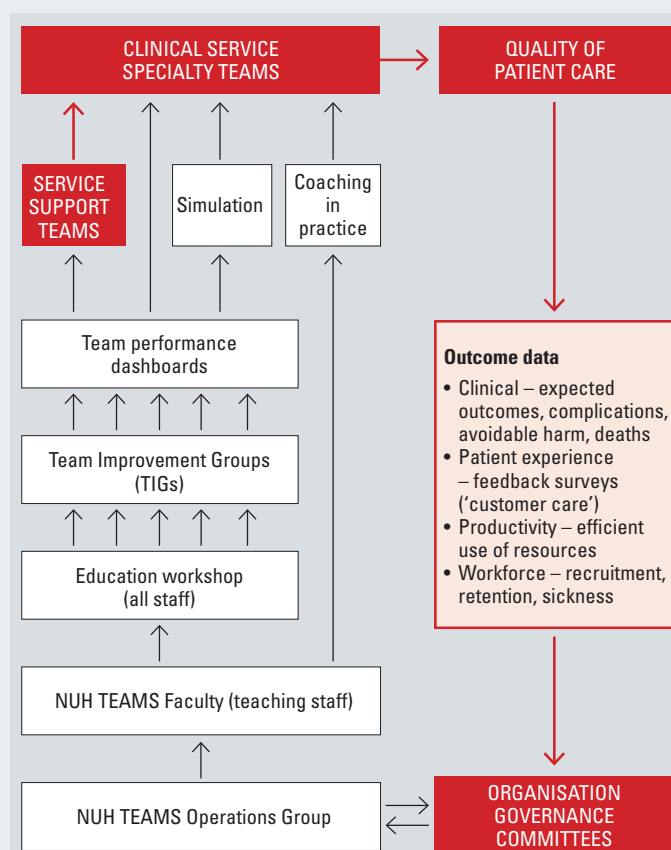

Figure 2: Overview of the NUH TEAMS Programme structure and processes

Red boxes show the system in place to deliver care and monitor performance via specific indicators of quality measured against defined standards.

White boxes show the different elements of the NUH TEAMS programme.

Where next?

The programme is well-accepted by staff from all professions and backgrounds, who apply some of the tools and techniques into their daily practices. There are still hurdles to be overcome in terms of altering individual behaviours, but enhanced coaching within teams aims to influence this by direct role modelling and feedback in practice.

Over time it is anticipated that data will give a more predictive view of optimising performance rather than a retrospective view of past performance. These measures will be aligned with critical aspects of collaboration and adaptability in teams, including the ability to:

- sustain shared understanding within and between teams
- manage conflict
- support each other's well-being
- embed trust and respect in daily work.

This will benefit resilience and safety at an organisational level by enabling teams to talk to senior managers about organisational changes needed (Salas et al, 2008). ⑤

References

AHRQ (2014). *TeamSTEPPS 2.0*. March 2014. Rockville, MD: Agency for Healthcare Research and Quality. Available at: http://bit.ly/2j3CJQO

Baker, D.P., Day R., & Salas E. (2006). Teamwork as an essential component of high-reliability organizations. *Health Services Research*, 41(4), 1576-1598.

NHS Improvement (2005). *Never events policy and framework*. 27 March 2015. Available at: http://bit.ly/NHSNever

Salas, E., Sims, D.E., & Burke, C.S. (2005). Is there a 'Big 5' in teamwork? *Small Group Research*, 36(5), 555-599.

Salas, E., et al. (2008). Does team training improve team performance? A meta-analysis. *Human Factors*, 50(6), 906-933.

Thomas, L. & Galla, C. (2013). Building a culture of safety through team training and engagement. *Postgraduate Medical Journal*, 89, 394–401.

Find out more

You can find out more at http://bit.ly/NUHTEAMS. Follow us on Twitter @NUH_TEAMS

Bryn Baxendale is a Consultant Anaesthetist at Nottingham University Hospitals (NUH) NHS Trust, with clinical responsibilities related to vascular and emergency surgical services. He is also Director of the Trent Simulation & Clinical Skills Centre at NUH and Honorary Professor at the School of Psychology at the University of Nottingham. He was President of the Association of Simulated Practice in Healthcare between 2009-14.

COLLABORATION IN POST-INCIDENT REVIEW

Online software is a fast-growing field that many industries, including aviation, depend on. It is a complex domain that crosses geographic and geopolitical boundaries and depends on multidisciplinary collaboration. For a fairly new industry, it has been innovative in introducing a collaborative form of learning from incidents, often called 'blameless postmortems', which we could learn from. **John Allspaw**, who has been critical to this, outlines the field and the approach to post-incident review.

John Allspaw has worked in software systems engineering for over twenty years in many different domains: government, online media, social networking, and e-commerce. John's publications include the books The Art of Capacity Planning (2009), Web Operations (2010) and a chapter in Human Factors and Ergonomics in Practice on HF practice in Web Operations. John holds an MSc in Human Factors and Systems Safety from Lund University. He is currently co-building Adaptive Capacity Labs, LLC.

KEY POINTS

1. **Outages or degraded performance in online software can have enormous impact, costing millions or even tens of millions in total lost revenue. Learning from such incidents is critical.**

2. **When there is an incident, a post-incident review (sometimes called a 'postmortem') is held. This is usually a semi-structured facilitated group debriefing.**

3. **Postmortems are 'blameless' to understand work-as-done (as opposed to work-as-imagined, by other colleagues or management) without fear of retribution or punishment.**

4. **The real value of blameless postmortems is in the dialogue during these debriefings. Different specialties come together to get different perspectives on what happened and how things normally work.**

The most important industry you've never heard of

Most people have probably never heard of 'web engineering and operations', and yet rely on it for many aspects of their lives and work, including controllers and pilots. There are some surprising similarities between this field and aviation. Both worlds involve many specialised professions, with individuals and teams working in high-tempo and competitive markets. There are many technical, cultural, and organisational challenges. People have to cope with complexity and time pressure on a daily basis. The displays and controls have similar challenges to those of people in safety-critical sectors such as the provision of air traffic services. And all aspects of the work are steeped in automation; except far more so.

The software and infrastructure delivering the software may need to support hundreds of thousands of users at any given time. There is huge interconnectedness between websites, applications and other network-connected services, which are often independently designed, owned, and operated. An e-commerce website, for example, may rely on external services whose functionality, availability, and performance that are not within its control. The software itself is built of many components, some of which are standardised and in the public domain, some of which are proprietary.

When incidents occur, it is often difficult for engineers to understand breakdowns and faults, and there are many opportunities to make a bad situation worse

Dealing with incidents in web operations and engineering

Just as incidents occur in aviation, outages or degraded performance occurs in web operations and engineering, sometimes with enormous impact. The routers and switches that make the global internet work fail often. Servers that contain content for websites and other increasingly critical services (official government statements and policies, payments processing, bank transfers, electronic medical records, etc.) go 'down' for various reasons (hardware, software), and more frequently than most of the public realise. These incidents affect business continuity at a cost of millions of dollars, and can have unintended consequences that spread to non-web domains, such as the loss availability of electronic medical records.

When incidents occur, it is often difficult for engineers to understand breakdowns and faults, and there are many opportunities to make a bad situation (e.g., an outage) worse (e.g., by corrupting data permanently). It is also difficult to understand and learn from outages and other events after they have happened.

'Blameless postmortems'

Typically in software-centred companies (like Facebook, Amazon, etc.) when there is an incident such as an outage, degradation, slow performance, or other significant surprising event, a post-incident review (sometimes called a 'postmortem') is held. In such cases, usually no single individual (or even a team) can fully understand what is happening, and there is no 'bird's eye view' of how it all works. Engineers specialise in doing things like building new features, fixing bugs, responding to outages, and maintaining all the technology that the business relies upon. So engineers must rely on the perspectives that others have on an issue to build a picture of what has happened, what is happening now, and what needs to be done. Collaboration is essential for normal operations and dealing with unwanted events.

Engineers must rely on the perspectives that others have on an issue to build a picture of what has happened, what is happening now, and what needs to be done

In 2012, I wrote a post for the engineering blog for my company, Etsy, Inc. (an e-commerce marketplace) called *Blameless PostMortems and a Just Culture* (https://codeascraft. com/2012/05/22/blameless-postmortems/). The post was about the need for 'blamelessness' in after-incident debriefings, in both verbal form (in the case of facilitated debriefings) and in written form (in the case of reports or other artefacts that come from the analysis).

Five years since writing that piece (which proved to be influential in my industry), I now understand that blamelessness is required for two important things.

1. to get real details from people as they experienced the outage (whether it's a degradation like a website or app being down or even a response to an active security breach).
2. to get different perspectives and specialties to come together and compare the different models they have in their minds about how things normally work.

The blameless postmortem is usually a semi-structured facilitated debriefing that involves some preparation of the timeline of events. Unlike in air navigation service providers, these are done in groups. This timeline will contain software logs, online 'chat' transcripts of what engineers communicated to each other during the event, and other artefacts such as diagrams or charts involving performance of various components impacted or involved during the issue.

The discussion uses the timeline as a scaffold for the group to build out context for details of the event. How people 'saw' problems and generated solution ideas are all the critical to flesh out the timeline. The resulting documentation of the event places importance on the perspectives given by people familiar with the event, as well as placing actions and decisions in the context in which they happened.

These blameless postmortems can provide rich data on work-as-done (as opposed to work-as-imagined, e.g., by management and colleagues), in the forms of both technical artefacts (logs, dashboards, etc.) and narratives about what happened, what people were trying to do, and what was affecting their work. Organisations that take this approach give engineering staff support for giving details about mistakes that they've made without fear of retribution or punishment.

The value of blameless postmortems turns out not to be the 'action items' that come from recommendations from this process. Of course, making recommendations for future design changes and introducing 'safeguards' for engineers working with the system (to reduce the likelihood of making a mistake) is valuable, reasonable, and good. But I have come to understand that the real value is in the dialogue during these debriefings.

Engineers can only make inferences about how things actually work – and therefore how they can break or fail. They have 'mental models' about what's happening in the code, in the network, between the components, etc. These can be compared to the air traffic controller's (mental) 'picture' of the traffic. The group debriefings (when facilitated well) encourage and support people to compare and contrast their mental models of how things work (and break) against each other, allowing a form of recalibration to take place. This can be understood via the parable of the 'blind men and the elephant':

> Six blind men were asked to determine what an elephant looked like by feeling different parts of the elephant's body. The blind man who feels a leg says the elephant is like a pillar; the one who feels the tail says the elephant is like a rope; the one who feels the trunk says the elephant is like a tree branch; the one who feels the ear says the elephant is like a hand fan; the one who feels the belly says the elephant is like a wall; and the one who feels the tusk says the elephant is like a solid pipe.
> A king explains to them:
> "All of you are right. The reason every one of you is telling it differently is because each one of you touched the different part of the elephant. The elephant has all the features you mentioned."

Figure 1: Like the blind looking to describe an elephant by pieces, software engineers can only glimpse and imagine parts of what they are responsible for

It's as if the blind men in the parable understood that they were all only experiencing part of the elephant, and were encouraged to talk through what each of them found, in order to aggregate their experiences, to produce a richer 'picture' of what an elephant is.

Of course, all metaphors have limits. To be a bit more accurate with respect to complex modern software systems, the elephant should be undergoing surgery, under attack by hunters, and engaged in some sort of elephant triathlon all at the same time.

The need to collaborate to bring combine individual perspectives into a more holistic picture of what is happening seems understandable, especially to those familiar with the real messy details. As well as accepting that one has a limited perspective, it is critical to be explicit with others continuously about what you are working with:

a) "here's my perspective on what is happening…now"
b) …how does what I'm seeing fit with what you're seeing?"

This applies to anyone working collaboratively in complex adaptive work, whether they are engineers with different specialised expertise and perspectives, or the various professions involved in the provision of air navigation services/air traffic management. The acceptance that your understanding is always incomplete and therefore always needs to be combined, contrasted, compared, and recalibrated with others' understanding is critical.

But as American author David Foster Wallace once stated in a now-famous commencement speech:
"…the most obvious and important realities are often the ones that are hardest to see and talk about."

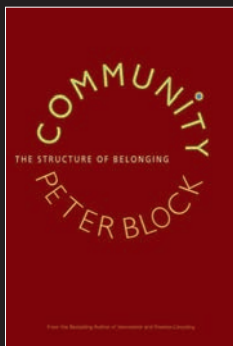Collaboration is one of those obvious and important realities. **S**

Find out more

Allspaw, J. (2016, May 22). *Blameless postmortems and a just culture* [Blog post]. Available at: https://codeascraft.com/2012/05/22/blameless-postmortems/

Allspaw, J. (2016, November 17). *Etsy's debriefing facilitation guide for blameless postmortems* [Blog post]. Available at: https://codeascraft.com/2016/11/17/debriefing-facilitation-guide/

Allspaw, J., Evans, M., & Schauenberg, D. (2016) *Debriefing facilitation guide: Leading groups at Etsy to learn from accidents.* New York: Etsy. Available at: https://extfiles.etsy.com/DebriefingFacilitationGuide.pdf

If you want to read more about some of the issues raised in this Issue of HindSight, then these books might be of interest.
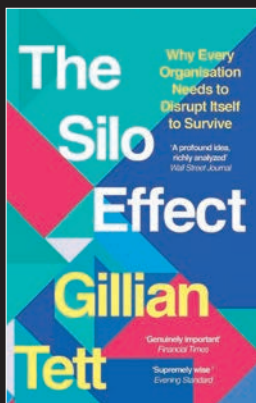
Community: The Structure of Belonging,
by Peter Block (2009)

From the author: *"This book is written to support those who care for the wellbeing of their community. It is for anyone who wants to be part of creating an organisation, neighborhood, city or country that works for all, and who has the faith and energy to create such a place."*

"Block helps us see how we can change the existing context of community from one of deficiencies, interests, and entitlement to one of possibility, generosity, and gifts. Questions are more important than answers in this effort, which means "leadership is not a matter of style or vision but is about getting the right people together in the right way: convening is a more critical skill than commanding." (Kolin Lynworth, Vancouver Observer)
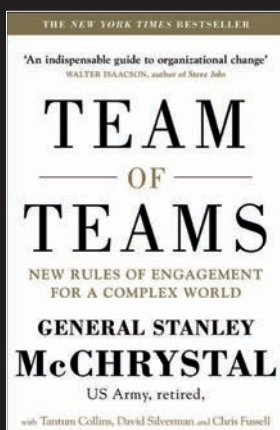
The Silo Effect: Why Every Organisation Needs to Disrupt Itself to Survive,
by Gillian Tett (2016)

From the author: *"This book started during the great financial crisis of 2008, but it is not a book about finance. Far from it. Instead, it asks a basic question. Why do humans working in modern institutions collectively act in ways that sometimes seems stupid? Why do normally clever people fail to see risks and opportunities that are subsequently blindingly obvious? … So this book sets out to answer two questions: Why do silos arise? And is there anything we can do to master our silos, before these silos master us?"*

"Highly intelligent, enjoyable and enlivened by a string of vivid case studies. It is also genuinely important … her prescription for curing the pathological silo-isation of business and government is refreshingly unorthodox and, in my view, convincing."
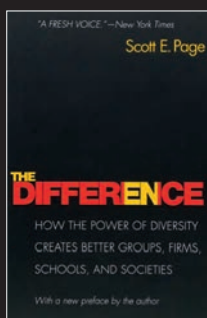(Felix Martin, Financial Times)

Team of Teams: New Rules of Engagement for a Complex World,
by General Stanley McChrystal (US Army, retired) (2015)

From the author: *"We hope to help the reader understand what's different in today's world and what we can do about it. We will argue that the familiar pursuit of efficiency must change course. Efficiency is important, but the ability to adapt to complexity and continual change has become an imperative. Using our experience in war, combined with a range of examples from business, hospitals, nongovernmental organizations, as well as more unlikely sources, we lay out the symptom of the problem, its root causes, and the approaches that we and others have found effective."*

"Team of Teams is erudite, elegant, and insightful. An unexpected and surprising wealth of information and wonder, it provides a blueprint for how to cope with increasing complexity in the world. A must read for anyone who cares about the future - and that means all of us."
(Daniel Levitin, author of The Organized Mind)

The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies,
by Scott E. Page (2008)

From the author: *"Diversity, as characterized in this book, means differences in how people see, categorize, understand, and go about improving the world."*

"Rather than ponder moral questions like, 'Why can't we all get along?' Dr. Page asks practical ones like, 'How can we all be more productive together?' The answer, he suggests, is in messy, creative organizations and environments with individuals from vastly different backgrounds and life experiences."
(Claudia Dreifus, New York Times)

LEARNING FROM COMMUNITIES:
A CONVERSATION WITH CORMAC RUSSELL

The study of communities and community-building activities can provide important insights into collaboration within and between organisations. Over the last 21 years **Cormac Russell** has worked in 35 countries, with communities, agencies, non-governmental organisations and governments. This article is an edited transcript of a conversation between Cormac Russell and **Steven Shorrock**, about learning from communities.

KEY POINTS

1. **Healthy communities have permeable boundaries to allow people in, and to create space for people who are inside to be able to get out.**

2. **Communities have 'connectors' at the edge, who connect people and help create community. Connectors are trusted and gift-oriented.**

3. **People can be seen in terms of their gifts, skills and passions. Discovering these and connecting them between people is at the heart of asset based community development.**

4. **Professions have become more siloed, and the effect can be to 'other' those people who are not in the silo.**

5. **Organisations can help to understand interdependence via small group conversations.**

Steven Shorrock (SS): *Cormac Russell, thank you for agreeing to talk to me. I wonder if you could just spend a moment to introduce yourself, a little bit about who you are and what you do.*

Cormac Russell (CR): I suppose the space that I hold dearest is just this love of community, and an interest in how to grow community. My formal credentials around that are that I am an ABCD Institute faculty member, and ABCD stands for 'asset based community development'.

SS: *So you talk about community there. What in your mind makes community a community?*

CR: Yes, it's a great question. I regularly hear people refer to groupings of people as communities and when you enquire into the reality, you find that there are a lot things that are excluded. Personally when I think about community, I would think about culture. I think about economy. I think about environment, the place, if you like – built and natural. I think about the associational life of the community but also the capacity of the community to welcome others that are not currently in the community into that space.

SS: *So related to that, in your book, which is called 'Looking Back To Look Forward', you interview a pioneer in community development, Professor John*

McKnight. And he related to you a story about a group that he once belonged to:

"I once belonged to the Cook County Labrador Retriever Owner Association because we just loved our lab. We'd all go out once a month and meet in a park and bring our dogs. We'd talk together about how wonderful our dogs were and the dogs sniffed each other. That was it – the joy of association. And then one day out of the woods into the parking lot came what I think must have been a woman with a wonderful German Shepherd dog, and all of a sudden the question is whether we want to let her in? What holds us together is the belief that we have the best breed of dog in the world."

CR: He was trying to relate this idea that every community, every peer group, every affinity group, has this invisible boundary that says to the world, "these are the people who are 'in', and these are the folks who are 'out'". So his challenge to us, I think, was to figure out how we could blur, or how we could create permeability around those boundaries. And to an extent that's the challenge of community. Its not to be able to grow a closed hermetically sealed circle.

SS: *He was saying, what holds us together is the belief that we have the best breed of dog. And maybe as professions,*

professions of all sorts, we think that we are the best breed of profession and we have to have a boundary around our profession. The question then is, is that boundary always a good thing and when do we need to create that permeability in the boundary in order that air traffic controllers can interact with others that they need to interact with in order to create safety both in the short term and in the long term?

CR: It's interesting. It isn't just allowing people in, I think, it's also about creating space for people who are inside to be able to get out on to do other things. How do we free some folks up inside those groups, who are probably more pro-social, who are probably more at the edge anyway, and can just operate in the interface? I think that there are always a number of people at the edge of any group, who are loosely called 'connectors', who move quite fluidly. I think about them as multicultural in a sense, in that they can move in between and across any grouping really. They have that competency and capability.

And then I think there are people who are good brokers. They may not necessarily be people who are good relationship builders, but they are good 'askers'. So maybe they have an authority or they have a leadership position, that says, "you know what, I'd like to have different conversation and I'd like different people in it".

SS: *So you use this word 'connectors'. What is it that connectors actually do?*

Well what I find helpful to think about in this regard is how a 'connector' is different to a 'leader' and a 'networker'. I feel that leaders are really, really good at crystallising issues that people can get around, so they can grow a followership. Not necessarily around themselves, but around a vision or an issue, and they can hold some stewardship around that. They are the good ones [Leaders]. So we need leaders and I think networkers tend, to my mind, to be – and I don't mean this at all negatively – but they tend to be quite opportunistic in the way that they bring people together. So they kind of sense the network being about a job of work or about very intentional exchanges. So I think entrepreneurs are really good networkers. But there is a lot of thought going into who owes who a favour. There is a lot of transaction.

Connectors, I think, are gifted-oriented

Connectors, I think, are gifted-oriented. So, I see them being able to see in me something that I can contribute to somebody else. They then know that they've got to connect two gifts, so two unconnected gifts is reprehensible to a connector. They want to see them connected, so they will make those connections. And they will often – not always – say something

or do something that suggests that you both act in some way together. They will suggest that you mobilise.

SS: *So they will put a seed in your mind.*

CR: Exactly. And they then lead by stepping back. They disconnect. This isn't what a networker does. The networker stays close up to the network because they need something back from the network. Whereas I find the connector will disconnect. If we go back to our conundrum of earlier on around the boundary circle that hasn't got enough permeability, then one of the ways of creating permeability is to find the connectors within each of those circles and help them relate to each other across the various siloed groups.

I've certainly met several connectors who are often in professional associations, and so they often act in a voluntary capacity. But what they do is, as I experience those people, is they reach out between professions, between sites. And also even between organisations. So is that the kind of person that you're thinking about?

In the community context what we will try to do, is we would try to find some kind of way of revealing those connectors, and getting them connected together

CR: Absolutely. And in the community context what we will try to do, is we would try to find some kind of way of revealing those connectors, and getting them connected together. So it is beginning to say, okay, well they are there anyhow, so is the culture currently nurturing what they do naturally anyway, or is it stifling it? And if it is stifling it, how might we disrupt that constructively and innovatively? And that's where community building and community organising comes in, I think.

SS: *Another thing that comes to mind here is that those connectors, when I think about one thing that they may have in common, is that they are trusted and that can be, I think, something that differentiates them from leaders or from networkers, who may or may not be trusted.*

Yes, Absolutely. I think it's really striking isn't in life generally that when you are in relationship with somebody that isn't trying to get you to be interested in them but is genuinely interested in you and has an interest in other people, that is kind of uncommon. And therefore you'll find that trust builds very, very quickly with people who behave like that. And what is interesting about them is that even though they're trusted, they are not in any particular rush. So they are going at speed of trust.

SS: Something that you mentioned earlier was that people with this connecting capacity are 'gift-oriented'. I am wondering if you can say a little bit more about what you mean by people's gifts and how that is relevant to this whole thing about connecting different groups and even connecting people within the same group.

CR: If you think about a person in terms of their capacities, I think about people as having gifts, and what I mean by that is stuff that they are just born with, they do naturally. So they didn't learn necessarily, it's just a part of their make-up. Skills are things that we've

world, who have gifts that they don't know they have. Now the interesting thing is that connectors are really good at helping them see those.

There are lots of people in organisations who have gifts that they don't know they have

A passion is by definition different because a passion is something somebody is taking action around. They might not be particularly good at it, but they feel passionately.

Somebody can have those three capacities and a lot of our work is about people helping people discover their capacities and then contributing those to other people. That's how you build community. You show up and you make that contribution.

Thinking about the issue of the interfaces between the various professional groups, locations of work, or organisations, it strikes me that those passions are a critical bridge that

acquired, and things that perhaps we've refined enough to either feel that we have learned them, and we can therefore find a way of expressing them to the world. So we often talk about skills that are head-based skills; things that I know and I could teach somebody else. And skills of the hands, so crafts.

The third thing I think about in terms of capacity is passion. And the way I would make the distinction between a gift, a skill and passion is, I think you can have a gift and even the skill and never express it. I can be very gifted at something I don't even know. And I think there are lots of people in organisations and in life generally outside of the organisational

could be built to connect up disparate groups in the aviation world that live in silos. So I am guessing a way forward is to look for, "what do you as professionals in these different groups care about enough to join together and take action on it, for safety or for any other thing that you care about"?

CR: That is certainly one way in. I think there are other entry points and to an extent it might be a scattergun approach. In the institutional world we demark. We elementalise. And the specialism becomes a big part of my identity. So one of the ways might be, "Well what are some of the areas of common ground where we need each other? What are the things we can do together that we can't do apart?" So in a

sense that's an invitation to go right to the very edge of your specialism and be honest about the limits of what you can do. The only way you can have that conversation is to talk about what you can't do. And that demands a certain humility. Let's have a mature adult conversation about what we can't do, because I think at that moment you can really invite other people into that interface space. Institutionally, it is saying: "You have a gift that we don't have. We need it. We can't do without you. Come in." That's the great siren call of community. "You have a wonderful singing voice. We have a choir. I don't know if you've heard it. It's pretty awful. We need your voice. Come in."

SS: It reminds me of some of my professional experience with these

fault lines. I'm wondering what would be practical ways, then, for professional groups to begin to address some of those fault lines? I'm thinking maybe of both formal ways or structured, systemic ways but also informal ways.

CR: I think of my father working in Shannon airport for 41 years. He was ground manager in Shannon airport in Ireland (for an airline), and the way he interfaced and the way he brought people together was very much through fun and food and celebration and conviviality. So that was something I learned from him by watching him.

He just instinctively understood that if you connect people by discipline they tend to go deeper into their silos but if you connect them by human affinity and by care and compassion and passion and things like that they find ways of building relationships that make them more inclined to challenge their silos. Because you are humanising. You are humanising the folk that are 'the other'. And that's the problem, you know, when we are in our silos we 'other' the people who aren't in our silos. And we deify the people who are, and ourselves included. And so a lot of that attempt to just give people the opportunity to be in relationship with the 'other' is, I think, absolutely gold dust.

Now interestingly today, if you look at the way that groups of professional people organise, compared to 20 years ago, I would say that they have become more siloed. If you look at how people thought about their job of being a police officer, for example. 20 years ago they would've talked a lot about their beat, where they policed, the place, the people, the neighbourhood, the town, the village. Most police officers I know today talk about their role in relationship to other police officers or to first responders. They talk about their discipline. And so that's a silo within a silo, in that sense.

SS: But in fact the work that anyone in any profession, in any silo does is only meaningful in its interactions with all of the other people that are involved in that. So the work of air traffic controllers means absolutely nothing except in the context of their interactions and interdependency with pilots, with

engineers, with meteorological specialists, with aeronautical information specialists, with safety, quality, and all of the other groups that you can imagine that form the aviation system. So in a sense the group on its own is only special in relation to all of these other groups of people that they are interdependent with, right?

Absolutely. That is something that people need to feel in their bones because the initial impulse is to think that we are conceding, or we're giving something away, and it's only when people feel that actually there's something really valuable, and something to be gained, in fact something quite natural about working this way, and thinking this way. I think that that's where the intentional community building comes in.

You can continue to hold your intimate small group connections, while at the same time getting the benefits of the wider relationships

The trick is to be able to say to people, "you can continue to hold your intimate small group connections, while at the same time getting the benefits of the wider relationships and we are going to figure out how to do that in a way that gives you both ends". Giving people the opportunity to really understand "what's going on here?", and being able

to say "Ah, alright now, your concern is, you're going to be giving up something. Let's find a way of making sure and that you're not at a loss". And I think that hardly ever gets teased out.

And being able to have lots of small group conversations that intentionally permeate to allow people to move between those conversations. So there is something, I think, about being able to facilitate those kinds of conversations and welcome the dissenting voices, but inviting people to take their complaints and turn them into requests, and inviting people to articulate what they want as well as what they are prepared to offer.

So we need to have that social contract conversation. What are your wants, what are your offers? And I think that begins to open things up. And the fluid way of doing that is to create more associational life. Like in the informal spaces as well. Your organisation can show up in very intentional ways to help those things find expression and get connected up as well. The animating aspect is important. And in those points of interface you can begin to seed some really interesting conversations and maybe even practices around having conversations. So beginning to have sessions that start with appreciative inquiry or encourage groups talk about their wants and their offers. All of that will open up new spaces. §

Cormac Russell is Managing Director of Nurture Development (www. nurturedevelopment.org) and a faculty member of the Asset-Based Community Development (ABCD) Institute at Northwestern University, Chicago. He is the Director of ABCD in Europe. Cormac has served on the 'Expert Reference Group on Community Organising and Communities First', by Nick Hurd MP, Minister for Civil Society in the UK. He is the author of 'Asset Based Community Development (ABCD): Looking Back to Look Forward'.

Steven Shorrock works in the EUROCONTROL Network Manager Safety Unit, where he leads the European safety culture programme and is Editor in Chief of HindSight. He is a Chartered Psychologist and Chartered Ergonomist & Human Factors Specialist with experience in various safety-critical industries. Steven is Adjunct Associate Professor at The University of the Sunshine Coast, Centre for Human Factors & Sociotechnical Systems. He recently co-edited Human Factors & Ergonomics in Practice.

"At Heathrow, we have introduced a 'What worries you?' box. Into it, any staff member can place a note about anything at all that worries them, about any aspect of the unit's performance. Open reporting is great but it tends to relate to events rather than people's concerns. We are now rolling it out to other interfaces we have so we can respond to their worries about what we do and how it impacts upon them."

**Dale Reeson, General Manager ATS
at NATS Heathrow Airport**

"Get in the car, get on a plane, go to the room next door. Wherever the other side of the interface may be, go there. This week I have spent the best part of 75% of my working hours driving to general aviation airfields, airports, a gliding club and a weapons testing facility. The thought of so much unproductive time on the road worried me, however it has been one of the most productive weeks this year. Events at the interfaces necessitated the journeys and the time spent looking through the lens from the other side was priceless. I often hear remarks about those at the other side - "incompetent!", "what where they thinking?" Having made the trek it became very clear. Despite their differing roles, be it glider pilot, airport operator, ATCO, or explosives expert, I seen the same in all of them. They are all airspace users who were trying to make it work. They did their best to do what they thought was safe. We often don't see this until we look at our world from their perspective. Aligning our perspectives is an essential step to improve an operational interface."

**Blain Kelly, London Terminal Control
Safety Manager, NATS**

"At ATCC Stockholm we have a small team of ATC personnel working together with pilots in an initiative called 'Kundgruppen' (the Customer Group). For 20 years and running, pilots and air traffic controllers have been getting together – formally and informally – to exchange experiences and share thoughts on the ATC-pilot system and what we can do together to improve flight safety. For example, last year 8 pilots took part in simulator exercises in the Stockholm airspace, working as approach, departure, director and feeder/stacker controllers. We also arrange flight deck journeys for ATC personnel, annual social events and invite pilots to our workplace on a regular basis. We believe that good ATC-pilot relations, and an understanding between our different – but thoroughly integrated – worlds, is paramount for flight safety."

**Axel Rydin, ATCO
at Stockholm Terminal Control**

"I try to instill into Tower controllers from an early stage, to plan for a pilot to comply with your instructions, but still surprise you. Pilots engaged in various operations and aircraft types are more or less likely to catch you out. At the top of the scale are balloons. They are flying with the breeze and will often require higher levels than we can easily arrange, and they frequently miss their intended landing areas. Helicopters can also turn in directions that you are not expecting, join very short or long circuits to land, or fly faster/slower or even climb very quickly. Lighter fixed wing aircraft may also help themselves to very early turns on departure, or even push out to 4 or 5 miles before setting course. All of these operations are permissible but may come as a surprise to a controller who has not allowed for this. It is important to consider what a pilot is entitled to do and compare that to what the ATCO is expecting the pilot to do. Likewise, if a pilot who operates the same way every day needs to deviate from that profile for some reason, then let ATC know."

**James Fisher, Training Officer
at Essendon and Avalon, Airservices Australia.**

"Years ago I managed a small group of controllers at the ATC Centre. Our ambition was to improve cooperation and understanding between controllers and pilots.
Things we did:

- Visit an airline crew base. Bring a box of chocolate and some printed information and be prepared to ask and answer questions.
- Try to arrange a place on a jump seat as often as possible.
- Arrange an "ATC workshop" and invite pilots. Give them a headset and put them next to a controller. If you have a simulator – let the pilot do the controlling. Coffee, cookies and a lot of discussions.
- Write articles about things happening at your ATS unit. Send it to a magazine that is read by pilots. We used the pilot union paper several times.
- Print a local information leaflet where you collect all experiences made during the activities above. Controllers are starving for feed-back on their job."

**Anders Ellerstrand Watch Supervisor
ATCC Malmö, Sweden**

Do you and your colleagues do something that other operational readers might be interested in?

Send your short examples of good practice (200 words maximum) to steven.shorrock@eurocontrol.int

"Once every second year the Watch Supervisors and the Technical Watch Supervisors meet for refresher training. We typically train actions during system degradation. What's really clever is that we take a break every now and then during the exercises. During that break each part describes their situation. The WS could tell how he really needs to know the technical status and to have a prognosis to be able to coordinate this with all the stakeholders. While the TWS explains how he really needs to be left alone to be able to find out what is happening and what to do about it. It is informative and fun and I believe it will improve the way we cooperate in case we have real problems."

Anders Ellerstrand Watch Supervisor ATCC Malmö, Sweden

....

"I believe one major cause for the gap between work-as-imagined and work-as-done is a lack of understanding and knowledge. The person designing the procedures doesn't fully understand the reality in which it is to be used. The person using the procedure doesn't fully understand the idea behind its design. I also believe there is one easy solution to the problem. Organise work so that as many as possible of the people designing procedures also maintain a current rating – as a flight data officer or controller or watch supervisor. And let the watch supervisor take his/her turns with the headset as well. To fully understand another person's situation, you might need to do the same work. Perhaps we should even have higher managers returning to the ops room for a short while every third year or so. At least to the simulator."

Anders Ellerstrand Watch Supervisor ATCC Malmö, Sweden

....

HindSight

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

The theme for HindSight 27 will be

Competence and Expertise

HindSight is an aviation safety magazine for air traffic controllers and professional pilots on the safety of air traffic services.

We welcome articles and short good practice examples by **Friday 23 March 2018**, especially from front line controllers and pilots. Some suggested subject areas include:

- Basic issues: competence and expertise, now and in the future
- Training, instruction and communication for competency and expertise
- Competency assessment
- The use of operational expertise in support functions
- Human performance issues
- Self-guided learning
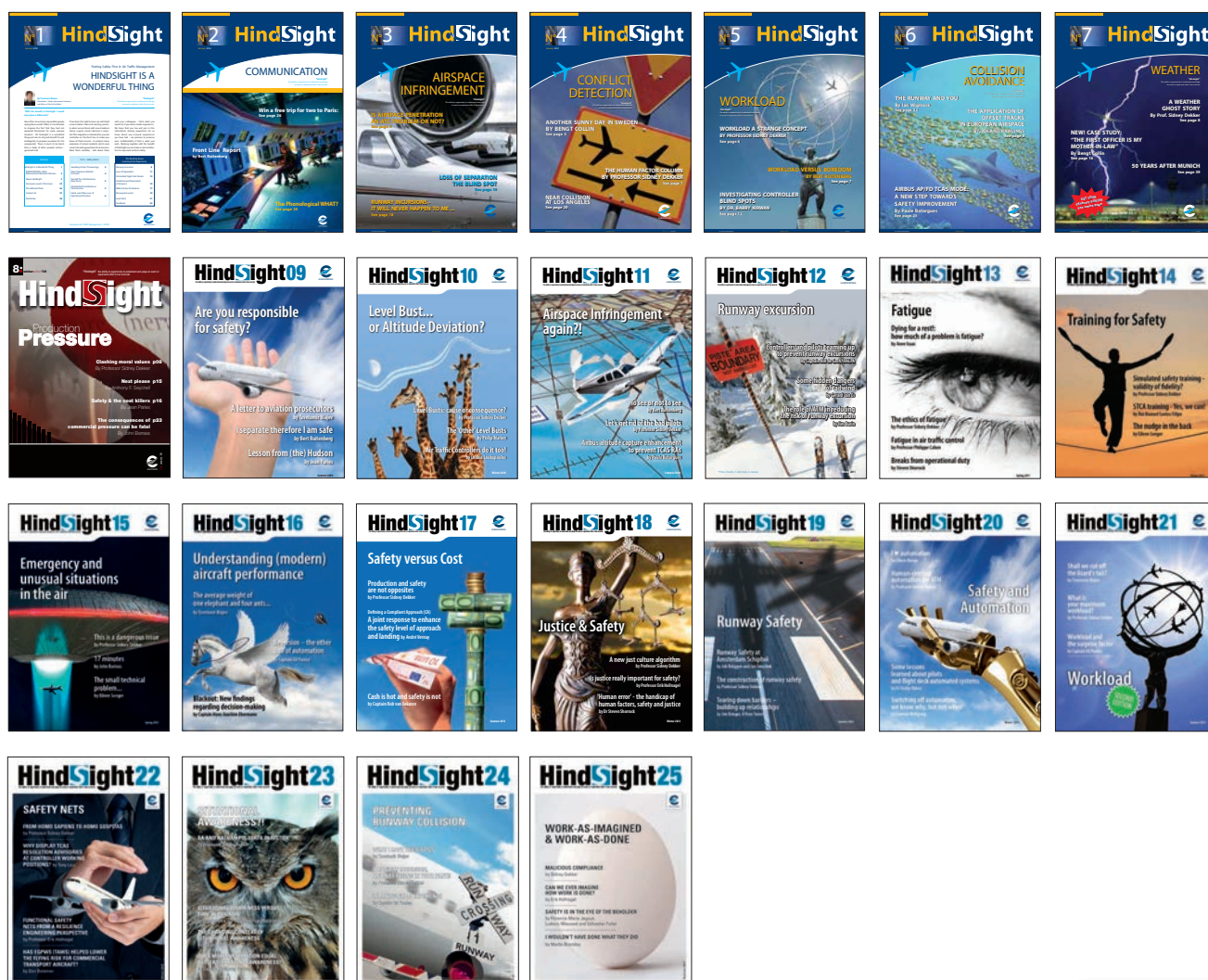- Teams and competency

Draft articles (1500 words maximum) and short examples of good practice ('What we do' – something that may be helpful to other readers) (200 words maximum) should:

- be relevant to the safety of air traffic services
- be presented in 'light language' keeping in mind that the target audience is air traffic controllers and professional pilots
- be useful and practical.

Please contact
steven.shorrock@eurocontrol.int
if you intend to submit an article,
to facilitate the process.

In the next issue of HindSight:
"Competence and Expertise"

EUROCONTROL

This edition is printed in 8000 copies