HindSight 28

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

EUROCONTROL

CHANGE

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Winter 2018-2019

DG'S FOREWO

Eamonn Brennan was appointed by the 41 Member States of EUROCONTROL to lead the organisation as its Director General from 1 January 2018. Prior to joining EUROCONTROL, he was the Chief Executive of the Irish Aviation Authority (IAA).

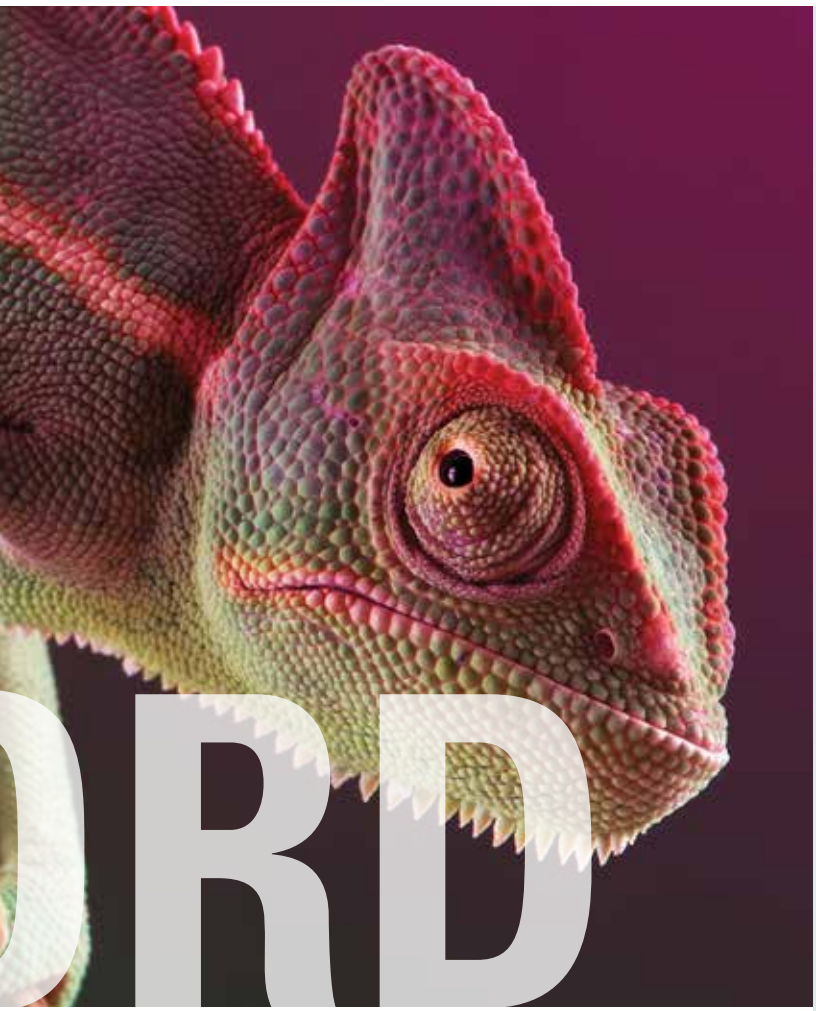
Eamonn Brennan has over 35 years' experience working across three continents, in over 25 countries, in both the public and private sector and has held many leading roles in the Air Traffic Management industry during his career.

There are many sayings about change – that change is constant, that it is painful, that you have to start by changing yourself, that it should not be an end in itself… However, ultimately most of these sayings are making the point that change is probably necessary, and it is better to embrace it and drive the change rather than resist it.

Often, there is little choice – as we are seeing now in how we manage the 11 million flights a year across Europe. Some of our airports are becoming seriously congested and this is set to become even more of a problem in the decades to come, as described in the "Challenges of Growth" report published by EUROCONTROL last year.

En-route delays in 2018 were exceptionally high and this summer is also expected to be very challenging. One of the implications of this lack of capacity is the impact that it has on costs and on the environment as aircraft take less efficient routes or fly at sub-optimal flight levels.

Meanwhile, demand continues to grow, with over 16 million flights forecast by 2040. Our current systems, our current ways of working, will not be able to cope with these traffic levels. At the same time, we are seeing new types of traffic – not just remotely piloted but also, for example very high altitude aircraft. So we have no choice but to change.



WELCOME

Welcome to Issue 28 of *HindSight* magazine. The theme of this Issue is 'Change'. Changes in aviation – in organisations, in industry and in society generally – affect us all, and can affect the safety of air traffic management. The pace of change is increasing. Change is necessary to adapt to the changing world, and we need to adapt to these changes as individuals, teams, and organisations.

In this issue, we have articles from the front-line, as well as from safety, legal, leadership, human factors and psychology specialists. All *HindSight* articles are written and selected to be interesting and useful to the primary readers of *HindSight*: air traffic controllers and professional pilots, and hopefully to all others who support operational work. Let us know what you think about this edition and about the magazine in general. And tell your colleagues about it, whether the paper version or *HindSight* online, at SKYbrary. If you need more copies for your Ops room, then please let us know.

This Issue starts with a section on the nature of change and some fundamental issues and implications. The following sections consider various types of changes, to airport operations, equipment and tools, airspace, procedures and traffic flows, jobs, and laws and regulations. The regular feature on 'Views from Elsewhere' includes articles from shipping, healthcare, banking, and psychotherapy for front-line professions. The articles cover many different types of change: large and small, systemic and individual, long- and short-term, obvious and subtle. The authors address a number of questions, such as: Why is there a need for change? What needs to change? Who makes changes, for whom? How should changes occur? When should change occur, and over how long? What influences whether change is successful, or not? What happens after change? How do we adapt to changing situations? Throughout, there is an emphasis on front-line involvement in change.

The next Issue of *HindSight* is on the theme of 'Goal Conflicts and Trade-offs'. Safety is the focus of this magazine and is obviously critical to air traffic management, but it is one of several goals, including cost-efficiency, CO_2 emissions, noise, capacity, and security. How do these goals interact? What kinds of trade-offs are made as a result? Let us know, in a few words or more, for your magazine on the safety or air traffic management – *HindSight*.

One example is the introduction of Free Route Airspace – a quiet revolution that is happening across Europe right now. For decades, flights have been channelled into very specific routes between fixed waypoints. That's now changing, with aircraft free to choose where they fly, resulting in more efficient trajectories.

The change is being introduced gradually and progressively, first at nights and/or weekends and then H24. Neighbouring FIRs are working together to develop cross-border Free Route Airspace. It is not easy and it has real implications for controllers, pilots, airline operations centres and the Network Manager. These have to be managed carefully, with safety always the priority. However, the benefits are clear and it is progressing well.

This edition is full of examples of change – both large and small. One theme I picked up is the importance of learning from experience, whether that's learning from your experience (for example, putting FRA in place overnight before going H24) or learning from the experience of others. One real benefit of our industry is that there is generally a real willingness to share our experiences – both good and bad! That's the basis of HindSight magazine and one of its remarkable strengths. Many thanks to all the contributors.

Eamonn Brennan

TABLE OF CON

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ACRONYMS

ACC	Area Control Centre
AIP	Aeronautical Information Publication
AMC	Acceptable Means of Compliance
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APP	Approach Control
ATC	Air Traffic Control
ATCEUC	Air Traffic Controllers European Unions Coordination
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSEP	Air Traffic Safety Electronics Personnel
CA	Competent Authority
CANSO	Civil Air Navigation Services Organisation
CEO	Chief Executive Officer
CNS	Communication Navigation Surveillance
EASA	European Aviation Safety Agency
ECA	European Cockpit Association
ECAC	European Civil Aviation Conference

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CONTACT US

HindSight is a magazine on the safety of air traffic management. The success of this publication depends very much on you. We need to know what you think of HindSight.

Are there some improvements you would like to see in its content or layout?
Please tell us what you think – and even more important, please share your experiences with us! We would especially like to hear from current controllers and professional pilots (the main readership) with a talent for writing engaging articles on the safety of air traffic management.

We hope that you will join us.

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Messages will not be published in HindSight or communicated to others without your permission.

ETF	European Transport Workers' Federation
EU	European Union
FAF	Final Approach Fix
FIR	Flight Information Region
FL	Flight Level
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	Human Factors
HMI	Human-Machine Interfaces
IANS	(EUROCONTROL) Institute of Air Navigation Services
IF	Intermediate Fix
ICAO	International Civil Aviation Organization
IFATCA	International Federation of Air Traffic Controller Associations
ILS	Instrument Landing System
IFR	Instrument Flight Rules
JCTF	(EUROCONTROL) Just Culture Task Force
KPI	Key Performance Indicator
MTCD	Medium Term Conflict Detection
NM	Nautical Mile
NOTAM	Notice to Air Men
OJT	On the Job Training
OJTI	On the Job Training Instructor
PAR	Precision Approach Radar
PSA	Preliminary Safety Assessment
PSSA	Preliminary System Safety Assessment
RNAV	Area Navigation
SESAR	Single European Sky ATM Research
SAM	Safety Assessment Methodology
SMS	Safety Management System
SVFR	Special Visual Flight Rules
TMA	Terminal Manoeuvring Area
TRM	Team Resource Management

Steven Shorrock
Editor in Chief of HindSight

A DESK IS A DANGEROUS PLACE FROM WHICH TO WATCH THE WORLD

Some years ago, I was part of a major project involving a new ATC unit. This involved several changes – a whole new building in a new location, new technology, new positions, new procedures. I entered the project at a fairly late pre-operational stage. Everything was designed, built and mostly installed. The controllers were training for the change. Safety assessments, including human factors analysis, had already been done and were exhaustive, comprising hundreds of pages of documentation from workshops and analysis.

But after reading the analyses and reports, I could not get a real sense of what was going on. The only way I could get a sense of risk and readiness for the changes was to enter simulator training and hang out – just watch and listen. I had no preconceived scheme of what to look for, except what I had internalised through observing people over the years as a psychologist and ergonomist, especially in simulation and live operation.

So I hung out in the simulator for the week. Being with the controllers, watching them and listening to them, allowed me to develop a moment-by-moment empathic understanding of their experiences. This is called *process empathy*. It's understanding people's experience as it unfolds, cognitively, emotionally, physically, socially. I also tried to develop a 'near understanding' of their worlds. This is called *person empathy*. It's understanding what it is like to be Michael or Michaela, the air traffic controller.

I was not prepared for what I experienced. And neither were the controllers. What I saw – as an outsider – was that they were not ready for the change, despite what several other senior people believed. The controllers could, by and large, use the equipment. They could see what they needed to see. They understood the procedures. *But they couldn't do the job.* Some lost the picture. They didn't know what was going on. Some had had nightmares about their job. Some broke down crying. I couldn't believe that it had come to this.

It is like the imaginary car described by systems thinking pioneer Russell Ackoff. Imagine selecting the best tyres available. The best engine. The best chassis. The best transmission. The best of everything. Trouble is, they don't fit together. It's not about the parts – the individual skills like using equipment and seeing the airfield. Even I can do that! It's about the whole. It's about whether you can do the job. And they couldn't.

The controllers could, by and large, use the equipment. They could see what they needed to see. They understood the procedures. *But they couldn't do the job.*

Operational staff had spoken up, but the message wasn't getting through. Sadly, it is a reality that people on the inside are not always heard. And they speak up less if they feel they won't be heard. And they stop speaking up if nothing happens when they do speak up.

Nothing in any documented analysis could give me anything like the understanding gained from hanging out, because it was just that – analysis: work-as-imagined, decontextualised, decomposed and detached from the reality of work-as-done.

As I arrived home after the fourth day in the simulator, all I felt I could do, as a safety specialist but moreover as a person with a responsibility to be honest, was write

openly about what I saw. Not as a report, but as a letter. So I wrote a letter in the late hours of the night. The next day, I went in to the unit to try to talk to someone about what I had seen, as a newcomer and outsider to the project. When I arrived, I read the letter to the project manager and the unit safety manager. Then, with these managers, I read it to the ops manager. Finally, I summarised the contents to these managers and the general manager, plus several senior project and facility staff, in an impromptu meeting. Despite the unorthodox approach, most listened and agreed to look into it further.

Sadly, it is a reality that people on the inside are not always heard. And they speak up less if they feel they won't be heard. And they stop speaking up if nothing happens when they do speak up.

But there was some resistance, and I was challenged about my conclusions. I could only think of one question in reply: *"Have you been into the simulator?"* It turned out that none of the (non-operational) managers or specialists present at the impromptu meeting had spent any time in the simulator during training.

There are many reasons why sitting with operational staff, especially in their own environment, might not seem like a priority on a major change project. Among these reasons are the pressures of the project itself (especially time pressures), as well as regulations and management systems. The time need to comply with formal requirements may get in the way of spending time in operational environments. Ironically, bureaucratised (office-based) safety can take the focus away from operational safety. Because time and other resources are always limited, there has to be a trade-off. The trade-off often favours an abstracted version of safety over a lived experience of safety.

In the weeks following, it was decided to delay the opening of the new unit to allow for more practice in the simulator and shadowing in the new facility. I was able to sit in the new unit during shadowing, and watch controllers develop confidence and competence – a felt ability to do the whole job. And I was able to develop a trusting relationship with more controllers. This is called *empathic report*. This helps us to feel more psychologically safe to disclose thoughts and feelings, and to act in a natural way. During this time, new human factors and safety issues were identified from informal discussions and observations.

The facility opened successfully a few months later. Not only were there no major safety issues, the unit operated with fewer capacity restrictions than would have been the case had it opened 'on time'.

This was a career-defining time for me, and I know that this was a significant period in the lives people of many at this unit. The lesson was clear: *if you want to understand what's going on, you have to get out from behind your desk*. For outsiders, 'hanging out' with operational personnel, preferably in operational environments, is critical to effective change. And empathy can be as important as abstract analysis.

In your worlds, how connected are managers and other non-operational specialists with operational staff and the operational environment, where changes ultimately end up? Those who wish to support operational staff through change must take the role of pupil, or apprentice – not master. They must get close to the work to understand how the work works. They must gain an empathic understanding of your world. But for that, they need your welcome.

As John le Carré, a former British MI5 and MI6 agent, wrote in his spy novel *The Honourable Schoolboy*, "A desk is a dangerous place from which to watch the world."

FOUR MODES OF CHANGE: TO, FOR, WITH, BY

Most planned change within the aviation industry is top-down. But it is not the only way, and is not always the best way. In this article, **Cormac Russell** contrasts four different kinds of change: TO, FOR, WITH, and BY. This can be a useful framework to recognise and improve how changes are approached in your organisation.

KEY POINTS

- **Four modes of change are active in any organisation, for safety and other goals. All have their place, but some are more appropriate than others, depending on the change and situation.**
- **The TO mode is when change is done to us, without us. This is the most authoritarian form of change, where change is imposed, often to serve a distant agenda.**
- **The FOR mode is when change is done for us, without us. This is a benevolent form of top-down change, where change is still imposed, but is thought to serve a genuine need,**
- **The WITH mode is when change is done for us, with us. This is a participative form of change, where change is done collaboratively, and is generally recognised as serving a genuine need.**
- **The BY mode is when change is done by us, for us. This is an empowered form of change, where change is done by those who do the work, without requiring permission, and serves a genuine need.**

In this article, I reflect on some of my experience in over 35 countries around the world, from communities that are probably like yours to communities in extreme situations, which are facing or want change. What I see from working with groups of people are four modes of change. These modes apply to organisations too, and apply to safety-related changes and more general changes that affect you.

The Four Modes of Change

TO – Change is done to us, without us

This is the most authoritarian form of change, where change is imposed, often to serve a distant agenda. This form of change is often felt as **decided without us to be done to us**. It's a model that typifies top-down, command-and-control management. The change is often seen as unwanted, unnecessary and ill-informed. The TO approach, even when carried out with good intentions, is seen as being heavy-handed and to the benefit of others, meeting resistance and resentment. This approach to change is increasingly questioned, as it is seen as is ill-suited for modern work. Examples of the TO mode of change might include imposed changes to working hours, reporting, imposed shift patterns, or reorganisations that are not seen to benefit staff.

FOR – Change is done for us, without us

This is a benevolent form of top-down change, where change is still imposed, but is thought to serve a genuine need, and may indeed be seen as servicing a genuine need – depending on the effectiveness of change management. This form of change is often felt as **chosen for us then provided for us**. It's a model of change that is sometimes necessary, but when used inappropriately, can result in top-down dependency ("nothing changes around here unless they do it!"), and resources that can be lost at any point in the future. It can also result in imagined needs not being met ("this is not what we wanted!"), resulting in disappointment and disillusionment when change does not occur as imagined ("they always break their promises!"). Examples of the FOR mode of change include changes to software and equipment, building refurbishment, or feedback meetings organised by management.

WITH – Change is done for us, with us

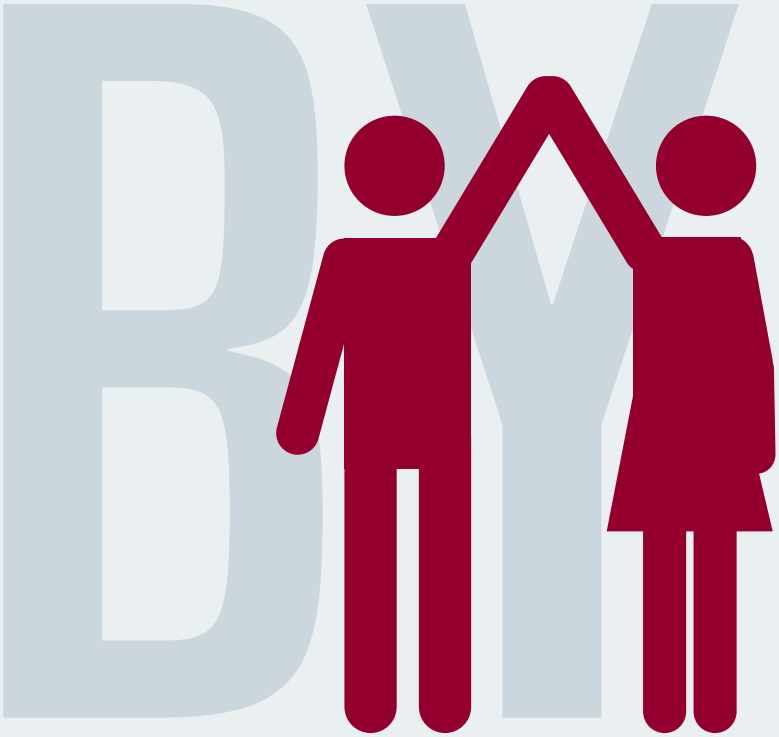
This is a participative form of change, where change is done collaboratively, and is generally recognised as serving a genuine need. The change is still essentially top down, and needs permission from the management, but also involvement from staff. This form of change is often felt as **consulted with us on what to do with us**. This is often the most appropriate model for organisations, and can bridge the gap between management and staff, or between different sections of an organisation. But it can also fail to embed sustainable change unless the participative approach is well-designed and is embedded in the organisational structure and culture. A positive example can be found in the article by István Hegedus on dramatisation of safety investigation in *HindSight* 25.

BY – Change is done by us, for us

This is an empowered form of change, where change is done by those who do the work, without the need for permission, and serves a genuine need. In the BY mode of change, we discover, connect and mobilise assets that are found in and between people, and in places at work. In this mode we realise, develop and spread these strengths. This may involve getting support from the organisation, but is done without formal permission or 'sign off'. This form of change may need an 'animator' or 'alongsider' to offer help or facilitation. This form of change is often felt as **done by us, for us**. This mode of change tends to work out from the small and local level, and tends to involve relationship-building and specific change-making efforts. Examples can be found in *HindSight* magazine, e.g., the article by Rob Hackett in this issue on theatre hats in healthcare, and the article by Juan Antonio Lombo Moruno on ATC simulation in *HindSight* 27.

For each change effort we plan or encounter, we might ask:

1. Which mode of change is being applied?
2. Is this the appropriate mode for this change?
3. If not, what is the more appropriate mode of change that meets more stakeholder needs and helps to connect and mobilise existing assets, including our own?



"When change is done to people they experience it as violence. When change is done by people they experience as liberation."

While all four modes of change have their place, there is a sequence by which each should be considered:

1. Start with what people can do themselves collectively, without any outside help (BY).
2. Then look at what they can do with a little outside help (WITH).
3. Finally, once these local assets have been fully connected and mobilised, decide collectively on what you want others to do for you (FOR).

In this issue of *HindSight*, we see several examples of top-down change with inadequate bottom-up involvement. Many of these sorts of changes have unintended consequences. Instead of people with relevant expertise and relationships creating change or adapting to change because they are trusted by those that are meant to support them, we sometimes end up with people whose expertise and relationships are ignored, and who are 'done to' or 'done for'. The more you 'do to' or 'do for' people that they can do for themselves, the more you diminish their capacity and 'social capital': the relationships within and between groups that form trust, relatedness, and collective capacity (see *HindSight* 26, Editorial). Rosebeth Moss-Kanter, a professor at Harvard Business School got to the heart of the problem when she said: *"When change is done to people they experience it as violence. When change is done by people they experience as liberation."* Where things must be done TO people, the principle of free, prior, informed consent should normally apply.

The reason for this sequence is to reduce inappropriate dependency on management or outside agencies for changes that could be better done more locally. Here is an example. I recently co-facilitated a series of small group conversations in ATM. One example of desired change was for people to be more friendly with each other at work.

- A BY approach might be for people to form informal associations at work (e.g., around sport, hobbies), and to organise coffee mornings, to send fewer emails and walk to see people instead, to organise barbeques, etc.
- A WITH approach might be a joint approach with management to find ways to connect, formally and informally (e.g., on project teams, organised coffee mornings).
- A FOR approach might be a behaviour change or campaign or 'nudge' by an organisation (e.g., aiming to smile more, to meet people more), or an away day.
- A TO approach might be a structural reorganisation and changes to offices.

The order of considering each mode of change is important. When we start with change done FOR or TO people, as often is the case, we preclude people's individual and collective power, and therefore choose autocratic or technocratic solutions over democratic and community solutions.

Toward WITH and BY

So how can we look to move more from the TO and FOR modes of change, toward WITH and BY? The WITH mode is sometimes called 'co-design' and 'co-production'. The BY mode is sometimes, in natural communities, known as ABCD, or Asset-Based Community Development. ABCD has a number of principles, adapted below to better translate to change in organisations:

- We cannot know what a community needs until they first know what they have.
- Every community has more gifts, skills, talents and resources than any one person or organisation can know, and these are easily disabled by professional intervention.
- These gifts, skills, talents and resources need to be identified, brought together and converted into change by the community.
- Top down change should do no harm to the first three principles, and ideally conforms to them.
- Taken in the round, ABCD calls for a shift towards a capacity-oriented approach to change where people are not viewed as passive recipients of change, but as producers or co-producers of change.

The BY mode is sometimes the least familiar in organisations, when we become dependent on others 'high up' to create change that we could sometimes create for ourselves, especially when it comes to the bedrock of all technical and operational change: relationships!

Based on more than 20 years of working with local communities and seeing how change happens for the better with people, here are a few ideas that might work for you:

1. Connect informally (e.g., via existing groups and associations) to help build social bonds within groups and bridges between groups. Change is easier with good relationships established.
2. Discover and connect the gifts, skills and passions that exist within your colleagues, within and (especially) outside of your own department. Discover also the assets within the organisation (usable spaces, rooms, chairs, white boards, means of communicating, etc).
3. Recruit an animator or facilitator to help host and bring about conversations and change efforts.
4. Host conversations to discover what people care about enough to act on, and the assets they require to address shared priorities.
5. Build connections through social interaction, especially face to face.
6. Develop a shared vision.
7. Implement the change together.
8. Celebrate your achievements.

Expanding the BY space

To expand the BY space – and create the possibility for more bottom up change – I offer the following questions to you and your colleagues to ask yourselves:

- *What would you love to do if three of your colleagues were willing to help?*
- *What do we care about enough to take action on?*
- *What are the things that we can do – or should do – to create change?*
- *What would it take to get others involved?*
- *What are the things that we can lead and achieve with the support of management or others?*
- *What gifts (things you were born with), skills (things you have practiced/ learned to do), passions (things you care about and are acting on or want to act on) could we tap into to address and realise our dreams, or address the concerns we have?*

Specifically for organisational management and leaders:

- *What will we do, stop doing, or not do, that will help to discover and enlarge free space, which can be used for change by staff?*

I don't offer these reflections as a how to guide, but rather as a 'how others have tried and are still figuring out' guide. It may be that in their efforts you might find the inspiration to see, understand, and do what you and your colleagues can and should do.

Cormac Russell is Managing Director of Nurture Development (www.nurturedevelopment.org) and a faculty member of the Asset-Based Community Development (ABCD) Institute at DePaul University, Chicago. He is the Director of ABCD in Europe. He is the author of 'Asset Based Community Development (ABCD): Looking Back to Look Forward' and the forthcoming book 'Rekindling Community: Democracy Redefined'. **cormac@nurturedevelopment.org**

Listen to a podcast interview 'Learning from Communities: A Conversation with Cormac Russell', by Steven Shorrock, and read the entire transcript, at http://bit.ly/HSCormac (58 mins). A short edited version of the interview is in HindSight 26. Watch Cormac Russell'sTEDx talk on 'Sustainable community development: from what's wrong to what's strong' at http://bit.ly/RussellTEDx.

MODE-SWITCHING IN AIR TRAFFIC CONTROL

In striving for a more efficient, resilient and safe operation, we continuously develop new ATC tools, procedures and airspace. Operational staff are required to switch between new procedures and different technologies, during testing, in the simulator, and with live traffic. In this article, **Zsófi Berkes** and **Miguel Aulet** describe how NATS deals with mode-switching.

KEY POINTS

- **Mode switching, and mode confusion are not commonly associated with air traffic control, but are increasingly becoming issues of interest.**
- **There are two types of mode-switching: change-related and in-service. Both happen when an operator uses more than one mental model to perform the same task.**
- **There are a number of risks and factors that affect mode-switching.**
- **Mitigations for mode switching include design and changing practice to accommodate effective mode-switching.**

Imagine you are the first officer on a Boeing 737-700. You first flew the 737-500 as a first officer. The pilot in command has left the cockpit and is requesting to return. You confirm on your screen that it is indeed the captain attempting to enter, reach out your left hand and operate the door lock control.

Mode-switching has been a known issue for some time for pilots with multiple type ratings, but it is not commonly associated with air traffic control. But this is changing.

It's not working, you get frustrated, so you do the obvious thing in this situation: you repeatedly operate the same button, but nothing appears to be happening. What you don't immediately realise is that you have just turned the aircraft upside down and the aircraft will have lost 6,300ft before you recover it. The investigators establish that you operated the rudder trim control instead of the door lock control. They also establish that the rudder trim control of the aircraft you were flying (737-700) was similar to the door lock control of the first aircraft you have flown (737-500) in its positioning, shape, size, and operability. This is thought to have led you to confuse the two switches.

What you have experienced is mode confusion and as you may have guessed, this was a real-life example. The same sort of thing happens in everyday life. You may have had experience of moving from a country where you drive on the right to another where you drive on the left, or vice versa. Or perhaps you have tried to use different key combinations or shortcuts on an unfamiliar computer. When you change modes, the same input (or what looks and feels like the same input) will have different results.

What is mode-switching?

Mode-switching has been a known issue for some time for pilots with multiple type ratings, but it is not commonly associated with air traffic control. For a long time, the task of a controller was relatively consistent across radar operations, with a radar screen and paper strips setup. But this is changing. In recent years new systems have moved on to electronic strips or trajectory-based (stripless) systems.

At NATS, we refer to mode-switching when an operator uses more than one mental model to perform the same task (with a mental model for each component). This can happen when an operator is required to perform the same or a similar task using different technical systems, operating environments, airspace, procedures, etc., and transitions are required between these.
In recent years, we have been managing an unprecedented rate and scale of change in our business. We have been continuously introducing airspace changes (e.g., systemised airspace) and increasingly automated technology (e.g., our trajectory-based system, iTEC). With these changes, we are creating more frequent mode-switching situations. At Prestwick Centre in Scotland, a number of controllers operate both our electronic flight data (EFD) system with electronic strips on lower level sectors as well as iTEC with medium term conflict detection (MTCD) functionality to control upper airspace. We have identified that switching

between these two systems may lead to mode-switching errors.

We consider two types of mode-switching: change-related and in-service.

- **Change-related mode-switching** takes place as we develop new tools, procedures, or airspace. Controllers operate a new tool (e.g., electronic strips) or new airspace in the simulator, and then afterwards have to plug back in the ops room on live traffic, operating the current tool (e.g., paper strips) or existing airspace.
- **In-service mode-switching** occurs when controllers switch between systems (e.g., electronic flight strip to trajectory-based systems) in live operations. It also happens when controllers switch between sectors or roles (tactical/executive or planning controller, or combined tactical and planner).

There are a number of factors that affect mode-switching performance. One of these is the similarity of technical systems, procedures, airspace, etc.

So what is the risk and how can we manage it?

One factor is awareness of mode-switching and related errors. For example, we have been in situations where we asked controllers whether they had ever experienced mode-switching issues and their reply was: *"Of course not! The two systems are completely different."* However, when we asked them if they had ever tried to use the mouse in the 'iTEC way' whilst operating the other system, almost everyone said *"yes"*. People regularly make small mistakes and they might not even be aware that some of these are due to mode-switching.

We design systems to be forgiving so that small errors are easy to correct and recover from. A wrong click should be recoverable and shouldn't cause a surge in workload or any other unsafe outcome. But small errors, whether due to mode-switching or something else, can lead to undesirable outcomes.

It's not just mouse clicks that are different between systems. Cognitive tasks and workflows are different too. Our iTEC trajectory-based system presents controllers with predicted conflicts that they have to resolve, whereas on the EFD electronic flight data system, controllers must proactively spot conflictions by scanning strips and radar. Therefore, a controller moving from one system to the other must adapt their mental model.

A potential risk could arise when the controller goes from a more automated to a less automated system. Here's an example of what could happen: John has just unplugged from iTEC where the system provided conflict detection. He now plugs in on EFD. It's been a couple of days since he last controlled on EFD. For a few seconds, he sits there waiting for an alert to pop up telling him about a conflict. Suddenly, he realises that he is on EFD and it's him who needs to do the conflict detection as automated conflict detection support tools are not available. Nothing bad happened. He caught it in time. But he was annoyed at himself.

To understand the mode-switching risk, we start with highlighting the differences between the two systems and examining the worst-case scenario when switching in either direction. This helps us understand if there are any risks. If we identify a hazard, we can conduct a formal risk assessment.

Our aim is to agree on a course of action to manage any risk. We frequently create checklists that highlight the differences in human-machine interfaces (HMIs), procedures, or functionality. These aim to help the controller get into the

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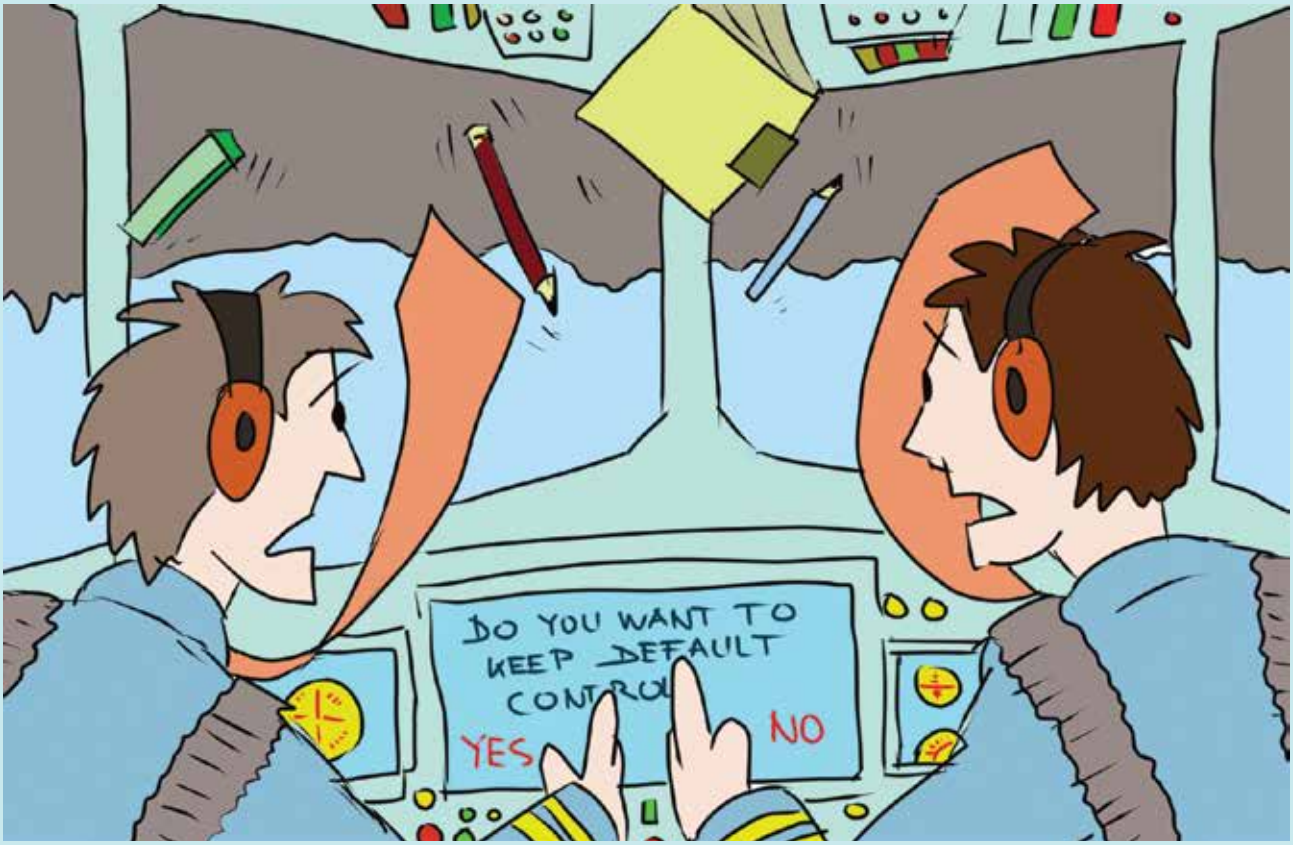

right mental model before plugging in. Other mitigations we have put in place include limiting the amount of switching and introducing mandatory breaks between switches. Our aim is to limit the exposure to mode-switching errors, but we always try to introduce tailored solutions that we continuously update. We also do not want to hinder the operation by imposing unnecessary constraints.

What affects our mode-switching performance?

There are a number of factors that affect mode-switching performance. One of these is the similarity of technical systems, procedures, airspace, etc. Having just spent a day on the simulator testing a small change in procedure for a specific sector, a controller may forget to switch to the current one when they plug back in during live operation on the same sector.

A potential risk could arise when the controller goes from a more automated to a less automated system.

Currency and recency play a role as well. If a controller has spent the majority of the previous week or month working on only one of the systems and then has to control on the other one, they may report that they feel 'rusty' on the other system, and we find that mode-switching errors tend to increase. Then there's fatigue; a fatigued person is more likely to make mistakes. Various other factors – controller competency, experience, current task load, type of sector, traffic complexity – can affect our ability to cope with mode-switching. It's not always clear cut when and why mode-switching errors happen.

Mode-switching in ATC – final considerations

Whenever mode-switching is required, one key focus is awareness and changing practice. We teach controllers about mode-switching so they can incorporate techniques to minimise related errors – for example by getting into the right mind-set when taking over a sector using a different system. And, similar to unsafe procedures being reported and improved or eliminated, mode-switching issues can be reported through our reporting system.

In the same way that our ATC manuals don't prescribe for every eventuality, we cannot predict or design out every issue that operational staff may encounter. So we need collaboration between controllers and everyone else involved in designing for safety to gain insight and develop effective mitigations.

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Table 1: Examples of mode switching errors and mitigations

Example of mode-switching error	Possible mitigation(s)
The same mouse is used for all the systems, but the buttons perform different actions. *"I clicked right button on an aircraft expecting a vector line and instead a menu appeared."* *"I inadvertently changed the range while trying to rotate a label."*	System design allows for quick/ easy recovery of errors *"I clicked the menu away and remembered to use the middle button to get the vector line."*
"I went from plugging in with the 'automated' system to the 'manual' one... I found myself waiting for a system prompt to show a conflict, to then realise I had to actively spot them."	Consult aide-memoire prior to plugging in; training.
"I spent half of my shift testing the new procedure in the simulator. . . When I plugged in to control live traffic I mistakenly used the procedure I had been testing... and had an embarrassing phone conversation apologising to the approach controller."	Introduce a break before switching.
"Lately I have been using the new kit a lot and it's been weeks since I used the old equipment. . . I have asked for a support controller as an extra pair of eyes for a few minutes because I wasn't confident I was up to speed."	Raise awareness and create a culture where controllers recognise the issues and feel comfortable making this call.
"I had to go from a 'low-level' sector with a small range where lateral separation is about 3cm on the screen, to a 'high-level' sector where the same separation is about 2cm. . . I got worried I may have lost separation between two aircraft on parallel headings when I actually had 8nm between them (when I only needed 5nm)."	Consult aide-memoire prior to plugging in; training.

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NOT SO FAST: RESISTING THE URGE FOR URGENCY

Aviation, and air traffic management in particular, are often cited as conservative, safety-critical industries. But changes in technology, infrastructure, roles, procedures and airspace, are now accelerating. And for some of these changes, there can be a perceived need for this change to be implemented urgently. **Mark Hughes** explores the effects of the urge for urgency.

KEY POINTS

- **Creating urgency has become synonymous with leading change.**
- **The need to create a sense of urgency may be problematic, with implications for changing practice, and more generally for individuals, teams, facilities, and organisations.**
- **Small steps can be taken to control the urgency instinct.**

Creating urgency has become synonymous with leading change to the detriment of individuals, organisations, and societies. The more leaders create artificial crises, the less we trust and engage with our leaders and the less effective their change leadership becomes.

The sense of urgency on a major organisational change was famously likened to a burning platform (Conner, 1998). Subsequently, the question has frequently been asked: what's the burning platform? Conner (1998) recounts learning about the burning platform through television coverage of an explosion and fire on an oil-drilling platform. Whilst 166 crew members, and 2 rescuers lost their lives, there were survivors. Andy jumped 150 feet in the middle of the night into a sea of burning oil and debris. He subsequently commented that "it was either jump or fry". We will all be confronted with situations requiring urgency, though rarely so dramatic. Thankfully the urgency required when confronted with an explosion and a fire was not typical for oil exploration companies. It is likely that many of their successes were by-products of patient research undertaken over many years, rather than taking 'jump or fry' gambles on different oil exploration sites. In this article, I argue that the need to create a sense of urgency has been overemphasised in accounts of leading change and that the urgency instinct may be problematic, with implications for changing practice.

Why the urgency?

Kotter (2008) devoted a book to change leaders creating this sense of urgency. The idea or urgency was the third of Kotter's (1996, 2012) eight leading change steps.

While Andy jumped from the burning platform because it was a case of 'jump or fry', Kotter (1996) appears to pre-empt the fire, with the change leader encouraged to engineer a sense of urgency so that the 'building seems to be on fire'. Kotter (1996, p. 44) offered many tips on raising urgency levels, such as "create a crisis by allowing a financial loss, exposing managers to major weaknesses regarding competitors, or allowing errors to blow up instead of being corrected at the last minute". Leading change in such an ethically problematic way is likely to result in trust between leaders and

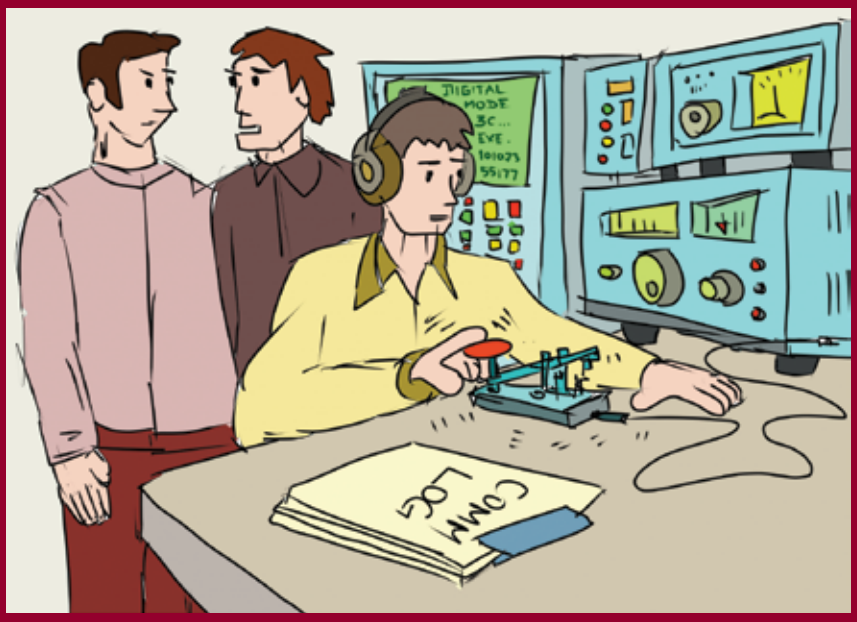
subordinates being lost. The urgency instinct can be appealing as it appears to invest power in the change leader over subordinates, but at what cost to individuals, organisations and societies?

Why is change urgency problematic?

In his book *Factfulness,* Hans Rosling (2018) was concerned with global risks such as global pandemics, financial collapse, world war, climate change and extreme poverty. He highlighted eleven problematic instincts when dealing with these risks. One of these was the urgency instinct. He uses very human examples to demonstrate how the urgency instinct can have tragic human consequences. He would have agreed with Andy's 'jump or fry' instinct. He would not have favoured Andy applying this instinct to all scenarios or change leaders modeling their leadership around such an instinct.

> "When we are afraid and under time pressure and thinking of worst-case scenarios, we tend to make really stupid decisions. Our ability to think analytically can be overwhelmed by an urge to make quick decisions and take immediate action." (Rosling, 2018, p. 226)

Rosling (2018) sees the either/or act or don't act as too simplistic. He warns that framing everything in terms of creating a sense of urgency drains credibility and trust with such constant alarms numbing us to when real urgency is required. He warns that "when people tell me we must act now, it makes me hesitate. In most cases, they are just trying to stop me thinking clearly" (p. 228).



"We'll move to digital communication eventually, but let's not rush the process."

We must not be seduced by a form of change leadership which emphasises being strong, with the Just Do It (JDI) mantra.

What can we do practically to control the urgency instinct?

Burning platforms and creating urgency have become interwoven with how to lead change with no appreciation of the diversity of change approaches and contexts. Urgency strengthens the hand of individual leaders to force through change, but can be detrimental to individuals, teams, facilities, and organisations.

Rosling (2018) offers four small steps in controlling the urgency instinct. These steps may be applied by anyone affected by or leading change.

1. **Take a breath.** Ask for more time and more information. It is rarely now or never and it is rarely either/or.
2. **Insist on the data.** If something is urgent and important, it should be measured with only relevant and accurate data. This data may concern safety, human performance, operability, competency, etc.
3. **Be wary of predictions.** Any prediction about the future is uncertain. Insist on a full range of scenarios, never just the best or worst case. Ask how often such predictions have been right before.
4. **Be wary of drastic action.** Step-by-step practical improvements, and evaluation of impact, are usually less dramatic but more effective.

In organisational change terms, this is more about an evolution, rather than a revolution. This does not negate the need for decisive and prompt action when a real crisis occurs, but creating artificial crises *urgently* needs to be challenged, especially where there are safety-related implications that may not be obvious.

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HOW NOT TO PERFORM A RUNWAY CHANGE

Front-line staff are the experts in their own work, and have expertise in the tools that they use. But sometimes, operational procedures are changed without appropriate input from operational staff. These changes can result from gaps between work-as-imagined and work-as-done, and can widen the gap when it is assumed that the procedure is working well. In this article, **Alexander Schwaßmann** provides a short example that operational readers may well relate to.

KEY POINTS

- **Before changing a procedure, management should understand if there is really a problem.**
- **When introducing a procedure, test the procedure, monitor any side effects after it has gone live, and provide proper training.**
- **Controllers should not simply disregard a procedure because it apparently makes no sense. You might not know the whole story behind it.**
- **Be sure to raise concerns before a new procedure goes live. Document any problems with a new procedure so that management knows that amendments are needed.**

The following occurred at a European aerodrome sometime in the last millennium. For years, ATCOs had orchestrated a runway change in a very safe and efficient manner. The aerodrome controller would coordinate with the airport authority and approach control that a runway change was to be conducted. All parties would agree on the exact time, and the approach controller would coordinate with the CNS service about when to switch the ILS to the opposite direction. This had worked for years without any serious incident and minimum delays for the airlines.

Then the management introduced a new ops order with respect to runway changes. From now on, it would be the approach supervisor who would handle the runway change. Tower would inform the supervisor that a runway change was necessary. The supervisor in turn would coordinate with all parties concerned and effect the runway change.

The tower and approach controllers looked at the new ops order, decided it was not necessary, and continued to change runways without involving the supervisor, and without any issues. Management in turn believed that they had satisfactorily solved a problem. That nobody else had identified a problem to start with did not seem to matter. And because nobody used the new procedure, no problems were reported. But in fact, work-as-imagined was now different from work-as-done. This meant that if anything went wrong, the ATCO would be at fault for not following the new procedure.

One day, the controller-in-charge at the tower decided that this state could not continue, and decided to resolve the issue by putting the new procedure to the test. He called the approach supervisor of the day and told him a runway change was necessary. The supervisor was taken by surprise because that request was new for him. Although he was dimly aware that a new procedure had been introduced some time back, he had not received any training for it, and because it had never been used before, he had no experience with applying it. So, recollecting what little remembered from reading the procedure a couple

The tower and approach controllers looked at the new ops order, decided it was not necessary, and continued to change runways without involving the supervisor, and without any issues.

of months ago, he phoned the CNS service and asked to switch the ILS to the opposite direction. Unfortunately, he forgot to inform the approach controller, who was unpleasantly surprised when suddenly four aircraft on approach reported that they had lost the ILS signal. Puzzled, the approach controller phoned the tower and was duly informed that a runway change was in progress "according to the new procedure".

The TWR, meanwhile, had told all aircraft awaiting start-up and take-off that a runway change was in progress, and that he was waiting for a signal from the supervisor-in-charge that it was completed. The whole process took almost half an hour to sort out, which effectively shut the airport down for that period of time.

The same day, the new procedure was withdrawn and the old one was put back into effect.

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ONE STEP AT A TIME…

Change may involve taking away rules and giving back the power to workers to decide how the work works, letting them create the change by themselves, one step at a time, as **Sebastian Daeunert** describes.

KEY POINTS

- **People react differently to changes and at different speeds.**
- **If you want to implement change you have to find solutions with and for those affected.**
- **Constantly monitor the adaptation and adapt it again.**
- **Sometimes changes can only be made step-by-step.**
- **Adaptation has to be integrated into the working culture.**

The only constant in ATC is change. The problem is, that air traffic controllers are a conservative lot, looking at every change with a suspicious eye. The stakes are high and the question is this: *Does it affect my ability to handle traffic safely?*

Change may affect proficiency or the ability to react quickly and correctly to challenging situations. So implementing changes is a difficult task, often meeting opposition, and adapting to changes is scary. Still, controllers do it every day without realising it. Every situation they meet requires small adaptations to respond to the dynamic situation. This is the core ability of an air traffic controller and the reason why things work. We call it flexibility.

> I soon realised that people adapt to change at different speeds. Everyone has their own experience, their own views, expectations, needs, and even fears. This dictates the speed at which changes are accepted as 'safe' or 'good'.

At my airport (Frankfurt Main) we started some years ago to introduce a stronger focus on human factors. We started to try to understand differences between work-as-done and work-as-imagined (see *HindSight* 25). We tried to listen to controllers about how they work. This demanded a cultural change not just with our controllers but also with our management. I thought the easy part would be the controllers, as all this was done to make things easier for them and to have their ideas and adaptations put into something they are allowed to work 'legally'.

A major change arrives

One of the major achievements was allowing controllers to work two runways from one working position if traffic allows, instead of one controller working one runway all the time. The advantage is that complexity is greatly reduced. There is less coordination and aircraft no longer have to wait in front of the runway of the other controller for crossing and change the frequency to that working position – a source of constant irritation with pilots.

Some controllers had long carried out the working method 'illegally', so the time was here to talk about it, and if possible 'legalise' it in a way that was safe. After a safety assessment and a look into the regulations and procedures, it turned out that a runway cannot be delegated but the traffic can. We involved controllers in the discussions, creating a trial period for the new method.

For me, this was about taking away rules and giving back the power to decide to our ATCOs. In short, to give back an ability we removed by making too many rules over too many years. This created a comfort zone in which to hide but at the same time we were not making use of controllers' expertise and abilities. Many controllers said this new procedure would give them much more work satisfaction.

Of course, a number of controllers were immediately unhappy. They were concerned about the frequency congestion, the workload, and some of their colleagues who might be 'overdoing it'.

Co-designing successful change

As these were safety concerns, it was impossible to ignore them. Workshops were performed where controllers were able to find a mode of operation, which would be okay for both sides. Rather than dictate a change, we let them create the change by themselves.

The key suggestion was that if one person – any person, in the ops room – would say "enough", the positions would be separated again without discussion. Also, after much discussion and concern, a guiding value of a set number of departures with start-up clearance (a number that can be read on the screen) was determined. If this value was exceeded, positions were to be split. This guidance value or limit was something I disliked. Why should a controller not decide what is enough for them?


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In parallel, questionnaires were developed in order to find out if things were going well. They included questions like: *"Were you put under pressure to separate the positions?"* and *"Was there any safety-relevant item during the separation of the positions?"* as well as *"How comfortable did you feel?"*

Small steps help adaptation

I soon realised that people adapt to change at different speeds. Everyone has their own experience, their own views, expectations, needs, and even fears. This dictates the speed at which changes are accepted as 'safe' or 'good'. Constant discussion is needed and we have to develop a culture of accepting changes. If you force people into the comfort zone for too long, it takes a while to take them out again.

I have learned that adapting to smaller changes step-by-step makes it easier than putting out the whole deal at once. Sure enough, the guidance value was never really observed. Already, some controllers were adapting the original adaptation.

A step back

We continued to work on our trial and introduced changes from the questionnaire responses. The person delegating their traffic should fall into a coordinator/support role rather than sit around doing nothing. The guidance value was to be abolished.

At the same time that we were about to make these tweaks, we had an incident where an aircraft approached a taxiway instead of the runway. The trial had been in operation at the time. Immediately, some people were talking about how these 'hot rods' were overdoing it. They had told the controller concerned several times before to split positions but no, the controller would not listen. This was 'proof' that the whole trial was hazardous, and taking away the guidance value was dangerous. I immediately sensed the concern about taking away that sacred guidance value. Why else were so many people suddenly saying the new method was unsafe when for months everyone said it was fine?

During the investigation I found out that exactly three airplanes had been on the frequency, well below the guidance value and what any controller can handle. The trial was in no way connected to the incident. It would have happened anyway. After the investigation had been completed, we reintroduced it again.

Again, it showed the different speeds of adapting to the new method. Things quickly calmed down but there had been a spike, a scare, that stirred emotions.

We are continuing on our way, but we are learning everyday how to make change easier and more acceptable. We are doing many steps to monitor the small changes, the events where the non-standard becomes the standard and trying to learn from these adaptations in order to create something better from them.

Funnily though, turning adaptations that are already in regular use into a new method sometimes makes it hard for people to adapt to their own adaptations!

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THE CURIOUS INCIDENT OF THE RUNWAY INCURSION IN THE NIGHT-TIME

Sometimes after an incident, a system-wide change is implemented that makes work more difficult and creates new problems. This story is one such example, which contains useful lessons for responding to rare events. **Steven Shorrock** recounts the tale.

KEY POINTS

- **When reacting to individual incidents, interventions can present additional unintended consequences that were never foreseen or predicted during traditional safety assessments.**
- **Multiple changes at the same time impact performance in ways that may not be imagined.**
- **When planning a change in practice, speak to a variety of stakeholders, especially front-line practitioners, to understand the work, the context of work, the tools, and the history of the situation that the change seeks to address, and to get their views on possibilities for change.**

This story takes place in a busy dual runway airport, where movements are restricted to daytime hours. Outside of those hours, one runway is kept one open and the other is closed for essential maintenance.

The drivers at the airport had a well-established process that they followed every night when they turned up to work for a night shift. The usual practice was that, on arrival for duty, drivers entered the office and checked a board on the wall for the live status of the runway – open or closed. The driver would then get into the vehicle, perhaps perform some tasks around the airport, and drive over to the runway. At this airport, drivers were required to call tower when approaching a runway for crossing, but not when leaving the apron and entering a taxiway. As drivers approached the runway, they had to contact tower if the runway was open, or contact the airside office if the runway was closed. If a driver were to call the airside office to cross or enter the runway when it was open, the driver would be were told to contact tower.

One night, a driver (Driver 1) approached one of the runways in his vehicle, believing that the runway was closed. During the period that the driver had been out, the runway had reopened for a planned late arrival. While the procedure was to contact the airside office to check before entry, the driver did not do this on this occasion. A runway incursion resulted.

At the time of the runway incursion, another airside vehicle (Driver 2) approached the runway from the opposite direction and saw Driver 1's vehicle cross the runway. Driver 2 called tower to cross the runway, because this driver knew that the runway was open. But Driver 2 had not heard Driver 1 contact ATC on the same frequency, and queried whether Driver 1 had clearance to cross the runway. Driver 2 was informed that Driver 1 did not have clearance.

Driver 1 was suspended pending an investigation. While this could not be confirmed, it was believed that local practice had changed, and that drivers had stopped calling the office due to the number of calls generated and the associated workload. During the period of the runway incursion, there were significantly more runway crossings than usual, and calls were more frequent. But ultimately, the reasons for the runway incursion were never fully understood. Crossing the runway without calling the airside office may have been deliberate, reflecting local practice, or may have been inadvertent – an unintended crossing.

At the time of the runway incursion there were no aircraft movements on the runway, but this was sheer luck. This was, however, the first time that a runway incursion in these circumstances had occurred.

The first intervention

At the time of the incident, there was pressure to reduce runway incursions and ground movement events, which had become tracked metrics and key performance indicators (KPIs). There was an expectation that a certain number of runway incursions per 100,000 movements would not be exceeded. This was also tracked by the airport as a company performance target.

The next day, airside management made a decision. No vehicle was to enter any runway – open or closed – without contacting ATC. The airside office was now out of the loop.
The ANSP put out an instruction to controllers detailing the new protocol. Thereafter, vehicles began to call tower regardless of whether the runway was open or closed. The procedure for drivers was clear.

Aerodrome lighting changes

At the time, another change concerning aerodrome lighting had been imposed upon the airport by the regulator. Two significant changes were therefore made at the same time. This caused confusion for ATCOs, but the airport was committed to the lighting change and the ANSP was instructed by the airport to implement the runway access change.

Stop bar usage

The tower was also required to change the operation of stop bars. The system was based on a timer, so the controller would press one button to extinguish the stop bar to provide a route across the runway and a timer would then illuminate the bar a few seconds later. At the time of the runway incursion, this timer system was inoperative. Controllers therefore had to extinguish the bar, then illuminate it for every vehicle accessing the runway. On a normal evening that would be 30 to 40 crossings a night. But there was still heavy traffic departing and arriving on the active runway. So now controllers had to give a crossing clearance, extinguish the bar, watch the vehicle cross the runway, then illuminate the bar again. This took away focus from the aircraft taking off and landing on the live runway. The tower had never done this apart from in low visibility procedures.

Unintended consequences

Workload was now higher due to increased calls and increased monitoring load. Controller attention was now divided between the active and closed runways, with 30 to 40 driver requests to cross the closed runway. Controllers were also confused about the idea of giving vehicles a clearance to cross a closed runway, and did not know what do with the stop bars on the closed runway.

Everyone did their job according to work-as-prescribed. But as a result, the whole system was in disarray. Several safety reports were submitted.

Adaptation and adjustment

In the intervening period, controllers conducted their own informal hazard analyses within their own teams and made decisions about how to work safely. But there were now three or four systems in place, all acceptable, but each different. This meant that anyone who transferred between those teams faced a different working method.

The second intervention

The Head of ATC observed nighttime operations to understand the impact and issued a condition not to give the runway to the airside office until after the last aircraft movement. The ANSP put out an instruction to controllers detailing the new protocol.

The runway now remained under ATC control until after the last aircraft movement. Controllers could now focus on aircraft landing and taking off. This protected the operation and gave controllers time to think.

The downside to this was that the airside office would not get that runway to work on until about one hour later than it would normally be worked on.

The third intervention

The ANSP and airport now searched for a long-term, collaborative and viable solution. The ANSP started a review process lasting around six months. The final intervention involved individuals from all watches and face-to-face briefings with every controller to get their input. Drivers and controllers met up regularly in workshops, then bringing in airside and ATC managers, feeding upwards a range of options. These were reviewed at all levels to come up with a workable and safe process.

The agreed solution was that when the runway is given away, there is a single agreed entry/exit point, with airside staff briefed accordingly. The red stop bar is extinguished. If a vehicle approaches and the status of the runway has changed since they left the office, the driver will stop at the red bar and call ATC.

The final system satisfied all stakeholders. The airport office received the runway at the same time that they normally would have, and controllers were not distracted from their primary task. There was therefore a balanced consideration of different stakeholder needs. There were no more safety reports.

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SEEING THE NEED FOR CHANGE… FROM THE OUTSIDE

Aviation is a conservative industry and change to working practices is often resisted. **Florence-Marie Jegoux, Ludovic Mieusset** and **Sébastien Follet** describe a case where the need for positive change can be triggered by an outsider, who sees problems more clearly.

KEY POINTS

- **Changing is difficult. It means leaving the comfort of habits.**
- **Outsiders can often see problems that insiders don't see, and can question well-established practices in a way that insiders find more difficult.**
- **Given this outsider insight, front-line staff can co-design work, going back and forth between work-as-imagined, work-as-prescribed, and work-as-done.**

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In one control tower, there are some common practices, rules and work methods regarding the paper strip board. Each plane has its own strip, including some of the flight plan information. Strips are laid out on a specific board in a specific order to help the controller to represent mentally the situation. It helps the controller to detect conflicts, and to keep the situation in mind even if he or she loses the sight of airplanes. Thanks to this tool and its associated work method, controllers keep a mental picture of the traffic, especially when the fog comes in or in case of a radar failure.

But in this control tower, there used to be a very specific practice regarding the use of the paper strip board. It was considered that the runway is a bay in the middle of the board, without any form of coloured distinction. Traffic are sorted by type of flow; expected or leaving traffic above the runway bay, traffic on frequency below, traffic on the ground and waiting at the holding point next to the runway bay. This method, unique in ATC towers, was used for years. No incidents related to this practice were reported. It was taught to new controllers with success for years.

This method was, one day, unexpectedly challenged by a trainee. It turned out that some felt that the method was too complicated, requiring great flexibility. But so far, there was no real reason to make the effort to change it. The first hint that a change was needed came after a trainee failed to qualify. One of the reasons the person failed was the lack of a dedicated strip representing the runway. The controllers first rejected these criticisms: this has worked for years and one failure is not representative. However, the growth of the traffic flow and the need to increase the number of qualified controllers questioned the local practices. The trainee had inadvertently triggered a change process.

Therefore, the whole group decided to go back to a blank page and try to imagine new methods. In the same period, the civil aviation authorities released a new set of rules regarding the control board, stating for example that a strip featuring the runway was mandatory. The group of ATCOs and their local manager decided to set up a brand new control board, totally changing their working habits, to comply with the new regulation. To do so, they used two large sheets of paper to draw a draft board. Then, they enacted new basic practices to be able to use it. For the next six months, they met weekly to implement changes either to the board or to the method of use. Finally, the process was successfully applied. In that case, the back and forth motion between work-as-imagined, work-as-prescribed and work-as-done truly led to a successful change. So far, every trainee found the use of the paper board very clear and easy. And no more trainees failed to qualify.

Changing is difficult. It means leaving the comfort of habits. In the example above, it meant controllers leaving a practice they had mastered. They lost the tool that helped them to build their mental picture of the situation for a new one that momentarily made them partly 'visually handicapped'. But they did it. The trainee highlighted the limit of the practice. His experience raised the group's awareness of possible incoming problems (e.g., training difficulties, lack of qualified controllers). These threats were sufficiently important for the group to make them accept the difficulties. They seized the control board problem, debated, tested and enacted a new rule. The work-as-imagined became the new group reference, the new work-as-prescribed. As this was a co-designed rule, it was fully applied and therefore it became the new work-as-done, making this change a model of its kind.

> The trainee saw its design flaws and how it affects performance more clearly from an outside perspective. He acted as an alarm clock for the group, pulling the group out of the comfort of the usual practice.

What made the trainee a good trigger for change? If the 'whistle-blower' had been an existing member of the group, he or she would have struggled to challenge the current, well-established practice. The trainee, however, was not yet part of the group. He didn't have the comfort of practice. Therefore, he saw its design flaws and how it affects performance more clearly from an outside perspective. He acted as an alarm clock for the group, pulling the group out of the comfort of the usual practice. But if the story went another way, the failure of a trainee could have easily been attributed to the trainee's competency, and the flawed design could have lived on, affecting future trainees. Sometimes we need to be more receptive to 'outside' perspectives, when others see what we can't, and can trigger positive change.

ARE YOU THINKING ABOUT JIM?

Changes often bring surprises that were never envisaged during the safety assessment process, but that become a practical reality for front-line staff. And with these changes come adaptations that often remain invisible outside of the operational arena, as **Adrian Bednarek** explains.

KEY POINTS

- **Organisations should focus on the change itself, not just on the process of safety assessment of changes.**
- **Quality of communication, including feedback from people at the sharp end, is crucial for safe implementation of change.**
- **Local level adaptations to change can be valuable lessons for an organisation.**

It was big and red. A big red button in the middle of a console in a small mobile tower, located at one of airports which, at that time, handled just a few flights per day – mainly domestic and military flights. The button was connected to few blinking lights inside the tower room, which didn't make any sense to anybody. Controllers loved the button, though, and used it few times a day, as a sort of entertainment device. Every new shift announced their takeover by pushing the button.

Coming back to work after few weeks of vacation can be hard, even for experienced controllers. The first few words spoken to the microphone sound weird. You just forget what you are supposed to say and your work performance isn't something you would be proud of. Additionally, a lot of things change while you're away.

It was Jim's first day after a long break, but it looked like nothing had changed. The mobile tower was in the same spot, the interior was still messy, there was still no air conditioning and it was still unbearably hot inside. Jim looked around and asked his colleagues if anything had changed. They shook their heads, packed their stuff and went home, leaving Jim alone, waiting for the next controller to arrive. To welcome the first shift after holidays, Jim smiled and punched the red button. To his surprise, nothing happened, even when he tried again and again. "Well, either it's broken or someone finally cut this thing off", he thought. A second later the radio came alive as the commander of fire services asked, *"Tower, what's going on? Is it a drill or a real thing happening?"* Jim looked at the red, big button, scratched his head and sighed...

Yes, coming back to work after a break can be hard. In fact, it is wise to assume that during that time some things have changed, even if nobody mentions any differences. It is not so bad if we're dealing with published modifications, like the aeronautical information publication (AIP), but changes can be subtle and unexpected. Very often, information concerning changes is buried in e-mails or somewhere in a self-briefing system. It could be even worse than that. For minor changes introduced at very low levels of organisation, the only source of information is sometimes your colleagues, who somehow became aware of those modifications. At this level, many things are details of the safety management system (SMS).

Safety assessment of change is a part of the SMS that allows us to properly identify hazards and to set proper safety requirements to handle risk correctly. It seems like a reasonable approach but, as always, the devil is in the detail.

First of all, what do we mean by a change to an ATM functional system? Is connecting a red button in a mobile tower to alert fire and rescue such a change? Perhaps. Is changing the identification number of a controller working position such a change? Perhaps not, but it turns out that it can have a serious, while totally unexpected, impact on the system, causing chaos in ATC sectors in remote parts of the flight information region (FIR). Sometimes, hindsight is the only tool available to successfully assess those

modifications, which means that safety assessment is triggered by occurrence investigation after the fact.

To make things worse, in many industries the safety assessment process has itself become so needlessly overcomplicated that it moves the focus away from the change itself. The most obvious symptom of this is the use of a quantitative approach during the assessment, which in many cases is based more on guesswork than on a scientific method. Nancy Leveson, professor of aeronautics and astronautics, points out the flaws of such an approach, with a conclusion that more focus should be put on figuring out how to make good decisions based only on qualitative analysis.

The most important and the most obvious step would be to include people actually affected by a change in the assessment process (see EUROCONTROL, 2014). They will be the most important element of the change implementation. People like Jim deal with changes at the sharp end and often feel lost or confused. Despite changes being introduced without adequate involvement, they are supposed to do their job, even when everything around goes wrong.

For front line specialists, information and our ability to apply that information to every day job, are crucial. What does it look like at your organisation? Are you familiar with the process of introducing changes at your organisation? Is there a procedure to follow? Is it being followed? Is it effective when followed?

Communicating is always a two-way street. It is not just about feeding employees with information. Finding a way to collect feedback and ideas of people about their work is one of the most important steps when creating a learning culture in a company, which is a huge advantage for effectiveness and quality of service.

Such feedback is a valuable source of information about hazards or performance limitations introduced by a change, which had never been considered by a project team or safety department. A simple example of this is new handsets for Voice Communication Systems (VCS), with a spiral cord so thick that it could trigger a push-to-talk button when the handset was put down over the cord in one specific way. When that happened, controllers ended up with a blocked frequency and an open microphone, picking up everything what was said in the ops room. After some time, it was noticeable that people who experienced such an occurrence were putting the handset away in a different, more secure way. Such information on adaptations in work-as-done is (or should be) valuable for people in safety or procurement departments, and it would be wise to spread such information to everybody using new handsets. Unfortunately, organisations rarely seem to have an effective system of collecting information other than occurrence reports. It often remains word of mouth, within a group of people.

Direct feedback is not the only information you could get from people at the sharp end. Properly prepared and conducted observations are a good way to see how people adapt to a change under different working conditions.

Those adaptations are usually just minor adjustments but they highlight issues that are hard or impossible to predict during formal assessments of change. New touchscreens can be so much less sensitive than ones previously used that people start using pencils or their own fingernails to operate them. New VCS can behave differently during simultaneous radio transmissions made by controllers and incoming phone calls. Let's say that the old system muted the ringer while the new one does not. This change was not identified at any stage of the project, but became a serious issue for controllers when the actual system was acquired. At a local level the solution could be to increase the delay between subsequent ringtones, which would solve the problem for controllers, but not for the organisation. Without collecting information regarding such adaptations, the same problems are created over and over again. This is happening right now in most organisations.

I am still wondering if any person who was connecting Jim's big red button to the fire station was even aware how controllers used it? Was anybody listening to the users? Was there anybody thinking about Jim coming back from his vacation?

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H-DAY: A SUCCESS STORY FROM 50 YEARS AGO

Major changes often bring unintended consequences, but there are examples of success. In this article, **Anders Ellerstrand** describes one such change in Sweden over 50 years ago and compares that with a major ATC system change. There are some basic but important lessons for how we manage major changes.

KEY POINTS

- **Successful change requires thorough preparation and coordination.**
- **There must be people to bring about successful change, with extra staff during the implementation phase.**
- **Excellent information and training are needed.**
- **It may be necessary to reduce demand on the system during and for some time after implementation.**
- **We can and should learn from successes, and we need to spend some time doing so.**

Figure 1: H-Day logo

This is a story about a very big change that happened more than 50 years ago in Europe and had the potential of becoming a carnage but instead was a success. I was there, right in the middle of it, as it happened.

Since I was only six years old then, I was in the back seat of my father's car. He was delivering morning newspapers and had special permission to drive that very early Sunday morning, 3 September 1967. This was the day that Sweden went from driving on the left side of the road to driving on the right side. Since 'right' in Swedish is 'höger', it was known as the H-Day.

In 1718, the Swedish king had tried to do the same, but in 1734 we were again on the left side. With all neighbours on right, there was a pressure and there was even a referendum in 1955. But fearing a carnage on the Swedish roads, 83% of voters said 'no'. Several years of international pressure followed and in 1963 the parliament finally said 'yes' (but only for roads, Swedish trains and subways are still on the left side).

The main responsibility for the change was given to Olof Palme, then the Minister of Communication. The main objection against the project was safety, with years of increased fatalities expected. To mitigate the negative effects, meticulous planning was needed and a special commission was organised. Financing came from a special tax on vehicles, in place from 1967 until 1970.

One of the main tasks for the commission was information and the campaign is possibly the most ambitious in Swedish history. The goal was to reach 90% of the population through media (in those days newspapers, radio and TV). There were home visits to elderly, sick, lonely and handicapped people. Information materials were developed for the visually or hearing impaired as well as for different languages. During the last weekend before the change, all major newspapers had full-page ads. TV broadcasted 12 hours of information programs, with 40 hours on radio, in ten different languages.

Roads were rebuilt, and mobile traffic islands and refuges constructed. 360,000 road signs were replaced and another 130,000 signs with 'H-reminders' were put up. Sweden already used cars with the driver sitting on the left side, but buses had to be replaced or rebuilt. During the last 24 hours, 20,000 people were on the roads putting everything in place.

Between 0100 and 0600 hrs only cars with special permission were allowed on the roads. My father was one of them and we had brought a transistor radio. At 0450 we were told to stop the car. We were then told to slowly reposition the car to the right side of the road and at 0500 we were allowed to continue, now driving on the right side of the road! One hour later anyone could try it, and many wanted to, by bike or car.

During the first days, 10,000 police and military staff were on the roads to check and assist the transition, and another 100,000 volunteered at 19,000 zebra crossings. During the first days, the maximum speed was reduced and then slowly increased during several weeks.

The expected panic and bloodshed did not materialise. The number of killed persons in traffic accidents was even lower than the year before. But this was in Sweden, on the roads and more than 50 years ago. What is the connection to aviation in Europe today?

There are similarities in how we manage big changes today. The biggest change I experienced was when we replaced the old Swedish-built ATM system. It was called ATCAS and was from the early 1980s. In 2005 we went from ATCAS to Thales Eurocat. The change included moving:

- from paper strips to lists and labels
- from manual/voice coordination to silent system-coordination
- from interpreting the strips to find out about routes to having routes shown on the screen, and
- from static flight plans to continuously updated flight plans.

It was a very big change, and, in some ways, you can compare it to the 'H-Day'.

Large resources were invested in information and training for the staff and for other stakeholders, resembling what was done for the Swedish people in 1967. Preparations were needed, just like the work on roads, signs and buses in Sweden 1967. One such adjustment was that in the old system we regularly worked one controller per sector but now it was decided to always work with both planner and executive controllers.

Like the extra staff on Swedish roads and at zebra crossings, the ATC centre had a help desk in the ops room, with experienced specialists available to answer questions and give advice and to hear about unexpected experiences.

From H-Day and some period after, maximum speed in Sweden was reduced for a period. In a similar way, the ATC capacity was reduced from the day of the new system implementation and then slowly increased to normal capacity. This allowed people to grow into the new way of doing things. It also allowed people to take care of the small mistakes that are almost inevitable in the plans and preparations.

My experiences from six years of age and my experience from 44 years of age are of course very different. Still, there are similarities in planning, preparation, resourcing, and coordination. And both changes were successful. Looking back on them shows how much we can learn from what goes well, if only we take the time to do so.

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Figure 2: Kungsgatan, Stockholm, on H-Day, 3 September 1967, during the night Sweden had changed from left-side traffic to right-side traffic

CLOSE ENCOUNTERS OF THE LEGAL KIND: A NEED FOR AIRSPACE CHANGE?

Encounters between visual flight rules and instrument flight rules aircraft in Class E airspace have long been a source of concern in air traffic management. In this article, **Marc Baumgartner** describes three 'legal encounters' with collision risk, suggesting that airspace classification may need to be reorganised, especially to help deal with future threats to safety.

KEY POINTS

- **In Class E airspace, air traffic controllers shall not provide any separation between VFR and IFR traffic, while traffic information shall be provided as far as practicable.**
- **Controllers may work according the rules and yet serious mid-air collision risks remain.**
- **ATC, airspace users and the national supervisory authority do not necessarily share the same risk perception.**
- **New challenges to ATM may force a reconsideration of airspace classification.**

In a European lower airspace, IFR traffic in out of busy regional airports can be problematic where a portion of the arrival and departure routes are in class E airspace. In airspace E, air traffic controllers shall not provide any separation between VFR and IFR traffic. Traffic information shall be provided as far as practicable. There is no obligation for the VFR traffic in airspace E to provide information.

Here are three examples that illustrate why this is a problem.

Table 1: Airspace classes

Class	Controlled	IFR	SVFR	VFR	ATC Clearance	Separation	Traffic information
A	Controlled	Yes	No	No	Required	Provided for all flights	N/A
B	Controlled	Yes	Yes	Yes	Required	Provided for all flights	N/A
C	Controlled	Yes	Yes	Yes	Required	Provided for all IFR/SVFR to IFR/SVFR/VFR	Provided for all VFR
D	Controlled	Yes	Yes	Yes	Required	Provided for IFR/SVFR to other IFR/SVFR	Provided for all IFR and VFR
E	Controlled	Yes	Yes	Yes	Required for IFR and SVFR	Provided for IFR/SVFR to other IFR/SVFR	Provided for all IFR and VFR flights where possible
F	Uncontrolled	Yes	No	Yes	Advisory only	Provided for IFR/SVFR to other IFR/SVFR where possible	Provided where possible if requested
G	Uncontrolled	Yes	No	Yes	Not provided	Not provided	Provided where possible if requested

Case A

A small twin-engine aircraft flies in airspace E at flight level (FL) 90 under IFR Rules and under control with the sector. (Airspace E starts at FL 105 and below.) Approaching the handover point, where the controller transfers the pilot to the approach frequency of the destination airport, the controllers observe a VFR radar return squawking 7000, climbing opposite the IFR traffic. The VFR pilot calls the Flight Information Service, which provides him with a code in order to inform him about the IFR traffic on an opposite track. The air traffic controller informs the IFR pilot about the observed traffic with unknown intention. Several transmissions and coordination between the Flight Information Service and the coordinator of the en-route sector take place. The short-term conflict alert at the en-route sector triggers a visual and an audio alert. In the end, the IFR pilot decides to turn away from the VFR traffic. The air traffic controller is only allowed to give traffic information and cannot give avoiding instructions to the IFR traffic, as the ATCO's instructions could lead to a collision with an unknown traffic. The nearest miss-distance is less than 1NM and a few feet.

Case B

An IFR departure from a regional airport in a mountainous area is announced by the regional airport tower controller by phone to the en-route sector. This coordination is accepted by the en-route sector. A few moments later, a target squawking 7000 is observed at FL125 climbing (at this point Class E airspace goes until FL 145). At first call the Citation Jet (IFR departure) calls on the en-route sector frequency and announces a TCAS descent. But the Citation pilot also has a ground proximity warning, as he is in a valley and decides to avoid the traffic visually. As soon as the aircraft correlates the code and callsign, the short-term conflict alert at the en-route sector triggers an audio and visual alarm. The closest miss distance is less than 1NM and a few hundred feet.

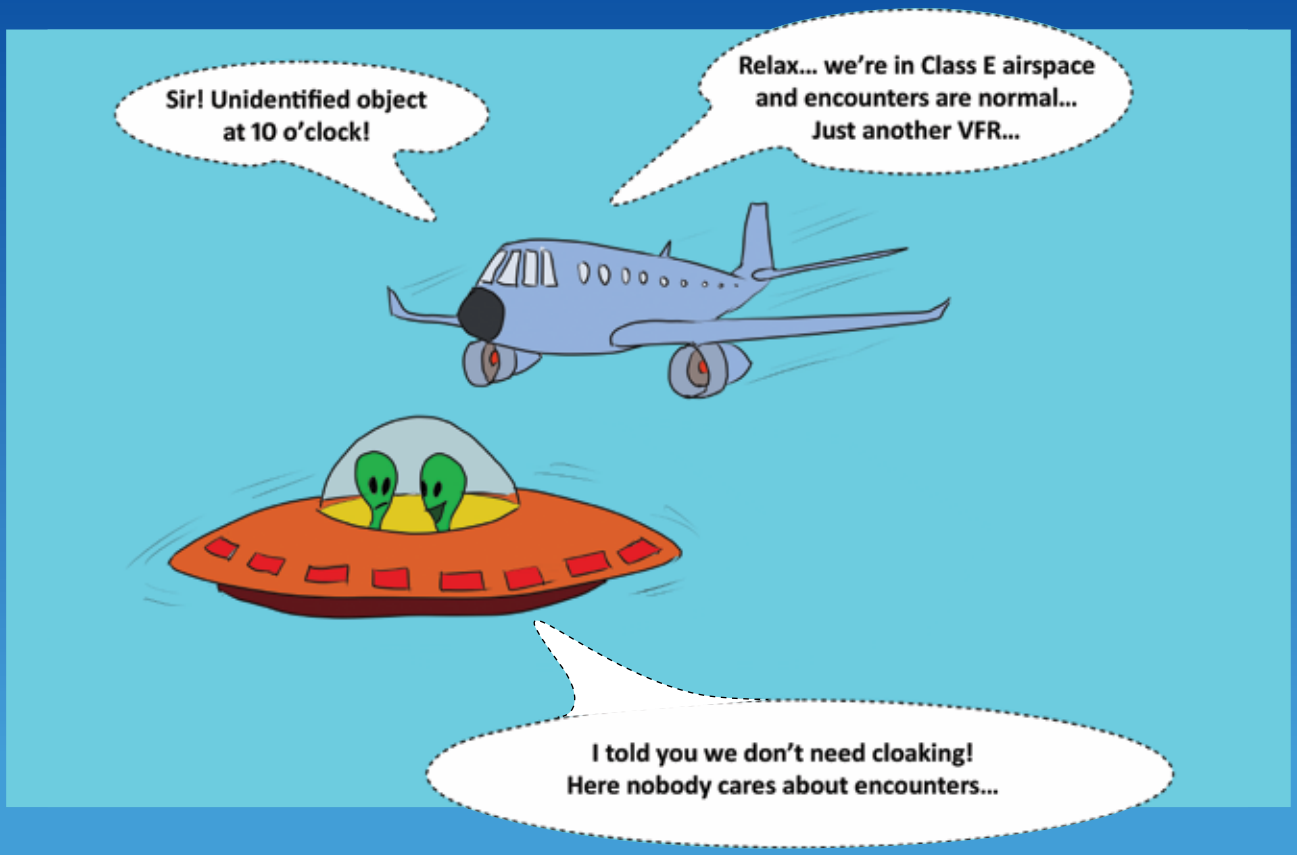
The aviation community lacks sufficient awareness of the services, roles and responsibilities applicable in Class E airspace.

Case C

An IFR aircraft is routing inbound to a regional airport. The pilot reports on the frequency of the approach controller, and files an air safety report as it avoided a glider by a few metres.

All of these encounters are labelled as a 'legal encounter'. Everybody (except the IFR pilot in Case A – by choosing to turn away from the opposite traffic – which saved the day for everybody) has worked according the book and yet in all cases there were serious mid-air collision risks.

The controllers involved in these legal encounters have made reports and have asked for an immediate airspace re-classification or a change in procedure, or both. However, airspace users or the national supervisory authority do not necessarily share this risk perception. On the one hand, the aviation community lacks sufficient awareness of the services, roles and responsibilities applicable in Class E airspace. As one example, surveys have shown that most cockpit crews, operating under IFR, expect that air traffic control is responsible for providing separation with regard to any other traffic. On the other hand, to re-classify an airspace induces changes in perceived



responsibilities and in the perceived degrees of freedom for controllers and pilots. The national supervisory authority is obliged to consider the complete set of stakeholders needs. Consequently, the national supervisory authority has until today not reclassified, but has promised to address these risks in an ongoing aviation infrastructure review project.

This illustrates why it is important to address air traffic management issues in a structured way as the Global ATM Concept of ICAO calls the layer of conflict management. The Global ATM Concept of ICAO explains the three different layers of conflict management.

ICAO Global Air Traffic Management Operational Concept Doc 9854

Conflict management will consist of three layers: strategic conflict management through airspace organization and management, demand and capacity balancing, and traffic synchronization; separation provision; and collision avoidance.

The airspace structure in the described cases is weak as it relies (when taking the ICAO conflict management approach) on the collision avoidance level to solve a problem which cannot be solved at a strategical level, due to political issues around the access to airspace by various users.

The controllers are wary and pay particular attention when clearing IFR aircraft into Class E airspace. Controllers mention to the pilots that they are entering airspace Echo and that they are possibly encountering unknown VFR traffic. From a duty of care point of view, legal encounters may be legally problematic and might be judged as a wilful act. Complicating matters in these specific situations is the fact that the VFR traffic are squawking 7000. This makes them potentially visible, though suppressed by the radar processor in order to avoid cluttering of the radar picture, and not necessarily in contact with the controllers.

So the problem and the need for change has been identified, but how will it be resolved? While the described problem is based on a local experience, the issue of airspace classification has been known for decades as a thorny issue, in particular with the opening up of new regional airports and the feeder routes into these airports. Addressing the issue at national level would provide some space to breathe for ATCOs in the described cases. But reopening the work carried out at ECAC level a decade ago on airspace classification may have to be organised soon in order to cope with the new challenges the drone industry will bring to ATM.

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ADAPTING TO SMALL CHANGES

Sometimes it is the little changes that, over time, tend to catch us out. **Julie Baltet** reports on changes in the context of learning and automatic behaviours, with some implications for management to help operational staff to adapt their routines.

KEY POINTS

- **Even a small change requires a learning process and creates new automatic behaviours.**
- **Errors due to these behaviours are difficult to detect.**
- **Stability, time and practice are necessary to integrate even small changes.**

When we think about 'change', we often think about big changes. If you are a controller, during your shift you probably face many small changes, perhaps to airspace, a new aircraft type, an airfield closure, or a new call sign. You adapt every day to small changes, without training. When you face a change, such as a new route map or new system implementation, you know that your routine will be mixed up.

Our routines include well-learned, automatic behaviours. These routines need little attention or conscious awareness. They are like familiar roads in the brain. But changes trigger the need for new roads. With practice, you will have a new road network.

When a new type of aircraft enters your airspace, you are forced to adapt:

- you analyse the data
- you try to understand the data
- you act
- you see the result, and
- you validate your action, or you adapt for next time.

That is a circle of learning. You do this circle many times, enough to create an automatic behavioural routine. In the end, you can predict how the aircraft will react in different situations without thinking much about it. This frees mental resources.

This 'resource-freeing' process that occurs during learning and practice ensures that performance is acceptably efficient, but in return we lose awareness of the process. This makes it difficult to detect problems, including mistakes. As a controller, you find your own ways to avoid and mitigate mistakes in order to work as safely as possible. For instance, particular aircraft may be difficult to monitor, and so you mark or highlight these aircraft. But these adaptations are not fully reliable, and small changes can disrupt our routines and adaptations.

> Small change by small change, you can face a complete reorganisation of your work, but it is not recognised as a complete reorganisation.

In Reims ACC, the procedure for Bern Arrivals has changed a lot in the last 10 years. Each time the descent profile changed, it was seen as a small change, so controllers received a briefing note to explain the change.

In this example, the old route was quite long and made a deviation. With the old route we usually had to provide separation with the slow climbing from Zurich departures. And we usually asked for a direct routeing to the Zurich West sector to help us in this crossing. Our rule became "If Bern Arrival, then ask a direct and send to Zurich West at FL150."

A final change occurred in 2018. We were sending these arrivals to Zurich ACC at FL150 but we now send them to Basel Approach. It did not look like a big change because the transfer level remained FL150 and the route was slightly displaced west. With only a briefing note, and no real explanation of the change for Basel approach and Zurich, we continued to descend Bern arrivals to FL 150 between HR and LUMEL.

In ten years, there were five minor changes.

Unfortunately, some hazardous coordinations occurred due to lack of understanding. We finally understood that the problem was that Basel Approach had to cross these arrivals with their own departures and then send Bern arrivals at FL90 to Bern Approach.

So a new circle of learning had to be launched. Now we have to descend Bern arrivals earlier, which means there is no problem with slow climbing from Zurich. But this means a new crossing in the upper sector. Bern arrivals now interact with Strasbourg and Basel descents from other Reims' sectors. We have to learn a new descent profile again. ▶▶

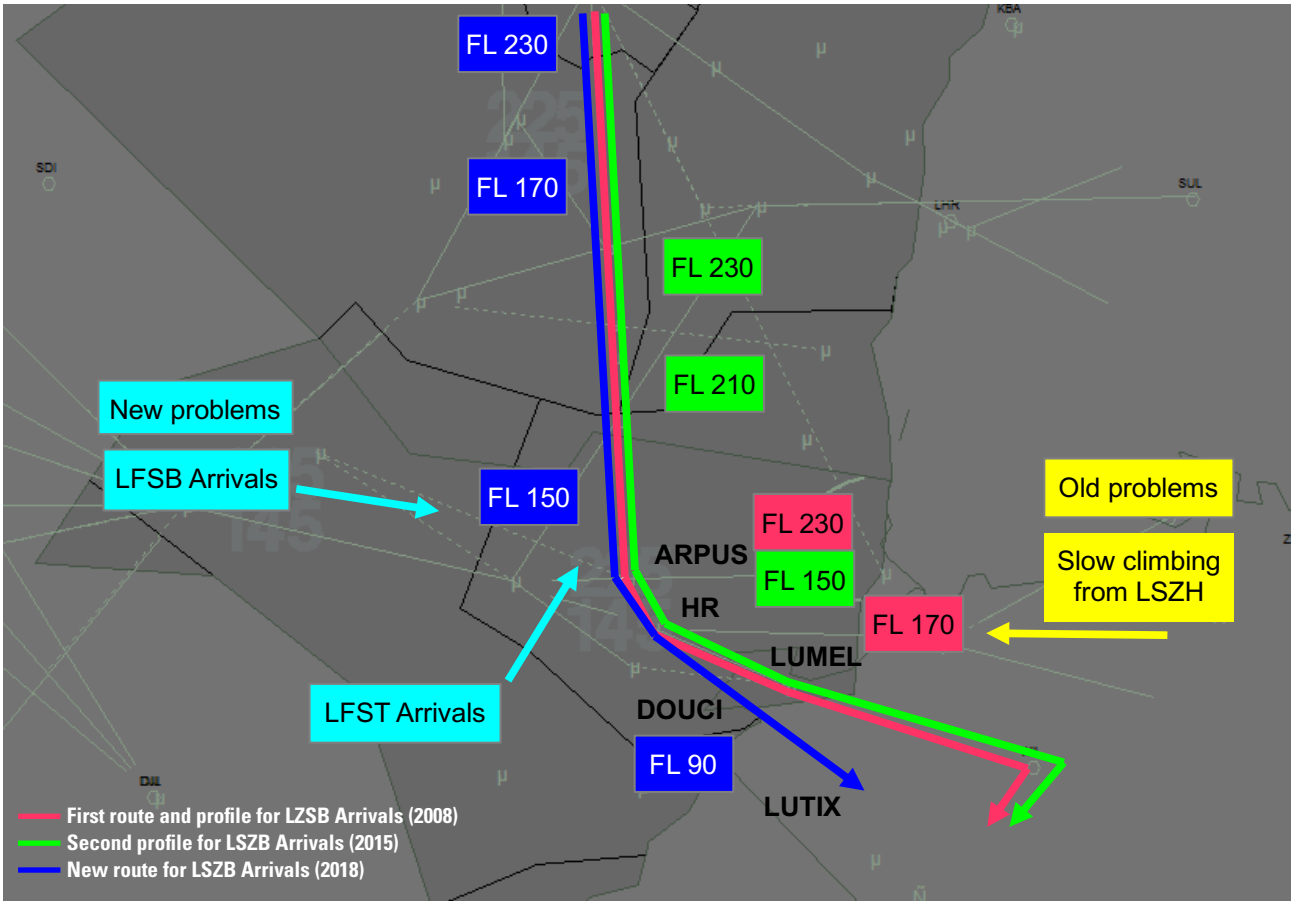

Figure 1: New route for LSZB arrivals

If you are a controller, during your shift you probably face many small changes, perhaps to airspace, a new aircraft type, an airfield closure, or a new call sign.

A small change became a complete reorganisation in our list of rules created by descent profiles.

Not to be entangled by small changes requires awareness of the situation, but it is not as easy as it seems. We can easily drift with the flow of change and two things can happen: 1) old automatic routines can pop up again, without consciousness; 2) new routines become automatic, they are monitored less with practice, and so mistakes become harder to detect. For that you have to force yourself to take a step back and analyse the process. When you are a trainee, your instructor helps you through this process. Now as an ATCO, alone in front of your traffic, you have no time for that.

For the Bern arrivals example, Basel approach helped us to detect a problem: they complained to the SE sector because they needed Bern arrivals below their own arrivals, which made us understand the real change in skill adaptation and learning was for the upper sector.

ATCOs and other front-line staff have no choice but to deal with multiple changes. These changes occur almost every day and interact in our minds with preceding changes. Small change by small change, you can face a complete reorganisation of your work, but it is not recognised as a complete reorganisation. Therefore, management has to help operational staff to adapt their routines by:

- giving operational staff time to adapt, train and validate the adapted skills
- allowing them to express themselves, to observe and understand how they adapted
- allowing them to debate on job, the rules, the adaptations and open their minds to new solutions
- providing adequate continuation training to help them to find ways among adaptations
- providing simulator sessions to help create new routines.

Adapting to change is a fact of frontline staff. And recognising this, the more we have to adapt, the more management has to adapt.

Julie Baltet has been working as an air traffic controller in Reims ACC since 2006. Feeling the need to learn more about HF, she became an HF facilitator for controllers in 2011. She joined the French HF team recently.
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GNSS RULES OK!

Some changes seem small and clear from the point of view of the procedure-writer, but in practice are far more complicated. In this article, **Emmanuelle Gravalon** describes one such change: GNSS approaches.

KEY POINTS

- **The assessment of change impact should first analyse whose job will be impacted, and then take into account that they will need to learn a new way of doing things.**
- **How operational instructions are written can affect performance and learning.**
- **Operators have to be provided different ways of learning, so they can find their own entry in the learning cycle.**

Some years ago, GNSS approaches started to be implemented, being a cheaper way to operate an IFR procedure on a small airfield, with little traffic. In the Terminal Control Area I worked in, the first GNSS approach was to be in operation on the first day of spring and had been announced by an operational instruction one week before, which said, to summarise:

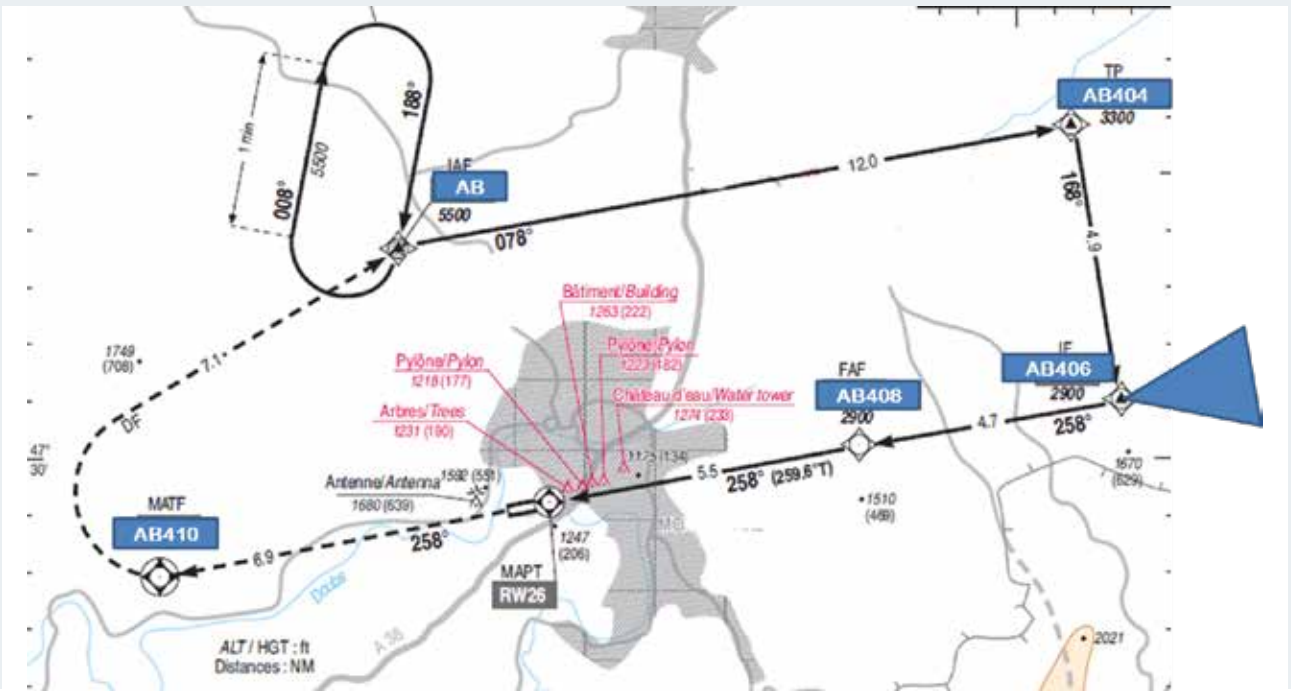
> Nothing new! GNSS approach starts at AB (beacon) and follows (almost) the conventional approach trajectory, the missed-approach procedure is the same, the job is the same. Minor changes: Each turning point is given a name, the turning point AB406 is now in D airspace of the above Terminal Control Area, so ATC has to provide control services until this point at least.

In addition, a short reminder of **"**GNSS rules**"** was provided.

It looked clear. Sparse traffic is usually expected to AB airfield. It will be easy! We can handle much more difficult traffic. The first time I had to handle a GNSS approach at AB Airport was in mid-summer, during a night shift at 0200 hrs (a critical time for tiredness and alertness), while I was alone in the tower. I had no chance to find either the memo "GNSS rules", nor the GNSS map. Fortunately, the crew didn't request a GNSS approach at first contact, and they read back the clearance to AB beacon for a conventional approach.

When I was about to give him descent and clearance for the conventional approach, the pilot asked for a direct to point AB408. Panic! I still hadn't found the map. AB408 was not the GNSS approach starting point. I had in mind that the short reminder about GNSS

Figure 1: Airspace map



said that any direct route to any point of the procedure was possible, except to the final approach fix (FAF) and with an angle restriction for the intermediate fix (IF).

I also remembered that an altitude is associated with each point. I granted him the requested direct route. I transferred him to AB auto-information frequency when passing 5000ft, leaving controlled airspace. And I kept my eyes on him as long as the radar permitted, as he was descending into uncontrolled airspace, proceeding to the FAF with an angle of 120°.

The memo and maps reappeared a little later in the night.

When the panic stopped and I collected my thoughts, some questions came to mind. I felt tricked by the "no change" message. Direct routing is actually possible to any point of the procedure except to the FAF, and at an angle <45° to the IF. This brought to mind more questions. The GNSS memo now seemed even less clear.

Does the angle restriction apply on the part of the GNSS route before or after the IF, when the IF is a 90° turning point?

- Why are the GNSS routes and points altitudes (given on the map) very different from radar safety altitudes?
- Direct routing is possible, but what about the safety altitude in this case?
- And what is the procedure in case of satellite guidance failure?

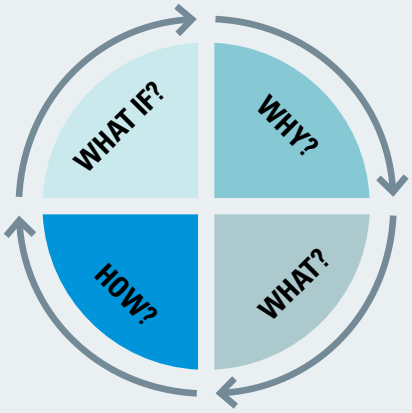


Figure 2: The learning cycle

The four questions help to acquire a new competency. The questions concern comprehension and action (e.g. Why should I do that? What is the procedure to do it?) What should I do? How should I do it? But, the cycle can be started anywhere, fulfilled in different orders. Entry into the cycle is linked to the individual and how they learn.

I certainly did my best considering my knowledge and the circumstances. But was it the best course of action to ensure the safety of this flight arriving at AB airport?

There was no loss of separation. But that was not thanks to the way the change was introduced. So what was missing? First of all, we lacked theoretical knowledge about GNSS approach. Few of us were young enough to have heard of GNSS approaches during initial training, and fewer remembered this theory, which we had never used so far. The main message in the operational instruction was that the changes were minor, that the job for ATCOs was unaffected, and that the differences were the pilot's concerns.

The assessment of change impact was based on the adaptability of controllers and exchange of experience. However, the low traffic at AB airport didn't allow for on-the-job training and experience.

Of course, it's easier to look for 'what went wrong' after the fact. But this situation can help to identify some of the key points of impact assessment for any change:

- Who will be impacted by the change?
- Which part of the job is impacted?
- What do they need to know?
- What do they need to be able to do?

Communication and training should:

- take into account the variability in actual and required competencies
- provide different ways of learning, to enable any entry in the learning cycle
- ensure basic theoretical knowledge and applied experience
- take account of how often the procedure will be used (more refresher training might be needed for rarely used procedures)
- allow for experience sharing (in this situation, with pilots operating GNSS already).

In short, even a minor technical change needs to be assessed and implemented with the users in mind.

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THE DANCE OF CHANGE IN TURKISH AIRSPACE

Turkey's airspace and air navigation service provider has undergone significant change over the last few years, with enormous increases in traffic, associated with changes in demand and traffic flows. How does an organisation and its people cope with such changes? In this article, **Önder Toydemir** and **Arife Aycan Mutlu** outline the changing situation in Turkey.

KEY POINTS

- **Being a learning organisation means being ready to anticipate, react and respond to change, complexity and uncertainty to sustain the safety of airspace.**
- **Highlighting team learning and personal mastery enhances employees' capacity to create a more effective air traffic control service.**
- **Constant communication and ongoing dialogue with all stakeholders integrates all employees via systems thinking and building a shared vision.**

In Turkey's airspace, overflight traffic increased by 47% between 2014 and 2017. This might be seen as an extreme change for the provision and safety of air traffic services. At the same time, a number of serious events affected air traffic control service, especially en-route control. 'The Dance of Change', as systems scientist and organisational learning specialist Peter Senge called it, had direct consequences on the organisational culture of the ATC Centre in Turkey. Here are some of the changes:

- The minimum separation has lowered to 5nm from 10nm as prescribed by ICAO Doc 4444 since July 2016. This change is very important for all European airspace due to the efficient use of ACC capacity.

- The crisis situation in Ukraine and the attack on flight MH17 in 2014 led to a significant number of flights avoiding the entire Ukrainian airspace due to concerns about safety. They instead moved to neighbouring countries, including Turkey. Traffic numbers increased dramatically, up 40-50% in a short time. According to the EUROCONTROL (2018) report 'The Challenges of Growth', it is expected that Turkey will face 2.5 times as many flights by 2040, and so west neighbouring countries will experience high level of traffic demand with expected growth around or greater than 80% compared to 2016.

Turkish airspace is in a critical 'bridge' position between Europe and Asia, and also Russia and the Middle East.

- The traffic between Europe and Middle East and Asia re-routed via Iran and Turkey because of the security situation, affecting flight efficiency. So major enhancements and changes were necessary in routes and the organisation of interfaces between ANKARA FIR - Baghdad FIR and the ANKARA FIR - Teheran FIR.

- ATS route network development was launched not only in the east neighbouring countries of Turkey, but also in the west neighbouring countries of Turkey. Reorganisation of interfaces between FS Sofia and ANKARA ACC and the new interface between FS Varna and ANKARA ACC, combined with new sectorisation, provided significant additional capacity. As a result, complexity was reduced significantly without any difference in safety performance. Average en-route delay per flight in ANKARA ACC decreased from 0.22 minutes per flight in summer 2015 to zero minutes per flight during the same period in 2016, and also in 2017.

- After the recovery of the travel ban of Russia on charter flights to Turkey, a noticeable change occurred between the Russian Federation and Turkey, which increased by 243% (+101 flights/day) in 2017 as a whole compared to the previous year.

- In 2015, there were two big changes in operation, with implications for competency and expertise for the safety of air traffic management: 1) transfer of current ANKARA, Istanbul and Izmir ACCs into the Turkish 'SMART' systems (see Toydemir and Mutlu, 2018, *HindSight* 27) with a new ATC system; 2) transfer of Istanbul ACC and Izmir ACC to new ANKARA ACC for FL245 and above. In 2014 there were just 10 sectors in ANKARA ACC. This grew to 22 sectors in ANKARA ACC.

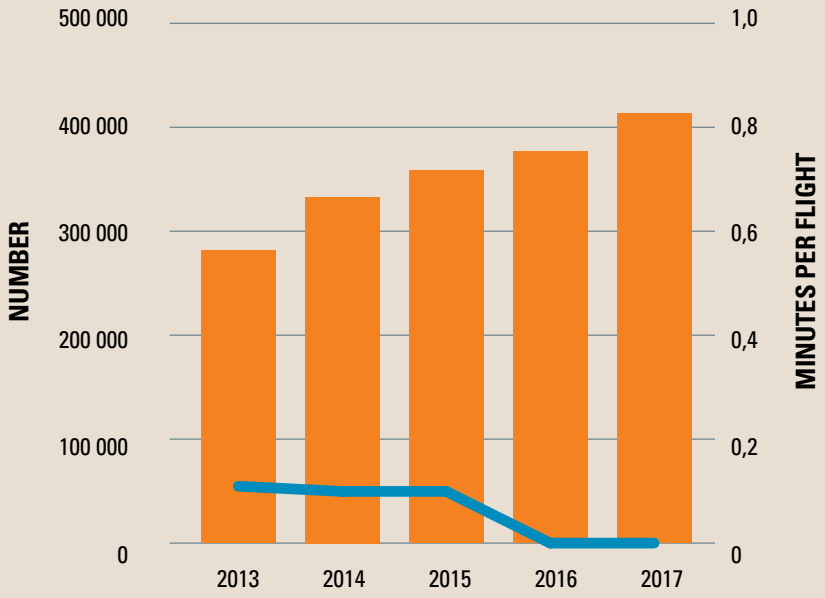

Figure 1: En-route traffic and delays

- Lastly, there was a change in the required expertise and competency in ANKARA ACC: 'mini sectorisation'. This change was necessary to maintain the safety of Turkish airspace.

Turkish airspace is in a critical 'bridge' position between Europe and Asia, and also Russia and the Middle East. So within just 4 years, the question is how these big changes were managed effectively while ensuring the safety of this 'bridge'.

The answer was to become a learning organisation. Peter Senge (1990) defined a learning organisation as "a group of people continually enhancing their capacity to create what they want to create". Senge outlined five characteristics of a learning organisation (see Figure 2).

Yogesh Malhotra (1996) defined a learning organisation as "an organisation with an ingrained philosophy for anticipating, reacting and responding to change, complexity and uncertainty" (p. 2). So we must be ready to react and respond to rapid changes and uncertainty while being sure that these can be handled safely, and be willing to sustain personal and organisational learning. Otherwise, an ANSP, which has 'learning diseases' such ignorance of problems, resistance to change, and lack of sharing of information, is unable to understand the system as a whole. It is necessary to be a learning organisation in order to handle a 47% traffic increase in just four years while maintaining safety and efficiency, and to survive and thrive in the aviation sector.

It necessary to be a learning organisation in order to handle a 47% traffic increase in just four years while maintaining safety and efficiency, and survive and thrive in the aviation sector.

As in Senge's five characteristics of a learning organisation, to be able to handle changes while creating safety, a number of applications and systems in ANKARA ACC are listed below:

- **Systems thinking:** Ongoing dialogue with all stakeholders to improve and refresh letters of agreements, considering the whole picture.
- **Team learning:** Interactive meetings, frequent briefings and brainstorming sessions. Having a supporting team ready to help the controllers while adapting changes.
- **Personal mastery:** Continuous learning and simulator practice.
- **Shared vision:** Constant communication between supervisors and controllers to discuss the problems and solutions.
- **Mental models:** Improving understanding by listening to the opinions of the airspace users, and making necessary changes to the system (people, procedures, equipment, etc).

To be ready for the expected increase in traffic in the run up to 2040 without compromising the safety of air traffic management and aviation, many important changes are planned, such as Istanbul's new airport, LTFM. This airport will offer flights to more than 300 destinations with an annual passenger capacity of up to 200 million, making it the largest airport in the world. This will be a major phase in the history of DHMI. These achievements and ongoing projects are all footsteps in the dance of change for DHMI and ANKARA ACC.

Figure 2: Peter Senge's five characteristics of a learning organisation

Figure 3: Ankara ACC

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SAFETY MANAGEMENT Q&A

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1. What the most significant change facing your organisation at the moment that has relevance to aviation safety?

ENAIRE is presently undergoing a very ambitious strategic plan called Flight Plan 2020. This plan was born to respond to the challenges and demands of the Single European Sky, as well as to meet with safety, efficiency and quality the growth of air traffic, in a global and very dynamic market. In this scenario where the organisation is continuously looking to improve the safety and efficiency of our services, we have recently implemented a new project called "BRAIN" (Barcelona RNAV Approach INnovations). We are restructuring the Barcelona TMA by creating new RNAV1 transitions between arrivals, for all runway configurations at Barcelona airport.

2. Why is this change necessary? What is the opportunity or need?

When we conceptualised the redesign of the Barcelona TMA, our priority was fundamentally setting the focus on the most valuable asset on the organisation, the human capital. We considered a crucial objective to support the role of our air traffic controllers, and at the same time, achieving benefits for safety, environment and capacity, even during periods of high traffic density. Operationally, the main expected benefits are:

- The simplification of ATC tasks and the standardisation of operations by reducing radio communications, workload and complexity.
- The improvement of traffic flow sequences, as a way to increase predictability on the arrival sequence, reducing delays, while reducing our environmental impact.

In summary, we have managed to incorporate a greater balance in the distribution of workload among the TMA sectors, whereas improving air space management. A better prediction of trajectories clearly allows more efficient flights.

3. Briefly, how is safety assured for the change?

First, we considered consultation of stakeholders as paramount. Our safety assessment previous to the change was triggered by a session of approximately 30 professionals from different profiles, including pilots of several airlines that usually operate at Barcelona-El Prat airport. Then, all ATCOs in Barcelona TMA received training sessions, both in the classroom and in the simulator. At the same time, ENAIRE's Operational and Safety managers led working meetings with the main airlines operating at the Barcelona-El Prat airport and with AENA, the airport manager. We made a great effort to make sure that the change was sufficiently disseminated, including the publication of an AIC a few months before the actual implementation of BRAIN. Additionally, ENAIRE conducted a series of trials, in cooperation with database providers and airlines, prior to the implementation of this redesign of airspace.

We are restructuring the Barcelona TMA by creating new RNAV1 transitions between arrivals, for all runway configurations at Barcelona airport.

It is extremely important to encourage front line practitioners to participate in the projects from the very early stages

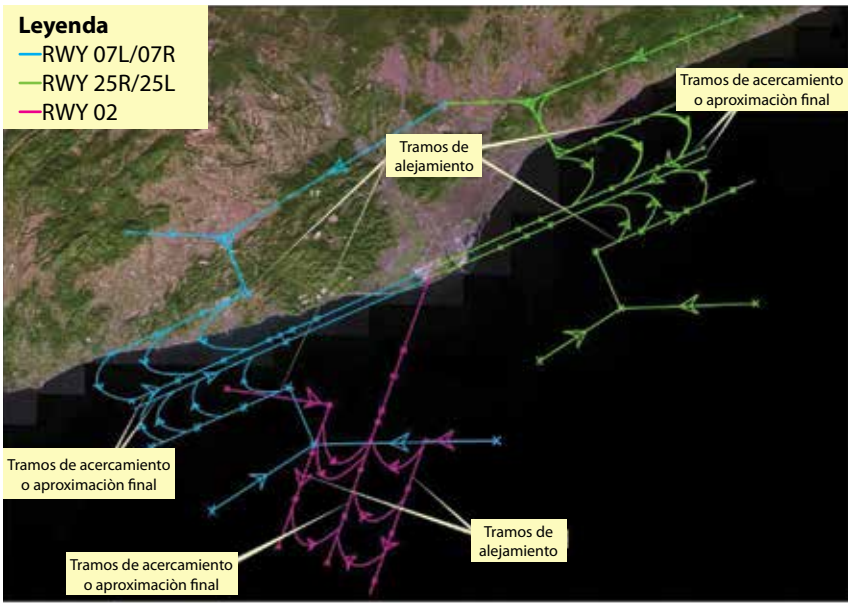
An operational transition plan was developed for the implementation of the change in two different periods, from 26 April to 19 May, and from 24 May to 8 June, including a reduction in capacity in several sectors of the Barcelona TMA (in different phases according to the two periods established). These measures were applied with the clear purpose that air traffic controllers and pilots, as the sharp end personnel, had the opportunity to become familiar with the new procedures. At the end of July, the usual operational capacity was recovered, once we determined it was acceptably safe.

4. What are the main obstacles facing this change?

The complexity and nature of the change were clearly the main challenges. BRAIN has required a complete restructuring of a large number of procedures, affecting all sectors in the TMA. From a human factors perspective, the controllers and pilots had to build new mental models and adapt to a new way of operating in a high density environment.

In addition to the above, another significant constraint is the fact that we also need to provide air navigation services to non-equipped aircraft, or those that do not have RNAV1 operational approval. This involves keeping "alive" the previous procedures for exceptional scenarios such as possible technical failures or severe adverse weather phenomena, which is clearly an additional difficulty.

5. What is the role of front-line practitioners? How is their expertise incorporated into change management?



From a human factors perspective, the controllers and pilots had to build new mental models and adapt to a new way of operating in a high density environment.

The role of the ATCOs working at Barcelona TMA has been decisive to foster the implementation of the change. The involvement of controllers was vital because they are the people who do the work, they are the specialists in their work, and they are essential for any system improvement. They provided their expertise along the whole process: from the initial conceptualisation and design phases until actual deployment. They made the difference and actually solved the problems when raised, helping to minimise the initial resistance to such a great magnitude change.

6. What do they think about the change?

We have consulted the controllers their opinion on a survey and we are still analysing the data. However, our perception is that once the initial resistance to change has been overcome by all the actors involved, the new way of working will be gradually internalised. Generally, it has been well received by the staff, despite the normal constraints related to such a large-scale project. This implementation facilitates traffic management and reduces the complexity of the sequencing of arrival flows to Barcelona airport.

7. How can front-line practitioners get involved in safety management to best support operational safety?

In our opinion, it is extremely important to encourage front line practitioners to participate in the projects from the very early stages, because their involvement contributes to the validity and usefulness of data gathering, analysis, synthesis, and improvement.

The controllers are vital partners in improving a system, and for this reason, it is necessary that they are informed in a timely manner and with sufficient detail, so that they can adequately identify the possible threats, areas of improvement or good practices applicable to the proposed change throughout the life cycle of the project.

CHANGING JOBS: OLD HABITS DIE HARD

A change of ATC discipline, or a change of aircraft type, brings obvious changes and changes that are subtle or hidden. These changes can affect performance in unexpected ways, but can be understood in terms of how they affect our mental processes, as **Caroline Fauquembergue** explains.

KEY POINTS

- **When changing operational role, some changes are obvious, but others are more subtle or hidden.**
- **'Obvious' changes can be dealt with consciously. 'Hidden' changes need an analysis of our own cognitive processes.**
- **We can understand changes in terms of how they affect how we understand situations, make decisions, act, and check the result.**

Three years ago, I started the most challenging professional change I ever encountered: I decided to transfer from Reims ACC to Nantes TWR/APP, in France. I knew from the beginning that it wouldn't be easy. We often say it's a totally different job. I knew I would have to reconsider a lot of the things I learned. But to what extent?

During my time in Reims, I got involved with the training department and I gained a lot of experience as an on-the-job training instructor (OJTI). I thought that even if the environment, procedures and methods are different, the mental processes would remain the same. I thought I would just have to make a few adaptations.

I arrived in Nantes (after a refresher course on theoretical knowledge at the Ecole Nationale de l'Aviation Civile [ENAC]), with a core of validated solutions and actions from 20 years in Reims ACC. This was a mix of 'rules' or 'what if' solutions ("if x occurred, then I will do y"), and skills, involving unconscious cognitive processes.

Of course, I had to experiment. I tried things I had never done before. But I also had to analyse and understand how I worked in Reims, and let go of some old validated solutions and skills that were outside the new core of validated solutions. I could adapt some other old skills, but had to do this consciously to understand the changes.

What kind of changes are we talking about? Those who know a little about ATC will know that en-route and approach control are very different tasks, dealing with two different phases of flight. En-route is managing mainly commercial instrument flight rules (IFR) flights at high level and with similar speeds. Approach takes different forms due to the mix between commercial and private, IFR and VFR (visual flight rules) flights. Guiding and managing flights for a feasible approach procedure brings more complexity.

So there are changes in objectives and rules. Those are quite obvious, but I also encountered subtle changes, which may seem quite minor. For instance, when I started ground training, I had the tendency to keep the strips of the arrival flights, sometimes 10 minutes after they got to the gate. I soon realised that I was used to "saying good bye" with a frequency change, and in Nantes, pilots don't have to call back on stand. So I kept the strips because in my mind they were not transferred. The action to put aside the strips was intimately connected to the phrase "Contact XXXXX, frequency YYYYY, bye". This is a good example of an ingrained skill, which can create confusion when you want to adapt.

I then understood that I was prepared (and ready to learn) for the obvious change but that I wasn't aware of all the hidden things that I would have to change.

The changes can be understood in terms of some of the mental processes. Dealing with traffic is like any situation: we have to understand in order to decide, act and check the result. As the situation is dynamic and continuous, we have to do this as a loop.

Understand

Understanding the situation used to start with looking at my radar display and finding the flight. So I tried to do what I did when I was training at the tower position. I wanted to see each DR400 joining west downwind each time I looked outside. I failed. Adding to the obvious change of my field of view, I realised that I really needed to see aircraft on a few very strategic positions. I had to learn to focus my gaze only on specific moments. To do this, I had to fight my instinct to try to find the aircraft on each cycle.

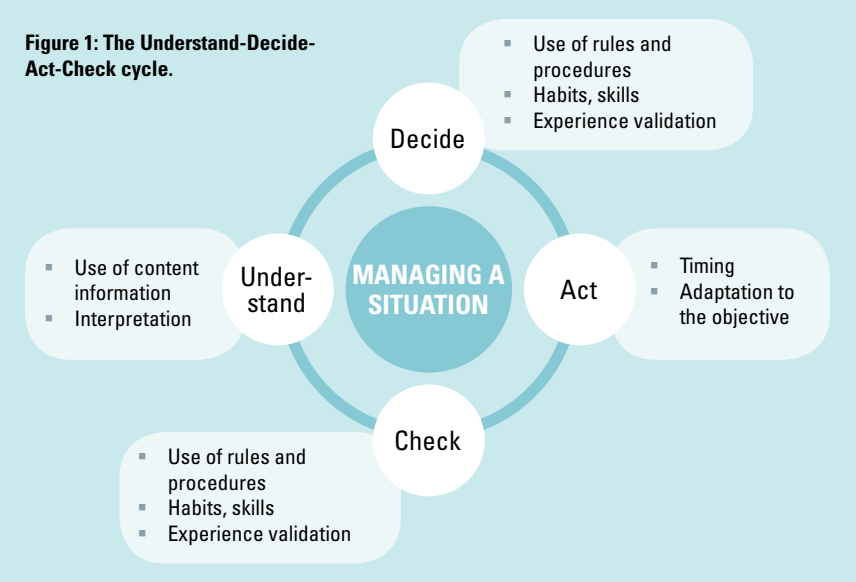


Figure 1: The Understand-Decide-Act-Check cycle.

Decide

The main thing to decide is the type of action. In ACC we used variations and combinations of four actions (turn, change level, speed, rate). In TWR/APP you have to add the VFR separation strategy to the mix, and that often involves the VFR pilot!

As an ACC controller I was used to assessing separation using my radar screen and being able to measure it (5NM or 1000ft of separation). When I started my training at the tower position, the obvious change was to decide if a VFR flight in downwind would be able to land and vacate the runway in time before the IFR commercial flight that was starting its approach. Even if I could see both of them, there's no way to measure that they won't be on the runway at the same time, especially because you don't really know how the VFR pilot will handle his flight.

That leads me to the hidden change: I was not used to involving the pilots in my decision process. I would tell a pilot to turn and he or she would do it. With VFR flights, it's sometimes necessary to state our intention, and ask what they can do about it.

Act

The obvious change when you want to act as a tower or approach controller is the phraseology you have to use. I quickly realised that not only the vocabulary was different (specific for approach and runway procedures), but also that it was longer, e.g., from "descend FL360" to "descend altitude 3000 ft, QNH 1023".

The hidden change for me was the perception of timing. In ACC you manage the timing of your action regarding conflicts. If you are interrupted at the moment you intended to act, you would give a bigger adjustment for the same result. In APP, and specifically when you manage a lot of arrivals, timing is more critical. You have a very small amount of time to give the last heading to intercept the final approach, and if you miss it, it can create consequences for all the aircraft involved (further vectoring, speed reduction).

Check

In order to check, we first have to extrapolate the situation. While we have some tools to help us, we mainly use our experience and training, especially to be able to monitor the multiple parameters of the flight (level, speed, rate, etc). When I arrived in Nantes, I was not used to the changes of speed (below FL100, during the final approach...). And now, I know that a BE90 can remain number one on approach, even if the A320 seems faster.

I found a subtle change in the methodology I used to scan my situation in approach. I first tried to use geographical scanning (as I did previously) but I soon realised that I needed to use axis-centred scanning, especially when dealing with a lot of arrivals.

I realised that most of the obvious changes occurred when rules had to be adapted ("If *X* occurs, then I can't do *Y* anymore. The speed is not the same.") and when I had to learn a new solution outside of my former range of experience. But some skills were quite difficult to change because they were deeply ingrained. An example of this is where to write on the strips.

So when changing roles or working situations, we need to let go of some old ways of working that are outside the new working context. We can adapt some other old skills. And still other skills we must acquire from the beginning.

Caroline Fauquembergue has been working as an air traffic controller for over 25 years. She started her career as an en-route ATCO in Reims ACC, but is currently working in Nantes-Atlantique airport, as an approach controller. She became a team resource management (TRM) facilitator for controllers in 2001, and has participated in creating HF training courses since 2002.
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RETIREMENT – THE END OR A NEW START?

One of the major changes in life is retiring. It is a change that many look forward to, without too much consideration. When I turned 50, working as a Watch Supervisor at a Swedish ATC centre, I simply looked forward to it and was pleased to know it was coming in only ten years. In Sweden, retirement age is otherwise typically 65 and I believe most controllers will go earlier than you would with another profession.

However, just a few days after that 50th birthday something happened that would change my view. I got the opportunity to work for ICAO in Namibia. It was to last for just over four years and I brought my family with me, with two daughters in a Namibia school. The job was professionally challenging and life in Namibia was a fantastic adventure for the family.

Back home again, with only five years to go, my views had changed. I realised that work can offer so much to life, and I felt that I had more than those five years to give as a professional. In Namibia, I had been involved in SMS, drafting handbooks and taking part in the training of inspectors. I investigated a lot of safety incidents and started thinking about what factors really made these things happen. Safety was of course always a part of my life as a controller, but now I wanted to know more.

As I returned home, I started reading books and got a part-time job doing safety assessments, with some training at EUROCONTROL IANS in Luxemburg. I soon found that whenever I read about safety, another term was mentioned: 'human factors'. Training opportunities were there, but unfortunately my employer did not share my enthusiasm, so I needed to do this on my own time and with my own money. Is it possible to learn a new profession, on your days off and in only a few years as you are getting closer to 60? It would have been harder if I had chosen a completely different job, but I believe that my comprehensive background as a controller, and my international experience, will match well with my new knowledge and skills.

I have attended courses at IANS and continue to do so. I have become a member of a few HF associations and try to visit conferences as often as possible. I applied to the Coventry University for their distance learning MSc Human Factors in Aviation. It is quite a lot of work and I do it on my free time but have managed this far. I am into my second and last year for the MSc and it is soon time to decide my thesis subject.

However, it is also great fun! I learn a lot and I meet a lot of interesting people with fascinating ideas and views. I find that this is already changing my own view on how we work at the centre. I believe I better understand both problems and success, I find areas that can be improved, and I really look forward to the years ahead. I do believe that it is possible to develop as a human and professional even as the years start ticking.

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THE JUST CULTURE JOURNEY IN EUROPE: LOOKING BACK AND LOOKING FORWARD

As aviation changes to adapt to the changing world, and as people adapt to change, there is always the potential for things to go wrong. This brings us to the notion of 'just culture', which has also changed over the years, as **Roderick van Dam, Maria Kovacova** and **Tony Licu** describe.

KEY POINTS

- **Just Culture has evolved significantly since 2005 when it was described in a EUROCONTROL safety report. It is now captured in EU law through EU Regulations 996/2010 (Accident and Incident Investigation), 390/2013 (Performance Regulation) and 376/2014 (Occurrence Reporting).**
- **Just Culture is an act of balance between safety and administration of justice interests. But the Just Culture concept does not simply identify two protagonists that are expected to sort out their respective roles and responsibilities.**
- **There is a need for Just Culture at the corporate (or organisational) level to help secure a healthy reporting environment. Internal processes have started to emerge for handling and assessing acts as reported within the organisation.**
- **There is an increased interaction with judiciary. The EUROCONTROL Just Culture Task Force (JCTF), in close cooperation with IFATCA and ECA, has reached out to more than 200 prosecutors, judges and other representatives of the judiciary from over 20 European States, inside and outside the EU.**
- **Aviation and the railways have teamed up to promote the Just Culture concept as a way of thinking in multi-modal transport, rather than a individual narrow ATM view.**

Where are we coming from?

Ever since the systematic investigation of aviation accidents with the aim of accident prevention, there has been at problem of the use of these findings for other reasons.

The improvement of aviation safety is based, to a large extent, on feedback from a system of accident/incident data collection and analysis that serves the whole industry as well as its regulators, allowing it to adapt and improve equipment and procedures. Learning depends on systematic and traceable records and active participation and reporting from all aviation actors.

In such safety critical domains as aviation and railways, criminal sanctions have always been an essential tool for sovereign States to enforce specific ways of working and to prevent and sanction unacceptable behaviour.

But there is concern among aviation and railway professionals, including air navigation service and infrastructure providers, airlines and railway safety regulators, manufacturers, railway undertakings and interest groups, about the interpretation of safety by the general public and especially by the criminal judiciary. This has led to growing fear of litigation and threat of criminal sanctions against individuals and organisations that are seen as partly or fully responsible for an incident or accident, which they may have reported. Words such as "criminalisation" are sometimes used to describe misdirected and unwarranted activities by the judiciary in the criminal law domain to address actions and events that should be dealt with in the safety domain.

In aviation, concepts such as 'non-punitive reporting' and 'blame-free reporting' were the precursors to the more realistic concept of 'Just Culture'. In general, aviation/railway professionals seem to have accepted that calling for a blanket immunity is not the right way forward.

When the legal consequences of Just Culture were first discussed, the initial reaction was that most European States would need to amend their laws significantly. The general feeling was that a Just Culture could not be implemented without such changes. ▶▶

The issue was not necessarily the need for legislative change, but rather the way in which existing laws and regulations were implemented and enforced by national judicial authorities.

Realistic and mature

"Just Culture means a culture in which front-line operators or other persons are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but in which gross negligence, wilful violations and destructive acts are not tolerated." (EU Occurrence Regulation 376/2014, Article 2, § 12, EUROCONTROL SAFREP Report 2005, Appendix B)

The above Just Culture definition represents an integral and universal concept. The definition of Just Culture that emerged from the discussions in the EUROCONTROL Just Culture Task Force (JCTF) has now been adopted into EU law through EU Regulations 996/2010 (Accident and Incident Investigation), 390/2013 (Performance Regulation) and 376/2014 (Occurrence Reporting).

All EU States, as well as the growing number of Pan-European States that have committed to implement EU legislation, are now expected to apply the JC principles. Just Culture addresses the mutual recognition of two key functions: Safety and Justice. These are two independently exercised functions that must interact to make sure that only acts of wilful misconduct and of gross negligence will be addressed by the judiciary and that 'honest mistakes' will not be prosecuted. But it is clear that, as wilful misconduct and gross negligence refer to criminally relevant behaviour, only a prosecutor – and not a chief pilot or an air traffic control room supervisor or a CEO – should make the call whether this is the case.

Striking that balance requires two important conditions. The first one is the creation of a dialogue at national level between safety professionals and prosecutors. The second, and perhaps the most difficult one, is the building of mutual trust and understanding.

A balanced corporate and judiciary environment will provide a sustainable basis for a incident reporting as well as accident/incident investigation. Both sides have in the past caricaturised each other: Judiciary, in their Ivory Towers , have been seen as the Ruthless Crime Hunters with complete disregard for the intricacies and realities of civil aviation. The Safety Czars, the Pilots and Controller Interest Groups have evoked visions of pilots, controllers and managers behind bars and demanding full protection against criminal interference.

This is a good moment to note the consistently high professional standards and dedication of pilots, controllers, train drivers and controllers and other aviation and railway professionals. Almost without exception, they represent realistic and hard-working processionals who take great pride in their job and quite ready to continue to work in an environment that will provide them with the reasonable expectation that the chances that they would find themselves subject of a criminal process would be very small.

It is equally encouraging that our ongoing contacts and discussions with the judiciary in Europe and beyond yield a picture of realistic, reasonable and responsible professionals with a keen interest in the specifics of aviation safety, in learning more about the safety environment, while at the same time ready to draw the line when necessary.

Just culture at corporate level

The Just Culture concept does not simply identify two protagonists that are expected to sort out their respective roles and responsibilities. Aviation is a complex industry where frontline operators work as an integral part of a wider system, interacting in teams with equipment and procedures. All actions must be seen in the context of the system as whole, and this system needs to be improved continuously, based partly on reporting. So there is a need for Just Culture at the corporate (or organisational) level to help secure a healthy reporting environment. As a result, internal processes have started to emerge for handling and assessing acts as reported within the organisation.

These initiatives may have been inspired by the provisions of the EU Occurrence Reporting Regulation 376/2014, which addresses, among other things, the reporting of incidents at corporate level and the European Corporate Just Culture Declaration of 1st October 2015. The Regulation encourages organisations to create internal Just Culture rules and the definition of a process, including the actors involved, to determine unacceptable behaviour in accordance with its description in Regulation 376/2014.

Just Culture at corporate level addresses the need to establish a reporter-friendly and trust-based Just Culture environment in an ANSP, Airline or Railway company as the essential first layer of the balance between Corporate and National Judiciary.

The good news is that both the EUROCONTROL/ERA Model Policy for an Aviation or Railway Prosecution Policy, and the EU Regulations 996/2010 and 376/2014, foresee institutional provisions and even agreements to ensure an open connection between two functions and other relevant partners, such as the national Accident Investigation Body.

Just culture and the administration of justice

Like safety, the administration of (criminal) justice forms one of the pillars of any civil society. Just Culture does not change that, but it does form part of the concept. The Just Culture definition, in order to protect "commensurate" behaviour, also singles out "unacceptable behaviour" in terms that describe criminally-relevant acts. It does so by describing two categories of acts: gross negligence and wilful violations/ destructive acts. As is the case with acceptable behaviour, the descriptions are rather generic or colloquial.

As pointed out earlier, it is clear that criminally-relevant behaviour should only be assessed by a prosecutor. It is less clear how and when the prosecutor could be invited to follow the Just Culture principles and to decide whether or not to 'draw the line' as set out in the Just Culture definition.

The EUROCONTROL Just Culture Task Force (JCTF), in close cooperation with IFATCA and ECA, has reached out to more than 200 prosecutors, judges and other representatives of the judiciary from over 20 European States, in and outside the EU. The EUROCONTROL JCTF has developed a model policy for a national aviation/ railway prosecutions, to help national Prosecution Organisations to publish their own policy. A number of States are now at different stages towards establishing their own policy. The UK and The Netherlands, already have an Aviation Prosecution Policy in place.

Of course, the adoption of a policy that would limit prosecution to cases of

gross negligence or wilful misconduct depends upon the existing criminal law and procedural criminal law of a State. Even in the absence of a policy, discussions with prosecutors from more than twenty States have revealed a tendency – in particular with aviation or railway incidents to not formally prosecute such incidents ("No blood on the runway or the rails"), unless unacceptable behaviour (e.g., a drunken driver, pilot or controller) played a role.

Another JCTF/IFATCA-ECA/ERA deliverable is the training of aviation/railway experts to help national prosecutors – at their request – to understand the technical and operational aspects of a particular incident or accident. An ongoing series of discussions and exercises between pilots, air traffic controllers, train drivers, and train controllers has met with great enthusiasm from all participants. The first list of experts to be invited by a prosecutor for a first briefing is underway.

Light at the end of the tunnel?

Finally, let's now take a look at the actual interpretation and acceptance of Just Culture as now imbedded in the EU and the pan-European domain. Recent discussions related to ongoing national indictments and criminal court cases in ATC provide an important and realistic picture of the practical assessment implementation of Just Culture.

Just Culture is now established in Europe and widely recognised in other Regions, and by ICAO. It is based on a realistic concept that focusses on mutually recognised needs for any civil society: safety for its citizens and full respect of the rule of law.

> In Europe, Just Culture is maturing. That is happening because of a more mature understanding among different stakeholders of how Just Culture serves both safety and justice.

In Europe, Just Culture is maturing. That is happening because of a more mature understanding among different stakeholders of how Just culture serves both safety and justice. The JCTF deliverables and a number of the provisions of Regulations 996 and 376 have been instrumental in starting discussions at the corporate level and also with and within the judiciary.

To put things into perspective, thousands of incident reports are generated yearly in each State. Of these, very few reach the prosecutor, mostly through the airline or provider involved. Often these are discussed in the context of regular informal meetings, which provide the prosecutor with a growing insight and understanding. But, of course, a prosecutor and a court may take decisions and actions in a case that others interpret differently. So be it. The law may be tough, but it is the law! The good news is that these discussions and views are increasingly held openly and will ultimately inform and benefit both sides.

The main conditions for a successful effort towards a widespread establishment of Just Culture in the aviation and railway domains have been identified and tested. Not surprisingly, they focus on harmonisation of applicable norms and (criminal) processes, on continuous communication and cooperation and, perhaps most importantly, on trust.

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THE LONG READ: POSITIVE JUST CULTURE FOR MODERN TIMES

Just Culture has changed from being a theoretical notion for improving safety to a legislative reality. But there remains much misunderstanding and concern about how the notions of gross negligence and wilful misconduct that are traditionally used in criminal and civil law should be interpreted. In this article, **Florentino-Gregorio Ruiz Yamuza**, Senior Judge in the Appeal Court of Huelva (Spain), discusses these issues, along with a number of possible implications for safety and justice.

In a seminar held in Seville in May 2018, one of the speakers delighted us with a fragment of the "I Love Lucy" series. In the episode, Lucy and her companion are wrapping chocolates on an assembly line. Their performance perfectly and hilariously illustrated, in the style of the great Charles Chaplin in his 'Modern Times', among other things, the overwhelming work pressure faced by two workers, and how they used workarounds to make it look like their work was achieved satisfactorily. The scenario emphasises not only dealing with unacceptable workload, but the challenge of presenting an ideal performance, in order to avoid being fired.

This brings us to Just Culture. In this brief review, I reflect on some of the changes facing the practical application of Just Culture. I will use the term 'positive' to describe the term Just Culture in two different senses: on the one hand, concerning the legal representation of it; and on the other, as a requirement for the correct application of the concept.

The positive context (the scenario)

From the legal point of view, at least in the field of western aviation, the idea of Just Culture has long ceased to be just an interesting theory on how to improve safety by facilitating the flow of safety-related information. Just Culture has become a directly applicable law.

Sticking only to the European Union, we have a compact legislative system, which the Member States have adapted in national legislation. This presents an official definition of what we have to understand by Just Culture, and a series of clear objectives about how to put it into practice. These objectives can be summarised as follows:

- ensure the confidentiality of the reporting of incidents and problems
- guarantee the shielding of the reported information
- foster reporting, and
- increase safety.

The first three are related to the fourth, which gives meaning and coherence to the rest.

The legal debate has shifted from the need to introduce the concept of Just Culture in our legal environment to the need to delve into some related notions. These require developments in legal theory and practice, including to make compatible the different legal systems that affect aviation.

Regarding the legal framework, the system comprises several legal subsystems. Air traffic and safety do not escape the legislative complexity present in any area of society. Therefore, we can distinguish two groups:

- aviation safety, including the notification and investigation of accidents and incidents to improve aviation safety, and
- responsibility at the criminal and civil level.

Of these two, the first group belongs to the administrative sphere. Here, sanctions are also established for breaches of standards. The second group concerns responsibilities that are only resolved in court.

The differences and commonalities between these groups may contribute to uncertainty regarding Just Culture. Specifically, there may be uncertainty about the protection offered by the confidentiality of the report, which has two significant exceptions: on the one hand, the severe lack of diligence in the terms contemplated in Article 16.10 of Regulation (EU) 376/2014; and on the other the conduct of judicial proceedings.

Thanks to the umbrella of Just Culture, when reporting situations and incidents related to air traffic, front-line operators are protected from possible administrative sanctions and labour reprisals. But the protection does not extend to cases of gross negligence or wilful misconduct on their part, nor to any liability that may be established in judicial proceedings.

Doubts and complications arise from the fact that the concepts of wilful misconduct and gross negligence might not always be completely clear or easy to determine or distinguish. Added to this, the diversity of legal and judicial systems, proceedings and procedural rules in the European Union may further confuse the matter.

In our meetings with pilots and air traffic control officers, the bulk of their concerns revolve around the nature and measurability of negligence. There is no legal ruling, for the application of the Regulations mentioned above, to clarify completely what should be understood as gross negligence and wilful misconduct.

The legal system of each country can define these concepts slightly differently. The concepts can be even more different for civil or criminal jurisdictions. But for a transnational content it is necessary to resort to other basic instrumental notions:

- action, which is the active behaviour or omission that a person carries out
- outcome, that has occurred because of the said action
- volition, or intellectual attitude that leads the person to represent the consequences of his or her activity as sure or likely and, knowing this possibility of occurrence, to take action.

Doubts and complications arise from the fact that the concepts of wilful misconduct and gross negligence might not always be completely clear or easy to determine or distinguish.

In Figure 1, I try to illustrate the conceptual position of both within the frame of reference of action, outcome and volition.

The outcome is not the essential consideration when it comes to negligence. This is because a higher degree of negligence does not necessarily produce a more serious outcome. The fundamental consideration in assessing the degree of negligence is the *probability* that the harmful event occurs and the acceptance of that probability.

Negligence differs from wilful misconduct. With wilful misconduct, the volition of the person covers both the action and the outcome. Negligence, on the other hand, implies that the action is wanted, but the outcome may be more or less likely, depending on the severity of negligence. Therefore, gross negligence would be the situation in which an average person, adequately qualified for the position he or she fills, should rationally foresee that a harmful event may very likely occur as a result of his or her action. And despite being aware of such likelihood, he or she takes the action and accepts the risk of the consequence.

The ecosystem

With this frame of reference, we can now explore the ecosystem in which Just Culture is applied.

The operational framework of modern aviation is complex. There are multiple actors and many factors coexist in tension in the work context that influence human performance.

It is important to bear in mind that the majority of planes that cross our skies (aside from military missions, civilian or humanitarian tasks) are commercial flights and that the airlines, like any company, seek to maximise benefits. This implies reducing costs, including those that derive from the allocation of human resources to different tasks. Although aviation safety standards and outcomes are genuinely high, problems comparable to that of other areas of enterprise or civil service do appear frequently. Understaffing, overtime, work overload and other problems – very similar to the 'I Love Lucy' chocolate factory – affect aviation employees, especially front-line operators.

In this operational context, the position of the front-line operator is different from that of other stakeholders, such as manufacturers, regulatory authorities or airline/ANSP Boards. If we take airline/ANSP Boards, their decision-making generates an operational context. Front-line operators have to work in that context; they must adapt to it and benefit or suffer the peculiarities of it. Furthermore, while company decision-making at the 'blunt end' is usually carried out under

conditions of sufficient and thoughtful deliberation (spanning days, weeks, months or years), front-line decision-making occurs under time pressure of seconds, sometimes in urgent or emergency situations. There is no time for thoughtful deliberation.

In other words, and returning to Figure 1, strategic decisions that may have a significant impact on risk occur under conditions that allow decision makers to consider strategic options and the likely results of any decisions. On the contrary, the specific activity of front-line operators will often lack ample possibilities of choice and foresight.

The errors corresponding to 'sharp end' decision making are sometimes called 'active failures', which are typically committed by the front-line operators. Errors corresponding to 'blunt end' managerial decision making, which affect the system more generally, are sometimes called 'latent failures'. Both involve a lack of success in achieving desired outcomes, in a context.

A real example illustrates this.

The facts:

A Boeing 737 pilot approaching Ciampino 'lost situational awareness' and diverted to Fiumicino with adverse weather. The crew began to miss ATC instructions and descended below the assigned altitude, getting into conflict with other traffic. It was then unable to approach Fiumicino and finally diverted to Pescara, where the airplane landed safely with just 1520 kg of fuel remaining.

The conclusions of the Aviation Authority Report:

Primary cause: the incorrect operation and conduct of flight by the flight crew in adverse weather at the unplanned and unbriefed diversion to Rome Fiumicino Airport.

Contributing causes:

- the captain's state of mind: illness, depression due to the recent loss of a child
- the limited experience of the first officer

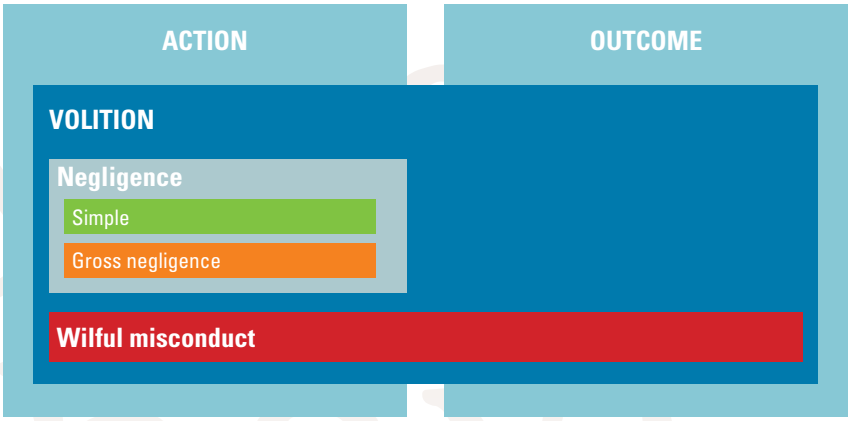

Figure 1: Negligence and wilful misconduct within the frame of reference of action, outcome and volition.

- poor cockpit resource management and cooperation
- inappropriate information provided by air traffic control in non-standard language
- inadequate analysis of weather data by the flight crew
- incorrect use of onboard weather radar by the flight crew
- the absence of timely available ground radar based on weather data in the Rome approach sectors, and
- lack of the minimum safe altitude warning on the radar approach of Rome's air traffic control.

If we carefully examine the elements of this incident (to which we can add the lack of fuel reserve, which generated an additional risk), we observe that most of them are structural/systemic. That is, they correspond to decisions resulting from a business or management option: letting the captain fly in an adverse mental situation, lack of pilot experience, lack of training regarding the use of weather radar by the crew, the absence of alerts on the onboard weather radar.

The crew's decisions – which seemed reasonable to the crew at the time – luckily did not end in a tragedy. But the ecosystem in which the pilots' work developed was adverse and raised the risk of a potentially dangerous event, to the extent that relevant airline personnel other than front-line operators should have foreseen and avoided.

The risks

This situation suggests some unknowns regarding the real effects of Just Culture and the risks that misuse of it can bring.

There is a considerable difference between mistakes at the managerial level and mistakes of front-line operators. Therefore, it would be interesting to specify if the notion of Just Culture should be applied not only concerning the actions of front-line operators but also of those who hold planning, direction or supervision positions related to air navigation. The Just Culture concept might apply not only to front-line operators, but to all the personnel of an organisation as regards decisions related to operational safety.

> With wilful misconduct, the volition of the person covers both the action and the outcome. Negligence, on the other hand, implies that the action is wanted, but the outcome may be more or less likely, depending on the severity of negligence.

Curiously, however, the Spanish version of Article 2 (12) of Regulation 376/14 does not coincide with translations to other languages in one essential detail. The Spanish version defines Just Culture as that "*... in which operators and other front-line personnel are not punished ...*" for their actions that are not malicious or seriously imprudent.

On the other hand, the English version of the Regulation, and also that of the

different EUROCONTROL documents, are slightly different: "…'just culture' means a culture in which front-line operators or other persons are not punished ...". This seems to be a broader scope, depending on how it is interpreted.

The distinction itself is not that important. In principle, other people who are not strictly filling front-line positions benefit from the confidentiality of the reporting system and the guarantee that they will not be sanctioned, except for gross negligence or wilful misconduct.

But it could be problematic to include not only 'second-line operators'/ support staff but also *all* those who make decisions within an organisation. The reporting of incidents applies from bottom to top in the organisational structure. Apparently, that is the philosophy contemplated in Article 4 of Regulation 376/2014 regarding mandatory notification. Managers, companies and organisations may be likely to balance other points of view and interests that may prevent them from engaging in a culture of voluntary reporting.

Decisions made at a managerial level usually correspond to strategic options adopted after consideration of a situation. This implies more time for decision making, and therefore the assumption of the possible consequences. The decisions and actions of those persons filling managerial positions would normally be seen as wilfully and consciously adopted and undertaken. This, in turn, implies that in principle it would be easier to regard them as likely to cover *both action and outcome*.

Going back to the example of the decision to permit aircraft to fly with an insufficient amount of fuel, managers and departments at a managerial level will hardly be encouraged to report situations that may be the consequence of strategic decisions that generate an operational context or ecosystem.

We do not yet have a practical perspective or a jurisprudential background on how to judge systemic deficiencies arising from the decisions taken at the corporate or organisational level, which increase operational risk.

There may also be a reporting deficit. If we deal with the reporting system in a bureaucratic way, and front-line operators can't see clearly improvements from their reporting, they may get sceptical about the system. This may reduce reporting, paradoxically harming the front-line operator position.

Finally, it is necessary to distinguish between:

- securing the information reported in order to avoid sanctions that do not relate to gross negligence or wilful misconduct, and
- the required transparency with respect to the collecting of information, the treatment of such information and the solutions adopted in line with the provisions set forth in Articles 8 et seq. of the Regulation 376/2014.

Conclusions

- Just Culture is now a legislative reality. Understanding this fact should be the first step of an approach to Just Culture by lawyers. Just Culture is no longer merely a theoretical notion.
- There is considerable controversy and concern among front-line operators about how the notions of gross negligence and wilful misconduct that are traditionally used in the field of criminal and civil law should be interpreted.
- There is still a lack of jurisprudence (legal theory) with respect to these two notions in the specific field of aviation and the protection of the information reported.
- Nor do we have jurisprudence regarding the compatibility of national legislations with supranational regulations, and the harmonisation of them.
- The Just Culture system at the organisational level should promote progress in terms of safety, but this shall only be achieved with efficient notification procedures and careful and exhaustive treatment of the information reported.
- It is crucial to monitor exhaustively the information, improvements and advances in safety derived from the reporting system and based on the information obtained from the repository.
- It is necessary to distinguish the protection of the reported information (in order not to sanction the front-line operator) and the transparency of the reporting system itself, and the associated benefits.
- Just Culture must not encourage an adverse ecosystem for front-line operators, in which discouragement and opacity regarding the treatment and use of information end up worsening the conditions in which operators carries out their work.

Returning to the delightful scene quoted at the beginning, Lucy and her friend should neither be sanctioned for faults that are excusable, nor be forced to carry out their work under such conditions with associated risk levels well above what is desirable.

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QUICK BRIEF: EU 2017/373

From 2nd January 2020, we will be operating under the regime of EU 2017/373. This lays down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight.

Much has been said about the changes the '373' will bring along and all the 'new' things that need to be done to meet the new regulatory requirements. An analysis of the changes made to the change requirements reveals the changes are evolutionary in nature rather than revolutionary. Many of the new requirements and Acceptable Means of Compliance (AMC) are actually good practices that have been in use for quite a number of years. For ease of reference, the table below list the main changes and some remarks about them. This may be useful for readers who are involved in safety change processes.

Change	Remark
Severity Scheme	No longer mandated but ANSPs need to formulate one for the risk analysis.
Safety Objectives	No longer required but replaced by the notion of Safety Criteria.
Safety Criteria	A set of high-level goals devised by analysing aspects of the new or changed functional system and then captured through a set of safety requirements.
Software specific requirements	Now at the level of Acceptable Means of Compliance (AMC).
Notification of Changes	The Competent Authority (CA) has to be notified of all changes, not just safety-related changes.
Safety Assessment/Case or Safety Support Assessment/Case	Air Traffic Services (ATS) providers have to perform a safety assessment and document it in the form of a safety case. Non-air traffic services providers have to perform a safety support assessment and document it in the form of a safety support case (SSC). • Workflows and processes are similar but require adaptations. • Non-air traffic services providers do not need to do hazard Identification or formulate Safety Criteria but they have to meet service specifications.
Preliminary Safety Assessment	Required for notification to CA. Similar to the current 'Safety Considerations' process. For non-air traffic services providers, the PSA is expressed in terms of what aspects of the performance of the service are impacted by the change. (Not to be confused with Preliminary System Safety Assessment [PSSA, a phase when using the Safety Assessment Methodology, or SAM].)
Service Specification	For SSC: • service has been defined in terms of functionality, performance and the form of the interfaces • correctly and completely records the conditions under which the specification of the service is true • interactions of components, under failure conditions or failures in services delivered to the components, have been assessed for their impact on the service and, where necessary, degraded modes of service have been defined • encompasses the interaction with the environment.
Monitoring Criteria	Criteria to demonstrate that the service delivered by the changed functional system will continue to meet the safety criteria. Demonstrate that the safety case remains valid during the operation of the changed functional system. For SSC: • demonstrate that the service delivered by the changed functional system will continue to behave only as specified in the specified context.
Proxy	A measure of a certain property along the causal trajectory between the hazard/event and the harmful effects of the hazard/event in question. Mentioned only in AMC. In the safety assessment of functional systems, the value of a proxy may be used as a substitute for a value of risk.

The consolidated version (Easy Access Rules for Air Traffic Management/Air Navigation Services [ATM/ANS]) can be found under the following link: https://www.easa.europa.eu/document-library/general-publications/easy-access-rules-air-traffic-managementair-navigation or http://bit.ly/2CQFfS1

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SOCIAL PARTNERS FOR CHANGE MANAGEMENT

Changes can affect us personally and socially, as well as in our work activity. So how can organisations and staff associations work together on change to ensure that all needs are considered and met, as far as possible? **Aaron Curtis** outlines a new set of guidelines produced by a European collaboration, which may help form a more united approach.

KEY POINTS

- **Getting change management wrong can be extremely costly and disruptive. Getting it right can benefit all stakeholders.**
- **Change can also involve social changes and working arrangements, such as changes to working patterns or relocation, yet the involvement of staff is haphazard and there are often inadequate skills embedded in the organisation to deliver change appropriately.**
- **ANSP management and their staff associations need to work collaboratively, with the right level of social dialogue to work through the change process.**
- **As part of a European Commission-funded project, the European Transport Workers' Federation (ETF), the Air Traffic Controllers European Unions Coordination (ATCEUC) and the Civil Air Navigation Services Organisation (CANSO), have produced a set of guidelines, designed to be used by ANSPs and their staff organisations.**

An arrival management tool was introduced into an operations room to aid in arrival sequencing for an airport. But it wasn't anywhere near fit for purpose as far as the staff were concerned. The specification for the tool had been met precisely by the contractors, but what the tool did in comparison to what it should have been able to do were a long way apart. For instance, the capture area for the tool was inaccurate. Traffic leaving a hold, for a reason such as weather, would drop out of the arrival sequence list, leading to an inefficient arrival order. The accuracy of the data was also questionable. Particularly when landing on a certain runway, the tool would show a delay when the aircraft had already left the hold to begin an approach. It 'did what it said on the tin', but it was the wrong tin!

Change management is becoming more important in air traffic management (ATM), particularly given the rapid pace of new and emerging technologies such as remote towers and the increasing use of drones. The importance of effective change management can be seen in many projects over recent years. Getting it wrong can be extremely costly and disruptive.

The SESAR program – the technological pillar of Single European Sky – is starting to move from a research and development program to deploying new technologies. These will have

far reaching consequences in to how ATM operates. Air Navigation Service Providers (ANSPs) and their staff will need to adapt to and introduce these technologies. Change is not limited to technology, but can also involve social changes and working arrangements, such as changes to working patterns or relocation.

While often criticised, the conservative attitude to change by front-line workers in the aviation industry provides a check and balance to ensure that the change is safe and fit for purpose. Front-line workers are aware of the consequences of getting it wrong. They tend to inherit the result.

Change is often emotive, creates uncertainty and can have various operational and social impacts. The attitude to change and the involvement of staff is haphazard around Europe, and until recently has had little focus from policy makers. This has to change. Change management and change leadership must be embedded from the policy-making stage, with political initiatives, the regulatory framework and economic arrangements all taking into account change management principles, through to implementation.

While often criticised, the conservative attitude to change by front line workers in the aviation industry provides a check and balance to ensure that the change is safe and fit for purpose.

If the ATM system is to be modernised, improving capacity and cost-efficiency, ANSP management and their staff associations need to work collaboratively, with the right level of social dialogue to work through the change process. Front-line staff understand the work and the operation, and with the right level of involvement, will ensure a more favourable outcome.

Another crucial element of change management is having the appropriate skills embedded in the organisation to deliver the change appropriately. Often, organisations don't have the appropriate skills to manage the change process and run into problems because of this. Managers and decision-makers need to be competent and supported by dedicated change management teams. Following implementation, new skills may be required, and thought should be given to in-house reskilling.

Recognising the importance of appropriate change management processes in the delivery of change has been a key focus for the European Transport Workers' Federation (ETF). As part of a European Commission-funded project, the EFT, Air Traffic Controllers European Unions Coordination (ATCEUC) and Civil Air Navigation Services Organisation (CANSO), came together over the last two years to consider how they may be able to support their affiliated members to structure change, with best practice guidance.

Working together, a set of guidelines has been agreed, designed to be used by ANSPs and their staff organisations. These offer voluntary best practice for the management of change, and are an aid to be used with other established change management methodologies.

The guidelines are broken down in 7 areas:

1. Importance of Social Dialogue

- A key precondition for effective change management. Well-functioning social dialogue, with early engagement, can help manage change in a socially acceptable manner.

2. Building trust

- Managers and staff representatives value each other's contribution. There is a shared responsibility for resolving issues, and local problem solving is recommended.

3. Pursuing the development of a shared vision and a cooperative culture

- Identify and understand the interests of both parties. Outline the objectives of the change management process. This approach should lead to an agreed shared vision set within a culture of cooperation.

4. Social Dialogue Toolbox

- Stable industrial relations are crucial to effective change management. In 2015, the ATM Social Partners created a toolbox for successful social dialogue. This toolbox gives best practice aimed at improving social dialogue and suggests tools to aid in dispute resolution (see https://www.etf-europe.org/resource/etf-toolbox-march-2016/).

5. Establishing clear targets and organisation of the process

This is further subdivided into:

- **Establishing a senior leadership project team.**
  - The primary role of the senior leadership project team should be to manage the change process at a strategic level.
  - The senior leadership project team may establish subgroups where the need is identified to address specific elements of the project, e.g. Social Impact Subgroup, Safety Subgroup, etc.
- **Identifying the reasons for change.** Generally, this will be because of a strategic decision, with the senior leadership team informing and consulting with senior staff representatives.
- **Social impact subgroup to identify the social impact of the change.**
  - The Social Impact Subgroup (comprising appropriate and mandated representatives of human resources, relevant ATM operations and staff unions), should be fully briefed on the change initiative and may carry out an assessment of the social impact of the change for staff.
  - Where changes are identified that may impact on staff, e.g., re-organisation of service provision, redeployment of personnel, downsizing of operations, outsourcing, etc., the mandated representatives of HR inside the Social Impact Subgroup may negotiate with the union officials and agree upon solutions to address the social impact identified.
  - In the first instance, measures to avoid or minimise compulsory redundancies should be explored, such as re-deployment to another location within the ANSP, re-skilling, re-training, etc.
  - Where redundancies are unavoidable and are permitted by local regulation, the Social Impact Subgroup should agree upon a mechanism to manage the process.
- **Communication strategy.** A coordinated communication strategy should be agreed to ensure all staff are kept fully appraised. Continuous and timely information should be provided including communication on any negative impact.
- **Identification of quick wins.** Irrespective of the long-term goal of the project, sub-groups should identify short-term targets in order to ensure that quick wins, which are clearly linked to the change process, are identified and acknowledged.
- **Build on the change.** Each short-term success should be assessed to identify improvements to build on the momentum.
- **Resolving blockages.** Where disputes arise that impact on the change management process, these should be dealt with as quickly as possible and in line with best practice and established procedures.

6. Equality of treatment

Any agreement reached between the employer and the unions should take account of equality requirements and be implemented in a non-discriminatory manner.

7. Adjusting agreements

Agreements reached between the employer and staff unions should be formalised and signed by both parties.

Each topic has an explanatory paragraph which can be used as guidance to help ANSPs and their staff associations to manage change. It also provides suggestions for employers and employees about how to discuss the change and its impact. These guidelines complement and build on the social dialogue toolbox that was successfully developed between the three organisations and is currently being promoted across Europe.

While we can never be certain of the future, the guidelines can help ANSPs and other organisations to achieve effective change.

Aaron Curtis is Vice Chair of the European Transport Workers' Federation (ETF) Air Traffic Management Committee, and Lead representative for International and Governmental affairs for Prospect ATCOs' Branch (the union representing Air Traffic Controllers in the UK). He is an operational air traffic controller (ATCO) at the London En Route Centre at NATS' Swanwick facility, a role he has held for the last 16 years. **aaron.curtis@atcos.co.uk**

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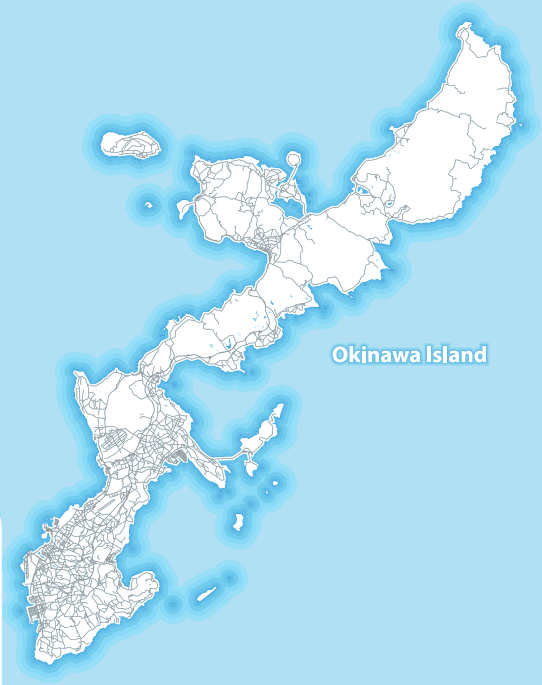
HIDDEN CHANGE

Change is not always obvious, and changes can be hidden by their presentation or how they unfold. From a pilots' perspective, **Nick Carpenter** describes three examples of 'hidden changes' with implications for safety.



KEY POINTS

- **Change can take many different forms: planned and unplanned, slow and sudden, expected and unexpected, obvious and hidden.**
- **Identifying the unintended consequences of change is difficult, but thought must be given to this during the change process.**
- **Understanding the reasons for differences between work-as-imagined and work-as-done can help in change management.**

Change comes in many forms. It can be planned, or it can emerge unexpectedly from situations. It can arise quickly, or occur slowly. It can be obvious or be hidden. Hidden change can be particularly troublesome because it is difficult to see and hard to understand. But in the technological world in which aviation has its roots, avoiding change is impossible, whilst making change can be essential for company growth and prosperity, and also for safety. In this article, I explore hidden change in the context of three examples that are relevant to aviation safety.

NOTAMs

In aviation, we have notices to airmen, or NOTAMs, which are meant to keep pilots up-to-date with short-term changes to airfields and navigational aids. An incident in July 2017, when an Air Canada A320 came within mere feet of colliding with a line of aeroplanes taxiing for departure, has raised the question of whether NOTAMs are an effective method of notifying crew members of the various small, but potentially important changes that they will face on a daily basis. The NOTAM system, which has been in use for many years was described by Robert Sumwalt, the NTSB chairman, as "a bunch of garbage that no one pays any attention to" (Trautvetter and Lynch, 2018). The danger of important details being lost in the noise of large amounts of information was discussed in a recent United Kingdom confidential human factors incident reporting programme (CHIRP) feedback (Dugmore, 2018). Experience with NOTAMs suggests that the risk of many small changes hiding important information is increased by poor presentation, making information hard to understand. The fact that aviators are not fully aware of all NOTAMs is not non-compliance. It reflects the lack of time available to prepare flights, the amount of information that must be read and understood and the paperwork that must be completed before departure. Unsurprisingly, some information will be overlooked and some forgotten.

Precision Approach Radar approaches at Okinawa airport

Long-term or emergent changes can also be hard to see and can disguise hazards. In April 2014, a Peach Airlines A320 was approaching Okinawa airport in the southern part of the Japanese archipelago. The weather was poor and the captain considered that the ATC-suggested non-precision approach was inappropriate for the conditions. Instead, a Precision Approach Radar (PAR) was requested, approved and flown. In the course of the approach, the crew descended early, reaching an altitude of 241 feet three nautical miles from the runway before conducting a go-around.

The busiest single runway airfield in Japan, Okinawa airport is constrained by two American Air Force airfields nearby: Kadena and Futenma. The consequence is that approaches to the southerly runway commence at 1,000 feet, restricting approaches to either non-precision or PAR. In a survey of pilots flying approaches there (Carpenter, 2018), it became apparent that many of them do not rely entirely on the instructions of ATC. Instead, they prefer to use onboard navigation systems to augment the ground controller's directions.

Historically, Okinawa airfield was an American air base only handed back to the Japanese Self Defence Force in 1982. PARs have only been conducted by civilian controllers in the last 5 years and Okinawa is the only civilian airfield in Japan where these approaches take place. This historical background has resulted in two issues peculiar to

Okinawa; a low platform altitude of 1,000 feet from which to commence the approach and the PAR itself. Training for both controllers and aircrew can only take place on the job because simulation is not available and, of course, PARs are rarely carried out. The change from military to civilian control has involved a gradual, and yet insidious change. Less well-practised controllers and crews conduct a complicated procedure for which they have limited on-the-job training under demanding real-world conditions. These issues, not identified in the official report, should be of concern. The fact that crews will consider using a GPS approach system in preference to an authorised PAR is, again not a reflection of undisciplined pilots. It is the by-product of a mismatch between design expectation and operational reality.

Carriage of lithium batteries onboard aircraft

In their book 'Nudge', Richard Thaler and Cass Sunstein emphasise the difficulty we have in judging the outcomes of change in areas where we are inexperienced or poorly informed, and where feedback is slow or infrequent. This is a common finding in human factors research. The unintended consequences of changes are masked, leaving latent problems in the system.

This can be seen in the industry change to allow the carriage of lithium batteries onboard aircraft. When the change was first made, some spoke out against the practice because of the associated problems. Lithium batteries carry their own oxygen, burn with extreme heat and create very little smoke, making them difficult to detect and extinguish. ICAO document 9481 'Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods' was amended so that some Group 9 cargoes, specifically RLI and RLM, lithium ion batteries and lithium metal batteries, had two, hitherto unmentioned, drill letters added. Group 9 drills carry 'no general inherent risk', but the two new drill letters F and Z meant that these particular cargoes were liable to catch fire, and once alight *aircraft fire suppression system may not extinguish or contain the fire*.

Discussions in the pilot community resulted in a general agreement that should lithium be on board, any indication of fire should automatically result in ditching. This was a radical suggestion and yet pleas to management to provide guidance on what should be done went unanswered. Where I work, promises were made to document the cargo and load it carefully whilst segregating it from other flammables. The unit load device containers designed by UPS to contain lithium fires were considered to be an unworkable solution because of the risk of damage to them. The Asiana Airlines accident over the Yellow Sea and the UPS freighter accident near Dubai, with the loss of their crews, focussed aviators' minds on the change to allow the carriage of lithium. And yet, as it stands today, lithium can still be carried on freighters but the Emergency Response Guidance has been changed to remove the troublesome wording regarding the inability of fire suppression systems to contain the ensuing fire. Fortunately, there have been no further incidents and as Thaler and Sunstein would have predicted, the issue has been conveniently forgotten.

The fact that crews will consider using a GPS approach system in preference to an authorised PAR is not a reflection of undisciplined pilots. It is the by-product of a mismatch between design expectation and operational reality.

Talking about change in human work

In all these cases, an open discussion with the front-line actors could have unveiled the hidden problems. However, front-line employees may fear that what is uncovered in such circumstances could result in a new bundle of procedures, requiring compliance with those that were already being worked around, and potentially, disciplinary action. The terms 'work-as-imagined', 'work-as-prescribed', 'work-as-done' and 'work-as-disclosed' (see Shorrock, 2016) help to reframe the conversations to reflect the fact that front-line workers understand more than policy-makers about the operational reality, but struggle to get their concerns heard, understood or acted upon. Their daily interactions make them more aware of the inconsistencies between current procedures and the difficulties of practically enacting them. Unless these concerns are understood and acted on, to reduce the mismatches, the underlying problems can grow until something dramatic occurs.

"I don't understand why you pilots are complaining. All the information is there in the NOTAMs."

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Nick Carpenter is a military trained and commercially experienced airline pilot flying widebody aeroplanes in Asia. His interest in flight safety has inspired him to study for both a Bachelor's and a Master's degree in Psychology. In addition to flying, Nick is the operations manager at the Aviation Safety Institute in Australia.

TRAINING FOR CHANGE
EUROCONTROL IANS COURSES

The EUROCONTROL Institute of Air Navigation Services (IANS), located in Luxembourg, develops and delivers Air Traffic Management Training, Services and Tools for Air Navigation Service Providers, Airlines, Training Organisations and Civil and Military State Authorities worldwide.
Building on over 45 years of expertise, the Institute provides a wide range of training courses, services and tools – from general introduction courses on ATM concepts through to advanced operational training.
Here are some courses that may be of interest to readers on the topic of change.

Systems Thinking for Safety [HUM-SYS]

To understand and improve the way that organisations work, we must think in systems. On this course, participants will explore 10 principles of systems thinking for safety to make sense of – and improve – system performance. The principles also help with practical implementation of Safety-II (i.e. ensuring that things go right). A variety of systems thinking methods will be introduced.

The HUM-SYS course is delivered in a workshop format and provides a background understanding for the majority of the existing SAF and HUM Domain courses.

Objectives
The course will explore concepts of safety and systems, perspectives of the people in systems, system conditions, system behaviour and outcomes.

Audience
The course may be of interest to reach anyone involved in complex sociotechnical systems, but particularly managers, safety investigators, and safety representatives.

Integrating Human Factors in ATM Projects [HUM-HF-CASE]

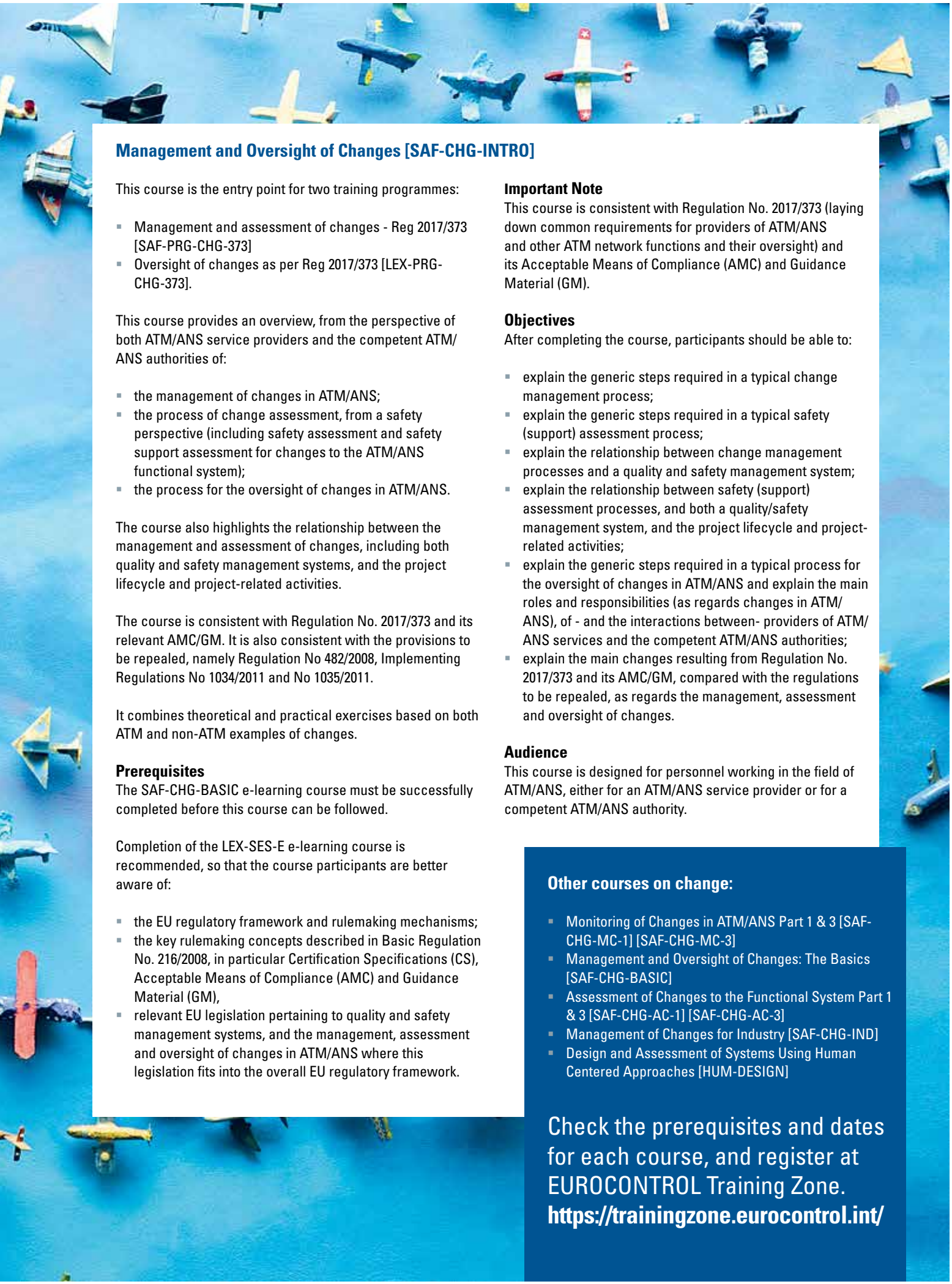
The Human Factors (HF) case is a process developed by EUROCONTROL to systematically manage the identification and treatment of HF issues as early as possible in a project life cycle.

The HF case methodology is designed to provide:
- an explicit way to manage HF issues;
- a checklist and traceability for HF issues as the project evolves;
- risk minimisation for HF issues occurring at a critical stage;
- ownership within the project team for HF;
- improved decision-making, resource and budget justification for HF.

The course is module-based and covers each of the 5 stages involved in the preparation of an HF case and the use of the HF case e-tool.

Objectives
After completing the course, participants will be able to apply the HF case as a practical HF integration process within ATM projects.

Audience
This course is designed for Human Factors (HF) specialists and other ATM personnel with HF knowledge and experience who are interested in applying the HF case in ATM projects.



Management and Oversight of Changes [SAF-CHG-INTRO]

This course is the entry point for two training programmes:

- Management and assessment of changes - Reg 2017/373 [SAF-PRG-CHG-373]
- Oversight of changes as per Reg 2017/373 [LEX-PRG-CHG-373].

This course provides an overview, from the perspective of both ATM/ANS service providers and the competent ATM/ANS authorities of:

- the management of changes in ATM/ANS;
- the process of change assessment, from a safety perspective (including safety assessment and safety support assessment for changes to the ATM/ANS functional system);
- the process for the oversight of changes in ATM/ANS.

The course also highlights the relationship between the management and assessment of changes, including both quality and safety management systems, and the project lifecycle and project-related activities.

The course is consistent with Regulation No. 2017/373 and its relevant AMC/GM. It is also consistent with the provisions to be repealed, namely Regulation No 482/2008, Implementing Regulations No 1034/2011 and No 1035/2011.

It combines theoretical and practical exercises based on both ATM and non-ATM examples of changes.

Prerequisites

The SAF-CHG-BASIC e-learning course must be successfully completed before this course can be followed.

Completion of the LEX-SES-E e-learning course is recommended, so that the course participants are better aware of:

- the EU regulatory framework and rulemaking mechanisms;
- the key rulemaking concepts described in Basic Regulation No. 216/2008, in particular Certification Specifications (CS), Acceptable Means of Compliance (AMC) and Guidance Material (GM),
- relevant EU legislation pertaining to quality and safety management systems, and the management, assessment and oversight of changes in ATM/ANS where this legislation fits into the overall EU regulatory framework.

Important Note

This course is consistent with Regulation No. 2017/373 (laying down common requirements for providers of ATM/ANS and other ATM network functions and their oversight) and its Acceptable Means of Compliance (AMC) and Guidance Material (GM).

Objectives

After completing the course, participants should be able to:

- explain the generic steps required in a typical change management process;
- explain the generic steps required in a typical safety (support) assessment process;
- explain the relationship between change management processes and a quality and safety management system;
- explain the relationship between safety (support) assessment processes, and both a quality/safety management system, and the project lifecycle and project-related activities;
- explain the generic steps required in a typical process for the oversight of changes in ATM/ANS and explain the main roles and responsibilities (as regards changes in ATM/ANS), of - and the interactions between- providers of ATM/ANS services and the competent ATM/ANS authorities;
- explain the main changes resulting from Regulation No. 2017/373 and its AMC/GM, compared with the regulations to be repealed, as regards the management, assessment and oversight of changes.

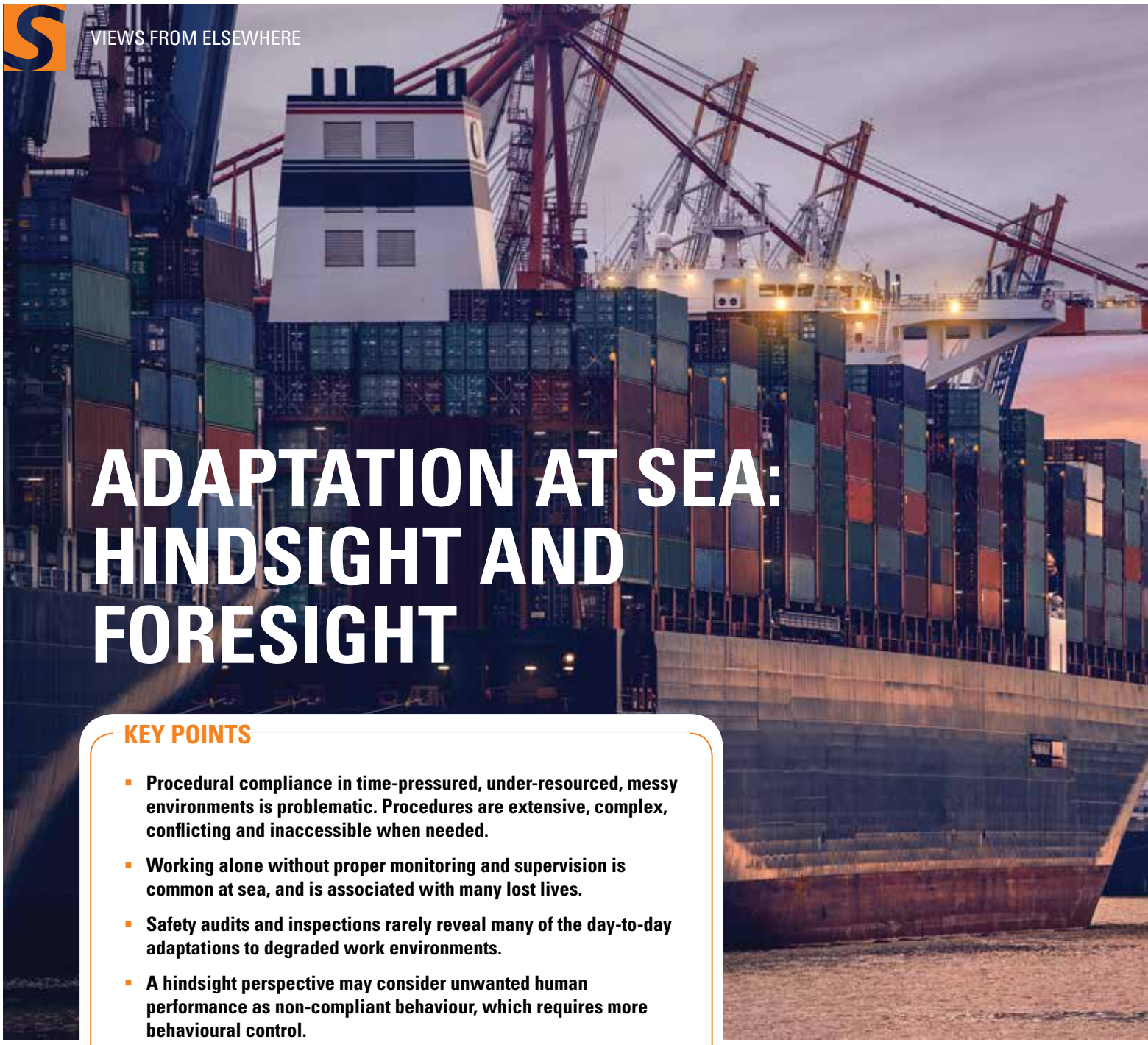
Audience

This course is designed for personnel working in the field of ATM/ANS, either for an ATM/ANS service provider or for a competent ATM/ANS authority.

Other courses on change:

- Monitoring of Changes in ATM/ANS Part 1 & 3 [SAF-CHG-MC-1] [SAF-CHG-MC-3]
- Management and Oversight of Changes: The Basics [SAF-CHG-BASIC]
- Assessment of Changes to the Functional System Part 1 & 3 [SAF-CHG-AC-1] [SAF-CHG-AC-3]
- Management of Changes for Industry [SAF-CHG-IND]
- Design and Assessment of Systems Using Human Centered Approaches [HUM-DESIGN]

Check the prerequisites and dates for each course, and register at EUROCONTROL Training Zone.
https://trainingzone.eurocontrol.int/



ADAPTATION AT SEA: HINDSIGHT AND FORESIGHT

KEY POINTS

- **Procedural compliance in time-pressured, under-resourced, messy environments is problematic. Procedures are extensive, complex, conflicting and inaccessible when needed.**
- **Working alone without proper monitoring and supervision is common at sea, and is associated with many lost lives.**
- **Safety audits and inspections rarely reveal many of the day-to-day adaptations to degraded work environments.**
- **A hindsight perspective may consider unwanted human performance as non-compliant behaviour, which requires more behavioural control.**
- **A foresight perspective may consider unwanted human performance as adaptations to a badly designed and degraded environment, which requires more attention to the system as a whole.**

In all industries, people work in an imperfect environment, in terms of people, procedures, equipment and organisation. This environment often degrades further over time, though this may be hard to see. Because of this, those charged with doing operational work have to 'make do' and adapt, in ways that may not be desirable. Master Mariner **Nippin Anand** walks us through an example of this in the maritime environment.

It's 4PM and a container ship is getting ready to depart from port. The crew has had a long day going through an intensive safety audit with a company superintendent onboard. Now the mate is dealing with last minute cargo manifests. Cargo lashing is still not completed by the shore gangs. The engineers are waiting to test the main engines but for this the gangway needs to be cleared off from the quayside. The duty officer is down in the engine room ballasting the ship to bring her upright. The harbour pilot is on the bridge pressing the captain to leave the berth soon.

The tug boats have arrived, and the captain calls for harbour stations to be manned within the next 15 minutes. The captain then announces on the radio, "Single up forward and aft as soon as you can", implying that all but one mooring line should be dropped off and retrieved onboard once the cargo operations are complete to avoid any further delays to the vessel schedule.

At the back deck, there are two able seamen, Jo and Max, eagerly waiting for the duty officer and the ordinary seaman to arrive before they can commence the undocking of the ship. Once they hear on their hand-held radios that cargo operations have completed, and the gangway is cleared off from the quayside, Jo and Max feel the pressure of time. While Max proceeds to the seaward side of the ship to make fast the tug, Jo takes the responsibility to drop off the mooring lines all by himself.

The winch control is located at the centreline of the ship. The position makes it difficult for one person to operate the controls and watch the mooring lines clear off from the quayside at the same time. Jo has a solution, but one that may not align with the design intent and company procedures. He pulls in the winch control lever, ties it with a rope (see Figure 1) and leans outwards from the shipside to monitor the rope. But to his bad luck, the harbour pilot watches Jo from the bridge and informs the captain. The captain calls Jo to the bridge and reprimands him for violating the procedures.

A detailed investigation follows soon after departing from port. The management is now seeking an explanation. With policies and procedures that preach so hard to prioritise safety over commercial interests, the management is annoyed with Jo's actions. There are at least two ways of understanding this situation – the hindsight view and the foresight explanations. Let's look closer into each.

The hindsight view

If I were the safety manager, it would make perfect sense to disapprove of Jo's 'reckless' behaviour. I would have difficulty proving otherwise. If I approved of Jo's behaviour, what is the difference between me and him? What examples of (safety) leadership am I setting? What message am I sending down the chain? I have invested so much in behavioural safety programs, I have warned each one of them not to take undue risks, I have asked them to reach out to me when in doubt. I expect them to follow procedures, conduct thorough risk assessment, and I always encourage them think in the moment. Think about your families and your loved ones before you do something silly! Clearly, Jo did not think. He chose to go against the rules, violating procedures. He needs to be disciplined. They must take risk assessments and tool box talks more seriously. We will continue to enforce better (more) procedures for mooring operations. This is certainly one way of looking at this event in hindsight.

> Why is it that no one noticed the deeper symptoms of Jo's behaviour in everyday work?

The foresight explanation

We now consider some foresight explanations and for this, we should get rid of what we know so far. Let go of the fact that anyone saw Jo overriding the winch control and ask some fundamental questions. Notice there was a company safety representative on the ship and a safety audit had just been completed. Why is it that no one noticed the deeper symptoms of Jo's behaviour in everyday work? Why is it that such behaviours are so hard to detect until they show up? What does this tell us about the state of safety audits and the overall effectiveness of control measures in ensuring safety? Is it really Jo's problem alone or is there more to it?

Safety audits

In my view, safety audits (and other forms of shipboard inspections) are not designed to uncover such issues. Rather, the focus is just the opposite, which is to conceal deep-rooted problems under bureaucratic, paper-heavy controls. Who would inform an inspector about shortcuts and compromises that form the basis of everyday work, and risk their jobs? The inspector is not interested, and neither are safety departments in most companies. Their goals are different. The inspector has an incentive to find fewer problems and those that do not do this ruffle too many feathers. The safety department has an incentive to aim at zero deficiencies, whatever it takes. Questions aimed at understanding messy realities (such as manual overriding of safety devices) are seldom directed at understanding the users' perspectives – their 'local rationality' (see EUROCONTROL, 2014). Rather, the aim is to provide an accurate (procedural) response from the highest

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Figure 1: Winch control lever tied with a rope

rank on the ship to avoid confrontation and skim through the safety inspection. Contributions from crew members in lower positions who actually carry out the work are not considered necessary. In many cases they are sidelined. Jo's behaviour on the day gives us an insight into the state of safety audits in many safety critical industries including the maritime sector – superficial exercises aiming at minimum compliance.

Pressure and procedures

What can we learn from Jo's behaviour about the effectiveness of control measures? Closer to departure time, there was an enormous build-up of time pressure and far too much to be achieved in limited time. Cargo securing, cargo planning, gangway watch, ballasting and stabilising the ship, preparing the bridge and engine room for departure, communicating with port officials, discussing the voyage plan with the pilot, manning the harbour stations, undocking the ship and making fast the tugs.

There is a procedure for each of these activities but the boundaries between where one activity ends and the next one starts become blurred. With a handful of crew members performing multiple activities, it is problematic to identify which procedure is most suited to the situation, who is responsible at what point and where exactly lies the 'violation' from procedures. In order to follow all the procedures one may well end up not complying with the hours of rest and work.

Indeed, there are detailed and extensive procedures for most shipboard operations in most safety management systems, but what is their real usefulness? Many of these procedures cross-refer to other procedures, regulatory requirements, industry standards and the so called 'best practices', whose practical usefulness for an average seafarer is questionable. This is not to raise questions about the competence and intellect of the end users of procedures. It is to understand the intent behind including such detailed documents that are both inaccessible and impractical for front-line work. Here it is important to raise a few more questions. How do people make sense of procedures and instructions in a time-constrained and a constantly evolving work environment? Are procedures readily available and accessible as work is being performed? Are we expecting people to carry procedure manuals along with them while they perform their jobs? Or do we expect them to memorise all of the procedures beforehand?

Ensuring that every operation at sea involves at least two people may save so many more lives than reprimanding a crew member.

Staffing and organisation

It is important in managing operational safety risk that one can monitor (watch for) and intervene (prevent) an escalating situation. Jo's story serves as an example to understand how the most effective risk control measures are forgotten in paper-based risk assessments and checklists. When Jo requested that Max go away and make fast the tug, he unknowingly removed a crucial control measure from the scene. Far too many lives are lost at sea whilst rigging the gangway in the dark, operating incinerators, working in confined spaces and painting aloft. It is not uncommon that the person is left alone without proper monitoring or direct supervision. Ensuring that every operation at sea involves at least two people may save so many more lives than reprimanding a crew member.

Seamanship

A final thought on Jo's behaviour. When people see the picture of a winch control being tied with a rope, their eyes tend to pop out. When I first encountered this situation I too felt deeply concerned and agitated. But such examples are reported in numerous industry publications (UK P&I Club Mooring Report). We may choose to call it a 'behavioural problem' and impose further controls. But we could also view Jo's behaviour as adaptation in the face of bad design, poorly written procedures, ineffective monitoring and limited resources. Interestingly, very little of these issues surface even with copious safety audits, inspections and other forms of governance.

"You have passed the audit! Everything seems to be in place.
But you have a non-conformity for the atrocious handwriting in the logbook."

Merchant seamen have long been acclaimed for their ability to 'make do' and adapt against the odds. Until such time as everything is properly designed to ensure things go well (or no one has spotted it), people will adapt. This is commonly referred to as 'seamanship'. But when things go wrong, the same adaptation turns into 'error' or 'violation'. Through the story of Jo, we have seen adaptation in hindsight and foresight. The one we choose defines our frame of reference as much as what Jo did in the heat of the moment.

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BOTTOM-UP SAFETY CHANGE IN HEALTHCARE:

OVERCOMING RESISTANCE TO OBVIOUS IMPROVEMENTS

In aviation, as in most industries, we tend to expect that safety improvements will be triggered, designed and implemented from above. Some improvements can, however, be brought to life by the people who do the operational work. Anaesthetist **Rob Hackett** gives two examples from healthcare, which sometimes meet resistance.

KEY POINTS

- **Front line staff have ideas and collective power and can organise to spread small ideas that can make a big difference.**
- **Resistance to change can come from the most senior employees, as well as management. But transparency can help positive change to spread.**
- **Instead of telling front-line staff how to do our jobs properly, there needs to be greater emphasis on making it easier for us to do our jobs well.**
- **Improvement requires much greater collaboration with all interested parties, particularly front-line staff.**

Recently an anaesthetist cancelled an elective operating list because the surgeon repeatedly refused to introduce himself during the team briefing prior to surgery. This was a courageous move given the potential negative consequences to the anaesthetist's reputation in the eyes of that surgeon, but the right one for providing an optimal environment for patient safety. It is important to know the names of team members in surgery. The surgical safety checklist (see Figure 1) includes an item, "confirm all team members have introduced themselves by name and role". Unwillingness to introduce oneself is a sign of deeper issues that could be relevant to safety.

I was interested to see what others would do in a similar situation. So I launched a twitter poll. A large majority of the 515 respondents indicated that they would do the same as the anaesthetist (see Figure 2).

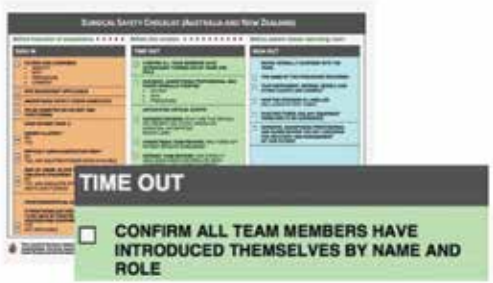

Figure 1: Checklist

Figure 2: Twitter poll

It is can be hard to implement even obvious improvements in a culture that tends to resist change. Within my own career, I've been subjected to intimidation for trying to change things for the better. The worst episode occurred three years ago. It culminated in me being brought into a room with departmental heads and the hospital CEO. I had been trying for some time to introduce another safety intervention. One individual pointed at me and said:

"I don't care who you are or what you do but if you do anything like this again you are out."

Other common responses include "no one else has complained about it" and "show me the evidence". There are also, of course, frequent references to "cost" (ignoring cost to life, and long-term savings) and the use of suffocating inertia. If staff persist with demand for change, then bullying, threats and intimidation can occur. Sometimes, whistleblowing results, at great personal cost.

Name & role hats

After months of deep reflection, mentoring, and learning about change management, I had an idea. Names and roles should be on theatre hats. It's obvious. Humans are very poor at remembering names. After first introduction, even when not distracted, we often forget names. But in healthcare, as in cockpits and as is the trend in ATC units, fixed teams are rare, so people need to remember names that they have just heard.

Alison Brindle, a British medical midwife student, came across the idea and developed the hashtag #TheatreCapChallenge. Alison had been handed equipment accidentally from physicians who mistook her for someone else several times. The initiative began to receive international support.

Four days after the hashtag was released on social media, the initiative was published in The Times newspaper. Two days later it was on the front page of the Sydney Morning Herald. The article received over a million reads two days in a row. It received over 300,000 likes and over 30,000 comments, mainly from patients. Patients thought it was an obvious improvement. A recent survey, as yet unpublished, found that 89% of 228 respondents working in healthcare institutions feel that operating theatre staff should clearly display their name and role at all times. In another survey of over 1000 individuals, 87% of front-line staff supported name & role theatre hats.

Healthcare is emotive, and the different professions and command structures can breed conformity and resistance to change. Some senior theatre staff have fiercely resisted the change. Those working within the industry the longest can be particularly influential and prevent change. While 100% of medical and nursing students supported the initiative, this number fell to 55% for surgeons with over 20 years in healthcare. Even though theatre uniforms look like pyjamas, the addition of a name and role on theatre hats seemed to be a step too far. Within one of my institutions, a senior surgeon prohibited presentations on the #TheatreCapChallenge. Managers have refused to challenge this despite being aware of the issue. The culture of a whole institution can be influenced significantly by one individual. There is also a 'not invented here syndrome' in healthcare, which is infused with innovation. Woodward (2017) noted that *"there can be reluctance to adopt or share new ideas or good practice"* (p. 63).

Figure 3: Name & Role Theatre Caps and #TheatreCapChallenge Hashtag

Often senior staff will jump from one change-blocking excuse to another. Infection control is a common excuse. Reusable printed cotton hats are perhaps the easiest way for staff to display their identity. Infection control has been used as an excuse to prevent this, even in institutions that already allow reusable hats. But five large studies have demonstrated no difference in infection rates between them and disposable hats. The American College of Surgeons and several others released a joint statement to this effect in February 2018.

After months of deep reflection, mentoring, and learning about change management, I had an idea. Names and roles should be on theatre hats.

From initial resistance, name & role theatre hats have now been adopted by several trusts in the UK National Health Service, endorsed by the Australian Society of Anaesthetists, and supported by the American Society of Anesthesiologists, the European Society of Anaesthesiology, and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists. We discovered that it has actually been New South Wales policy since the Garling Inquiry 2008 that we should be displaying our names and roles. We just haven't been doing it.

A 'Name & Role' project group has gathered information to help promote the #TheatreCapChallenge further. The group contains professors of communication, experts in simulation, nurses, midwives, surgeons, operating department practitioners, anaesthetists, and many others.

We've since heard of problems from staff misidentification. In one case, an Anaesthetist believed that a staff member was a nurse qualified in checking blood, and allowed it to be given. However, the person was a theatre porter. The blood hadn't been checked. The patient died from an incompatible transfusion. Based on previous research, we believe that name & role theatre hats will improve name recall and increase theatre efficiency and improve communication during simulations, and increase the performance of name and role introductions. The hats create an environment where name & role introductions become less forgettable and more likely to be performed properly.

The visual nature of name & role theatre hats provides a visual and symbolic indication of a culture supportive of change and improvement.

We aim for the surgical safety checklist to be updated to something like: "ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES AND HAVE THEIR NAME AND ROLE CLEARLY DISPLAYED ON THEIR PERSON."

Hospital Emergency Numbers

The #TheatreCapChallenge is only one of numerous initiatives we're driving through The PatientSafe Network. We've helped deliver several other human factors design improvements.

One of these is hospital emergency numbers.

We identified 51 different numbers within Australia (data obtained through crowd sourcing on social media). This is relevant to safety because staff move between hospitals. As discussed by Suzette Woodward (2017) in the context of different prescriptions sheets and different colours allergy bands and labelling, there are too many local variations in designs, which makes it hard to standardise. This situation has developed over many years.

A project group was formed to standardise the Hospital Emergency Number in Australia. NSW Health recently agreed to standardise internal hospital emergency numbers across the state to 2222. Dr David Whittaker has helped to extend the UK standardised number 2222 to Europe and elsewhere, internationally.

Making change transparent

The UK NHS already produces a subjective league table based on the feedback of front-line staff, focussed on how well they believe their opinions are listened to. This transparency can help positive change to spread. Within Australia the hospital emergency numbers (HEN) have been displayed on a map, indicating visually which institutions have upgraded to the standardised 2222 number. Displaying information in this way is helpful in encouraging standardisation and in helping to raise awareness. We are looking to encourage the same internationally in the future.

Transparency could be extended to other aspects of patient care. For instance, which hospitals use:

- the standard hospital emergency number?
- name and role identification?
- safer oxygen cylinders?
- vivid antiseptic solutions?

- standard labelled drug ampoules?
- resuscitators that supply sufficient oxygen?

Front-line staff driving improvement

We can all lend our support to a culture of safety by considering how the design of work, tools, artefacts and environments helps or hinders our work, whether as an anaesthetist, surgeon or nurse, or as an air traffic controller, pilot or engineer. Staff can work together to improve the system, one 'small' change at a time.

There also needs to be a shift in thinking amongst managers and senior staff. Instead of focussing on telling front-line staff how to do their jobs there needs to be greater emphasis on making it easier for them to do their jobs well. To me, this is what human factors design is all about: providing an environment which makes it easier for us to do our jobs well. This requires much greater collaboration with all interested parties, particularly front-line staff. This is how the PatientSafe Network operates. The PatientSafe Network is a non-for-profit charity focussed on collaborative implementation of effective safety interventions. The PatientSafe Network brings together different sources of expertise to improve patient safety.

We can now work in ways not available to us in the past. Through social media, networked international teams can help to improve patient safety and the effectiveness of services. Social networks like Twitter, Facebook, LinkedIn and others allow us to collaborate efficiently, sharing information. Other software platforms (we're using BaseCamp) allow us to utilise this information within focussed project groups of passionate individuals. It's amazing to see this in action, and to be part of it through the PatientSafe Network.

Perhaps you and your colleagues could do something similar.

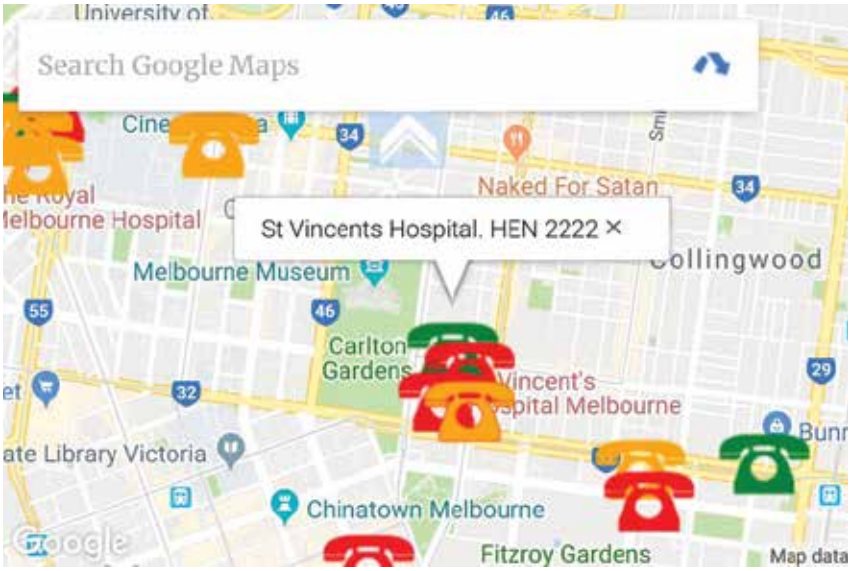

Figure 4: Standardised Hospital Emergency Number in Australia

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Dr Rob Hackett is a senior consultant anaesthetist who works at several distinguished hospitals throughout Sydney Australia. He has an interest in human factors and is passionate about improving front line work environments for patient safety. He hosts the PatientSafe Network, www.psnetwork.org/about/. **patientsafe@icloud.com**

DON'T BE A SUPERHERO:
RECOGNISING STRESS AND BUILDING RESILIENCE

KEY POINTS

- **'Change' is among the top underlying reasons for stress in the workplace, along with workload pressure, interpersonal relationships and changes at work, and managerial support.**
- **Early signs of stress are often overlooked: The 'Stress-APGAR' concept outlines five dimensions of early signs of stress.**
- **Manage your energy, not your time.**

Change is the 'new normal'. As an air traffic controller or a senior executive, we all face stress and need to find ways of handling stress and building resilience. **Thomas Hellwig**, Professor of leadership at the INSEAD Business School and a medical doctor, shares some of his research findings and reflects on a high-profile business case.

António Horta-Osório is one of those 'magicians' working in the financial district known as 'The City of London', an environment full of strong personalities working constantly under high stress. After his education in a top school and an impressive career at Bank Santander, he became the CEO of Lloyd's Bank. He had an impressive track record: Whatever he touched on his way to the top, he turned into a success story. If you want someone in the cockpit of your organisation, it should probably be someone with a track record like him.

However, in the midst of the financial crisis, pressure was mounting. He ignored this for a long time. His doctors finally diagnosed extreme fatigue and stress due to overload at work. One billion pounds of shareholder value was wiped off the books overnight when he had to stop working in November 2011. The unthinkable happened even to this overachiever. The untouchable became a victim of one of the biggest challenges of the modern world of work: extreme stress and burnout.

Employees at all levels in organisations often feel overloaded and out of control. In this article I focus on two areas:

- How to recognise early signs of stress in ourselves and others.
- How to build resilience, an antidote stress.

Stress

When analysing this high-profile business case, certain dynamics can be seen in many stressful professions such as doctors, teachers, emergency services, as well as air traffic controllers and professional pilots: pressure, change, relationships and management support are key. These factors are common to large scale surveys (e.g., the UK Labour Force Survey) and studies involving general practitioner doctors (see Health and Safety Executive, 2018).

From a neuroscience point of view, change can trigger in us the same kind of fight-or-flight reaction as physical pain.

From a neuroscience point of view, change can trigger in us the same kind of fight-or-flight reaction as physical pain. So we should question whether all change initiatives are really necessary within organisations, including changes to working patterns.

In the leadership centre at INSEAD, one of the top-ranked business schools in the world, we have investigated and interviewed many people in different industries and at different hierarchical levels. We also tested our initial findings with experienced executive coaches.

It appears that there are often similar patterns of early signs of stress that we tend to overlook.

After an in-depth analysis we have identified the following five dimensions which we regrouped and published as 'Stress-APGAR'. Stress-APGAR is based on the original APGAR, as used in neonatal medicine to assess the vital symptoms of new-born babies. We have adapted the APGAR concept to stress research. The following five dimensions help to identify early signs of stress:

1. **Appearance:** Any form of physical appearance of stress, such as sleep deprivation, extreme weight loss/ gain, chronic pain, etc.

2. **Performance:** A drop in performance can be a sign of stress.

3. **Growth:** When we strive to achieve and grow, we can handle more challenge. But the opposite is also true: when employees stagnate and stop growing, this could be a sign of overload and stress.

4. **Affect control:** Psychologists have recognised for a long time that stress is often related to a loss of control over one's emotions, both in professional and private contexts.

5. **Relationships:** Stress can be associated with a decrease in the quality of relationships in the workplace. Before going into chronic stress – or burnout – we often observe some form of social isolation.

Although there might be other symptoms to diagnose stress, we recommend managers in certain at-risk professions to look out for these five dimensions in the work context in order to pick-up early signs of stress in the workplace.

Resilience

It is essential to counteract stress, especially in professions like air traffic control and piloting. One important way is to design out sources of inappropriate stress and manage organisations so that stress is not excessive. This is the duty of the organisation and mostly under management control. Another way is by building resilience in individuals and teams. This needs management support, but is also in control of staff. Over the recent years, a simple framework has gained huge popularity focusing on energy: *manage your energy, not your time* (see Schwartz and McCarthy, 2007). Whereas many people in high-stress environments focus on the management of their time (and fail, over and over again), the focus on managing our energy better seems to be far more promising.

Whereas many people in high-stress environment focus on the management of their time (and fail, over and over again), the focus on managing our energy better seems to be far more promising.

According to this framework, we have four resources of energy available to us:
- IQ (mental)
- EQ (emotional)
- PhQ (physical)
- SpQ (spiritual).

We all have our preference within these four elements, but a balance in the four dimensions is helpful for surviving and thriving in high-stress professions. From our experience in INSEAD, the mental and physical dimension are often the unique focus when under stress, while the emotional and spiritual dimensions are often overlooked.

So here are two simple pieces of advice for high-stress professions to build your resilience and your energy. Focus on your sleeping pattern and start to practice relaxation. Even 10 minutes of relaxation (e.g., mindfulness meditation) three times a week could change your brain structurally and functionally after only 8 weeks. If this were a drug, we would call it a 'blockbuster'.

It's good to talk

The trouble with high-stress professionals is that, often, they don't talk about stress. But it is increasingly recognised that talking is not only a good thing, it is essential. António Horta-Osório, recently wrote an article in *The Guardian* newspaper entitled, "It's time to end the workplace taboo around mental health". He acknowledged *"fundamental changes to our working lives during the past decade – flexible working, the end of the nine-to-five working day, an 'always on' culture and the rapid evolution of technology."*

António has written openly about his personal experience and mentions the need for a new mindset that recognises that we all have mental health just as we all have physical health. We can experience physical and mental ill-health and need treatment and support for both. He admitted that, *"I thought I was Superman. I felt I could do everything."* He was not used to asking for advice or showing emotion. But in the end, he learned: *"I was not Superman. And I became a better person, more patient, more understanding and more considerate. It was humbling but you learn."*

António is still the CEO of Lloyds, where he helps to spread good practice to try to ensure that employees don't have to learn the hard way. Here are perhaps three key lessons to learn from his case for all of us: Firstly, we need to break the taboo around stress and talk about it not naively, but openly. Secondly, the risk of extreme stress and burnout is shared by all professionals, even – or especially – those that seem 'superhuman'. Thirdly, we can make it to full recovery, and help others to do the same.

"Now remember, you're not Superman."
"Superman? Pah! I'm an Air Traffic Controller!"

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Check out the new EUROCONTROL IANS course 'Energy Management [HUM-EM]' on the Training Zone website.

Dr Thomas Hellwig works as a professor, programme director and coach for INSEAD in the field of organisational behaviour. He is a trained medical doctor with 20 years of experience (emergency, cardiology, and cancer medicine) in hospitals in three European countries. He has a doctorate in psychotherapy and an MBA from INSEAD. His special interests are in the areas of executive teams, leading change, organisational culture, and health and stress.

THOUGHTS FROM A VELVET SOFA

Reflective practice is a key component of many professions. Thinking critically about our practice is important for professional improvement and for change – opportunities and threats – to be better understood. In this article, **Maciej Szczukowski** compares his experience of ATC with his recent experience of psychotherapy as a new profession, considering how reflection at work has affected his practice, and how it might benefit yours.

KEY POINTS

- **Even after leaving the operational environment, front-line practitioners continue to be somehow involved in the profession.**
- **Understanding and implementing changes requires time for discussion and reflection.**
- **Reflective practice involves time for reflection, learning and self-development, challenging one's personal and group assumptions, blindspots and biases.**
- **Reflective practice can be developed from very early stages of training.**

I have been an air traffic controller for over 17 years. We now handle more than twice as much traffic compared to what I witnessed at my airport on the first day of my on-the-job training. Since that day I have heard a dozen 'maydays' and many more 'pan pans' (and have read about hundreds more). Usually, soon after each of them I have seen many changes and have felt their effect on cooperation, efficiency, safety, and even team morale.

I have seen changes that were discussed properly beforehand, and changes that were just imposed. I have seen changes that worked, changes that failed, changes that were overlooked, and changes that were delayed. Being a trainer at the local training centre, I have also seen the process of change in students' knowledge and awareness of the ATC profession.

I have also been a psychotherapist for almost a year and a half. A psychotherapist is a person who helps to create conditions in which clients can make their existence more satisfying. In a certain way, a psychotherapist is like an air traffic controller who creates conditions that make pilots' work as safe, efficient and satisfying as possible. A decision to begin a second career, so different to the previous one, has shown how challenging change can be. But it has also shown how much one can learn from such a change.

> Now during classroom training, when a trainee asks me what phraseology should be used in a given traffic situation, I ask back what are the difficulties in finding the best solution at this particular moment. Then I ask what is the outcome that she or he wants to achieve.

Reflective practice

Contrary to what many believe, an ATCO's work does not stop when she or he removes their headset. We remain somehow involved mentally, even without conscious reflection. Perhaps there has been an unusual event that we wish to make sense of. We also have recurrent training, secondary duties, and of course read material relevant to our profession, such as *HindSight*. This kind of involvement is even more obvious for therapists. The process of psychotherapy does not only cover the actual face-to-face counselling work (as you may see it in movies, with two people sitting opposite each other). It also requires significant time for reflection, learning and self-development – reflective practice. A professional therapist is also expected to attend regular supervision sessions. This 'supervision' is different to supervision in ATC. A psychotherapy

supervisor is an experienced and highly qualified therapist who discusses the work of the colleague she or he supervises, and complements it with a different perspective, reflection, and ideas, helping to create a strategy for future work.

In my first supervision sessions I quickly realised that I need to make a very important change. At first, I was preparing for them by making scrupulous, detailed notes covering almost every minute of every session. By reading them to my supervisor I tried to deliver the most detailed image of client's diffculties. Very soon, however, I learned that such precision is not necessary, nor even welcome, because it may obscure the bigger picture.

What is more important to discuss and reflect is how the therapist understands and experiences the patient's difficulties and the therapist's own reactions to them. That is essential in order to improve one's practice. This was so revealing for me! After 17 years (so far) of continuous, meticulous and precise work with data, much of which is critical to air and ground safety, I was told that there is an alternative and that it works in a domain in which one deals with most sensitive and sincere emotions. I changed my style and the quality of my therapeutic work improved. I became more interested and involved in how a client experiences something, rather than any specific goal or resolution – something we are so used to in ATC.

Application to training

I decided to use this experience in the local training centre. Now during classroom training, when a trainee asks me what phraseology should be used in a given traffic situation, I ask back what are the difficulities in finding the best solution at this particular moment. Then I ask what is the outcome that she or he wants to achieve.

When approached with such an attitude of concern and collaboration, the trainee is better able to find the resolution, with much less effort and much more satisfaction than if I would simply provide a resolution. That understanding makes the student (and me) more confident that when a real traffic situation evolves, she or he will be better able to re-phrase the phraseological message accordingly. With ongoing reflecton, the student will be able to adapt and respond to a change, and not simply react according to a strict rule. The student will be more competent, in general (see Peeters, 2018).

Reflective practice in aviation?

In aviation the continuous traffic growth, a neverending race for better performance and efficiency leaves less and less space for such thoughtful reflection. This is something for which there is always time in a counselling office. Would I offer a client a set of rules, regardless how tempting it could be for both the therapist and a patient, I am sure it would be rejected as soon as client's inner voice would remind them about all the limitations, pressures and anxieties not yet taken care of. Would I be given a new ATC procedure (or equipment or additional task) without letting me, the person responsible for its use, understand how it takes care of my needs and those of other stakeholders, I would sooner or later look for a way around it. We all would. That is how we act, as humans.

How often do front-line staff engage in reflective reading, discussion and writing about our profession? What is our commitment to reflective practice? Is mutual mentoring something that could be of value to controllers and others in aviation, beyond training and competency schemes?

The word 'reflection' appears many times in this article. From my ATC experience as well as the time I have spent so far on the velvet sofa in my counselling office, I believe that we should invest more time in reflection, including discussions about our practice and about changes that affect our practice, regardless their size or range. Although it requires effort and time, reflecting on experience is vital to ensure that changes are appropriately designed and implemented, and not merely rejected or worked around.

Maciej Szczukowski has been an Air Traffic Controller and OJTI for over 17 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, is an accredited Junior Aviation Psychologist, and is currently undergoing training in integrative psychotherapy.

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LEARNING FROM PSYCHOLOGY AND PSYCHOTHERAPY:

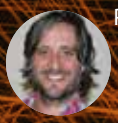
A CONVERSATION WITH DAVID MURPHY

Changes of all kinds can have a profound effect on us, both in terms of our wellbeing and performance. **David Murphy** has worked therapeutically with people, including front-line professionals, for over 20 years, helping them to change, and adapt to change. David talks to Steven Shorrock about dealing with traumatic events and more mundane changes.

KEY POINTS

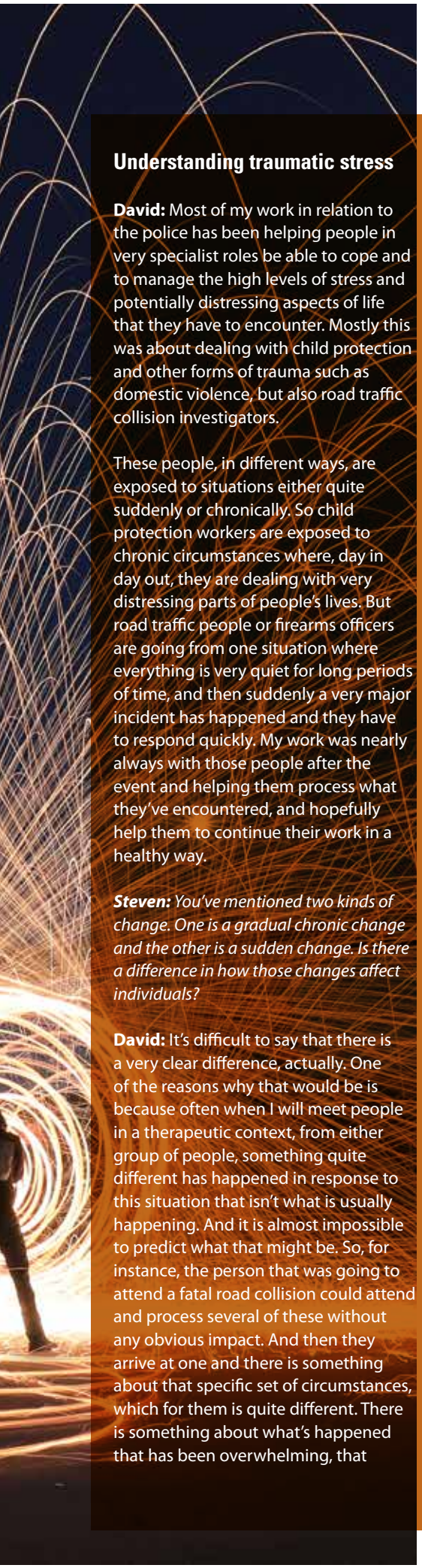
- **People may be exposed to situations suddenly or chronically. Traumatic stress often relates to something different that has happened in response to a specific situation.**
- **In response to traumatic circumstances, people often have distressing reminders, thoughts, images, and feelings. People will sometimes either avoid these or re-experience them.**
- **People can be hyper-aroused, on high alert, or numbed to situations when they have experienced trauma, for a few weeks afterwards.**
- **Adaptability, openness to experience, and ability to talk about challenging changes are constructive ways of dealing with stress. Rigid thinking and denying facts about situations can problematic.**
- **Change is linked to our sensory experience, self-concept, and ideal self.**
- **We tread a line between autonomy and belonging. We may find it hard to speak out about certain things because we fear that we will be rejected by the group. Being able to communicate these conflicts in groups is healthy.**

Steven: *David, thanks joining me. Could you please spend a few moments to introduce yourself and your work?*



David: I am currently Associate Professor at the School of Education, University of Nottingham, and I'm a Chartered Psychologist with a special interest in psychotherapy. Previously I've worked in the UK National Health Service as Honorary Psychologist in psychotherapy in the trauma unit in Nottingham, working for the police in Leicestershire, and also in youth and university counselling settings. My current work is mainly in education, connected to the idea of human growth and development, and education and therapy as different means by which people are able to change and grow in constructive directions.

Steven: *People who work in front-line services will identify to some degree with some of the experiences of professionals such as the police. If you think back to your time at the police, what were some of the kinds of change that people would experience and would affect them professionally and personally?*



Understanding traumatic stress

David: Most of my work in relation to the police has been helping people in very specialist roles be able to cope and to manage the high levels of stress and potentially distressing aspects of life that they have to encounter. Mostly this was about dealing with child protection and other forms of trauma such as domestic violence, but also road traffic collision investigators.

These people, in different ways, are exposed to situations either quite suddenly or chronically. So child protection workers are exposed to chronic circumstances where, day in day out, they are dealing with very distressing parts of people's lives. But road traffic people or firearms officers are going from one situation where everything is very quiet for long periods of time, and then suddenly a very major incident has happened and they have to respond quickly. My work was nearly always with those people after the event and helping them process what they've encountered, and hopefully help them to continue their work in a healthy way.

Steven: *You've mentioned two kinds of change. One is a gradual chronic change and the other is a sudden change. Is there a difference in how those changes affect individuals?*

David: It's difficult to say that there is a very clear difference, actually. One of the reasons why that would be is because often when I will meet people in a therapeutic context, from either group of people, something quite different has happened in response to this situation that isn't what is usually happening. And it is almost impossible to predict what that might be. So, for instance, the person that was going to attend a fatal road collision could attend and process several of these without any obvious impact. And then they arrive at one and there is something about that specific set of circumstances, which for them is quite different. There is something about what's happened that has been overwhelming, that they've been unable to deal with in that particular situation.

Steven: *Could there be a gradual build-up of chronic stress or trauma, which is then be released by a particular episode? And if so, might there could be some signs earlier on that suggest that people need support on before they are tipped over into traumatic stress?*

David: That's possible, but one of the reasons why people experience traumatic stress is because they've been exposed to something which has not been able to be processed and integrated into their self-concept or view of the world in that particular moment. They might have a very fixed view of the world, let's say. These might be ingrained but out-of-awareness beliefs. Then they are presented with a set of information that makes them have to completely re-evaluate those assumptions. Their cherished beliefs about the world are suddenly shattered.

Then people have to do something with that information. Seeing how adaptable they are, how open to integrating this new information, how they are able to talk about these differences and challenges that they are experiencing, will be all really constructive signs.

Somebody who becomes much more rigid in their thinking, who tries to hang onto their cherished beliefs at all costs, and is distorting and denying facts, they might be more of a concern. There is a risk that this person could suddenly be overwhelmed by something when they are unable to protect themselves against this information.

So the way people process their experiences in approaching situations might be a useful way of understanding how somebody might be able to respond to traumatic circumstances. Although an absence of support, overload of work, feeling vulnerable or insecure in your position, would be very important to try to understand.

Steven: *Might some signs be visible, especially to colleagues and managers, when people are experiencing a level of change which is somehow distressing to them? Might there be signs that are more relational, that relate to our communication, or that are quite personal or behavioural?*

David: People are usually experiencing in two ways in response to traumatic circumstances. They may be caught up avoiding situations: reminders, thoughts, feelings. It could be avoiding certain conversations, avoiding reading certain things, avoiding watching the TV.

The other side is that people are caught up in re-experiencing, where you are doing the opposite. You're troubled by distressing thoughts, images, and feelings about what's happened. It's not only remembering. It's remembering with distress. So, often when that's happening, people are more agitated, irritable, showing less understanding or compassion – what is sometimes referred to as burnout. Those signs tend to be more obvious in workplace settings in relationships where people might respond in a snappy way.

The other thing is that people can be either hyper-aroused or being very numbed to situations. So people might really flatten out their feelings and have strong emotional numbing or they might be actually on a really high alert. So somebody knocks their cup over on the desk next to them and they jump up out of their seat. They have such a startled response because their body system is still alert to the potential for a new danger that they've got to respond to. Those are the sorts of things that people might display where they have had to face circumstances beyond what they have been able to process at the time or in the immediate period afterwards.

In certain policework, it's not uncommon to feel any of those things for quite a while after. Days or weeks wouldn't be unusual to still be processing thoughts or images or feelings about what people have had to encounter and still maybe feeling a bit

upset about that. But after a few weeks, you'd expect to see that starting to even out and people should be more able to talk about it again without becoming upset. It takes time for that equilibrium to come back.

Change done to us and by us

Steven: *I guess a difference between people working in emergency services compared to the readers of HindSight magazine, who are primarily air traffic controllers and pilots, would be that first responders would experience events that could be traumatic on a more regular basis.*

In workplace settings any kind of change other than the change that the person is making for themselves and by themselves has to be managed knowing that there is likely to be some sort of tension.

Whereas a professional pilot or air traffic controller probably won't experience that very often but they will experience lots of changes, some of which will feel like they are forced upon them. Listening to thousands of front-line practitioners as well as middle managers, it's the changes that are done to people that seem to be the ones that cause so much stress. Where they have no agency, no choice, no control, and also where they feel that the change is not really in their favour, even if that might be the intention. Do you have any kind of experience in the work that you've done of working with people with those kind of changes, which may not be traumatic but are stressful?

David: The types of changes that we might work with in therapy are those that come from the person themselves. Person-centred and experiential therapy is an approach based on humanistic psychology and the founder of the approach is psychologist Carl Rogers. With this therapy, change takes place within them as a person in the way in which they decide, in the direction at which they decide, and at the pace at which they decide. That whole approach is based on the idea that people are capable and have a right to self-determination. So external controls nearly always create conflict with a person's sense of agency and autonomy. This only doesn't happen when the change that's coming from an external control is completely congruent with the direction of change that the individual is moving towards anyway.

In workplace settings any kind of change other than the change that the person is making for themselves and by themselves has to be managed knowing that there is likely to be some sort of tension.

The self and change

Steven: *You mentioned Carl Rogers. Part of his theory on the self is this difference between life as we are experience it, moment by moment, and our self-concept, which is how we see ourselves. The tension between those things can also relate to changes that are imposed on us – changes done to us rather than by us. What did Carl Rogers have to say about that?*

David: He's saying that inside each person a process of evaluation that will be either towards the maintenance and enhancement of the organism, and its fellows, or a threat to the organism. Every experience is evaluated internally. This is an innate capacity in living organisms to respond and evaluate to the environment.

The self-concept is thoughts and feelings about who I am in relation to my environment, and part of that environment is my family, friends, peer group, culture, etc. But it's really very goal-directed and our behaviours are all directed towards the meeting of some kind of need.

So I might think of myself as being a good air traffic controller. My self image is of somebody as being quite competent and capable. And then a change process is instigated within the work environment where I now feel like I don't know what I'm doing. But my self-concept is telling me, "You'll be able to do it. You're a competent, capable person." But that might be grounded in a whole history of, "Just get on with it. You mustn't fail." There is no room for doubts or saying "I'm not really sure what's happening here". I've got to maintain this concept of myself as a capable person. Because I haven't been able to say, "Actually I'm not always capable", I haven't been able to acknowledge that in my self-concept, it isn't part of who I am. Then if I make a mistake, I'm really stressed, I'm very anxious. The way in which we've developed can really affect us in terms of how we approach things.

Steven: *With certain professions such as air traffic control, professional pilots, doctors, there can be a superhero syndrome, that you have to be super capable at all times in order to do the job. In those professions, there is less space to admit any kind of difficulties or struggles.*

David: Yes. And that's the same with the police officers. In a specialist role, what are perceived to be signs of weakness of vulnerability might mean that they might be asked to stop doing what they do. That is to do with the culture of organisations and professional groups. And it's probably not a very good thing to let it go unaddressed.

Steven: *People might be concerned that if they admit to struggling with a change they've experienced, be it sudden or gradual, traumatic or non-traumatic, their licence to operate could be under threat, especially in highly regulated professions.*

David: What tends to happen is people get caught up in defensive practice. If there is a culture where people feel fearful of acknowledging a struggle or a loss of confidence or some sort of doubt in their understanding or knowledge or capability, then they are far more likely to take actions to defend themselves against something that hasn't actually yet happened. But paradoxically, when people are defending against things that might happen, they are more likely to create the situation that they are worried about.

Personal growth and change

Steven: *Another thing that I'd like to go back to is this idea of growth that you mentioned earlier. Carl Rogers also wrote about the ideal self, which perhaps relates to how we can grow from change. What*

did Rogers have to say about the ideal self in relation to those other aspects of the self?

David: This idea of an ideal self is the self that I think that I should be. That might be based on something that I really want for myself but it might also be based on what other people have told me that I really ought to be. If I really think I have to be something other than what I really am currently then that can be quite a difficult thing. That's likely to lead them into more distress or more disturbance and feeling more anxious.

Rogers also talked about the idea of a fully functioning person. He had an idea that intrinsic in each person is this motivation towards fulfilment of potentials, becoming open to our experiences, being able to trust in myself and also being able to trust others. He was saying that that's the direction of change that people are always striving for, but they are not always able to fulfil.

Often we find ourselves feeling that we can't speak out about certain things because we fear that will have nothing to belong to, or we'll be rejected by the group.

Change, autonomy and belonging

Steven: *I guess one possible barrier to that, especially in occupations such as the ones that we've talked about so far, is colleagues. You, as a young trainee air-traffic controller, pilot, police officer, or clinician, land in an established culture where the ways of doing things, the beliefs, the attitudes, the ways of expressing, are already set. The difficulty for an individual, even though there may be an inbuilt or a natural tendency to wish to be more authentic or congruent, might be disapproval of colleagues.*

So for instance in the face of a major change, you may be quite okay with the change. But you may feel that you can't say that because the group position is that the change is bad. And so a barrier to your being open in expressing what you think may be that your colleagues have made it clear that "this is our position".

David: Yes, we're always treading the line between autonomy and belonging. Often we find ourselves feeling that we can't speak out about certain things because we fear that will have nothing to belong to, or we'll be rejected by the group. This will lead to inauthenticity. However, sometimes people will or might find that the most authentic thing to do would be to be aware that that is what they feel, and that's what the group feels, and then to make a decision based on what they decide is the right thing for them and their group, doing it with full awareness of all of the available information.

Steven: *In that sense either option could be stressful because with one option you're denying your authentic self. And with the other you're denying belonging with a group which is conditional upon your acceptance of group norms and the group's view. One thing that you could do initially is to name what was going on, that I feel conflicted now between my own view and what (I think) you think I should think.*

David: If people are able to do that, that would be a very high functioning environment. If everybody were able to say, "I feel this. I think the group thinks this. I think the group thinks I need to do this. But if I do this I'm going to feel this", then that's a true dialogue amongst members of a group. If that were possible, that would be a very high functioning group. They would know what it is that they're thinking, able to take responsibility for that, and then actually do something with it, which is speak it to the group and see what happens next.

My colleague Stephen Joseph wrote a book called 'Authentic', and one of the things he says in there is exactly what we've just been talking about. He said, know yourself, own yourself, and then be yourself. To know yourself is to have self-awareness. To own yourself is to take the responsibility having known yourself. And then to be yourself is to act in a very real, authentic, congruent way. I think that would be a good message to get across to anyone in any workplace.

Dr David Murphy is a psychologist specialising in psychotherapy. He is Associate Professor at the University of Nottingham, UK, and is the Course Director for the MA in Person-Centred Experiential Counselling and Psychotherapy. His research interests are in the field of mental wellbeing and human flourishing. He has edited books on counselling psychology, relationships and trauma. He is editor of the international journal Person-Centered & Experiential Psychotherapies.
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To listen to the podcast conversation (60 mins) and read the transcript, see https://www.skybrary.aero/index.php/Hindsight_28 or www.humanisticsystems.com

DID YOU KNOW?

New EUROCONTROL operational safety study of mid-air collision risk in Terminal Control Areas and Control Zones

EUROCONTROL has completed a new operational safety study of a sample of A and B severity incidents that occurred in the Terminal Control Areas (TMAs) and Control Zones (CTRs) around airports in EUROCONTROL member states. The study analysed 187 incidents of separation minima infringement and inadequate separation from a total of 553 A and B incidents in the period 2014 – 2016 that were reported to EUROCONTROL. The results of the data analysis concern the following barriers: ATC tactical separation assurance; ATC tactical conflict prevention; ATC collision avoidance' barrier; ACAS pilot collision avoidance' barrier; pilot visual collision avoidance; ATC controlling techniques; and providence. ATC-induced tactical conflicts accounted for 71% of the analysed incident data sample. Recommended areas for further monitoring and analysis, which were over-represented in the data, include:

- incidents in class D and E airspace
- encounters between low level going-around aircraft and the preceding departure
- VFR/IFR encounters in TMA and CTR airspace.

Learn more at https://www.eurocontrol.int/news/new-operational-safety-study-mid-air-collisions-terminal-control-areas-and-control-zones

Aviation and Railway experts meet with the Judiciary in a major conference

EUROCONTROL Network Manager in cooperation with European Union Agency for Railways (ERA), and Romanian Civil Aviation Safety Investigation and Analysis Authority (SIAA), organised an event on 24-25 October 2018 in Bucharest on the theme of *Just culture across industries: Continuing to learn from each other*. Over 150 pilots, air traffic controllers, safety specialists and members of the European judiciary joined together to discuss developments in just culture, helping to improve mutual understanding and closer cooperation.

The conference supports ongoing training of aviation and railway experts and prosecutors, with participation of IFATCA, the European Cockpit Association, EUROCONTROL and ERA. The biannual European courses, and frequent regional meetings, also help representatives of the European judiciary to deal with and discuss aviation accidents and incidents with experts in aviation safety and the legal domain.

Download the conference agenda and presentations at https://www.eurocontrol.int/services/es2-experience-sharing-enhance-safety

TOKAI Tops Sixty ANSPs

There are now more than 60 ANSPs using TOKAI - the Toolkit for ATM occurrence investigation. TOKAI is a web-based application, which helps air navigation service providers (ANSPs) manage the entire air traffic safety incident investigation process. An added benefit is that TOKAI users automatically comply with EU Regulations, in particular Regulation No 376/2014 on reporting occurrences in civil aviation, and Regulation No 390/2014 on performance. TOKAI is free for European users. EUROCONTROL pays for the development and administration costs. The development is steered by users so they get what they really want.

Our European customers include DFS, ENAV, Austro Control, NAVIAIR, Belgocontrol, MALTA ATS and FerroNATS, with NATS and DSNA soon to join. Globally, TOKAI is used by ATNS South Africa, Airways NZ, CAAS Singapore and AEROTHAI Thailand. The FAA has been a contributor and tester, but uses a version of their own.

Drone safety and EUROCONTROL development

Before unmanned aircraft systems (UAS) can operate in controlled airspace, complex simulation exercises have to be run to ensure that safety or airspace capacity will not be affected, and safety assessments are needed to show that the safety level is acceptable.

EUROCONTROL has developed aircraft models for simulating the performance of drones in detail. We have now developed four UAS models, capable of flying at different levels – such as Global Hawk and Reaper. We have included them in our aircraft performance base-of-aircraft-data (BADA), available to anyone who does airspace simulation research.

First exercises have involved simulating a multinational airspace environment with realistic traffic flows and inserting UAS into the traffic mix. We then capture in detail what the controllers need procedurally and in terms of system support to allow UAS to be seamlessly integrated into their normal traffic.

Simulations have also been run on contingency measures, seeing what the UAS would do if there were a significant link failure.

Kevin Harvey, operational team leader for real time simulations at the Experimental Centre, explains: *"Everybody is very excited about drones. But people forget that we're operating in a safety-critical system and we need to assess the overall impact of drones in the airspace overall and that's something that we are only starting to do now."*

Our safety assessment is always done in three axes: operational safety in normal, abnormal and failure conditions. For normal conditions, we have to know what requirements are needed for making the ATM system robust, taking all categories of drone performance into account – including low-speed and low-climb performance.

Abnormal conditions could include strong crosswinds and other environmental events which could cause trajectory drift, or interference and jamming of signals.

"Before they can give permission for drones to fly in controlled airspace, air navigation service providers will have to develop safety assessments to show that the safety level is acceptable in their airspace," says Bruno Rabiller, Safety Team Leader in the Research and Development/SESAR department at the Experimental Centre.

Read the article by Bruno Rabiller on airspace risk assessment for UAS safety at https://www.eurocontrol.int/sites/default/files/publication/Skyway/2018-skyway-68-cover-story-safety-risk.pdf

Read the article by Kevin Harvey at drone airspace simulations at https://www.eurocontrol.int/sites/default/files/publication/Skyway/2018-skyway-68-cover-story-drone-airpsace-simulations.pdf


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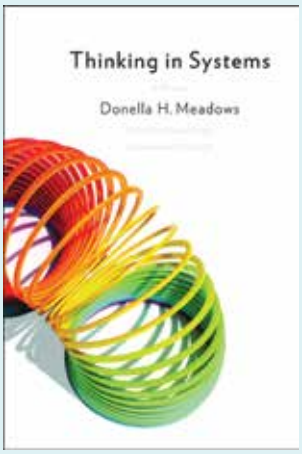
If you want to read more about some of the topics raised in this Issue of HindSight, then these books might be of interest.



Thinking in Systems: A Primer,
by Donella H. Meadows (2008)

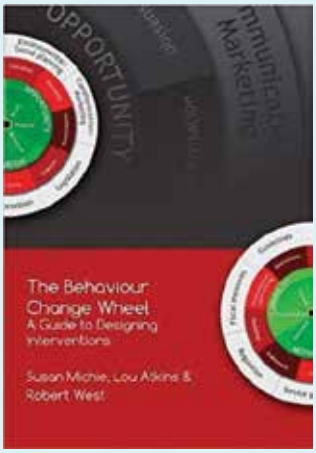
From the publisher:
"Thinking in Systems, is a concise and crucial book offering insight for problem solving on scales ranging from the personal to the global. Edited by the Sustainability Institute's Diana Wright, this essential primer brings systems thinking out of the realm of computers and equations and into the tangible world, showing readers how to develop the systems-thinking skills that thought leaders across the globe consider critical for 21st-century life."

"When I read Thinking in Systems I am reminded of the enormity of the gap between systemic thinkers and policy makers. If this book helps narrow the gap, it will be Dana's greatest contribution." (Lester Brown, Founder and President, Earth Policy Institute)

Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation,
by Tim Brown (Second Edition, 2019)

From the publisher:
"Change by Design explains design thinking, the collaborative process by which the designer's sensibilities and methods are employed to match people's needs, not only with what is technically feasible, but what is viable to the bottom line. Design thinking converts need into demand. It's a human-centered approach to problem solving that helps people and organizations become more innovative and more creative."

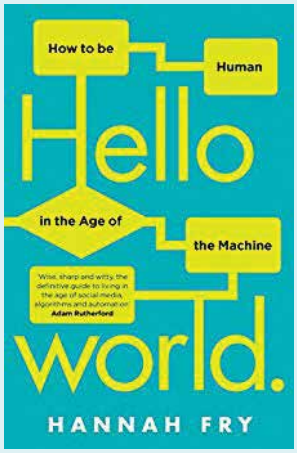
"In his new book, the CEO of design shop IDEO shows how even hospitals can transform the way they work by tapping frontline staff to engineer change." (BusinessWeek)



The Behaviour Change Wheel: A Guide to Designing Interventions,
by Susan Michie, Lou Atkins & Robert West (2011)

From the publisher:
"This is a practical guide to designing and evaluating behaviour change interventions and policies. It is based on the Behaviour Change Wheel, a synthesis of 19 behaviour change frameworks that draw on a wide range of disciplines and approaches. The guide is for policy makers, practitioners, intervention designers and researchers and introduces a systematic, theory-based method, key concepts and practical tasks."

"Michie, Atkins and West provide an excellent step-by-step guide based on their extensive experience and expertise, using their COM-B model." (Marie Johnston, Emeritus Professor of Health Psychology, University of Aberdeen)



Hello World: How to be Human in the Age of the Machine,
by Hannah Fry (2018)

From the publisher:
"Hannah Fry takes us on a tour of the good, the bad and the downright ugly of the algorithms that surround us. In Hello World she lifts the lid on their inner workings, demonstrates their power, exposes their limitations, and examines whether they really are an improvement on the humans they are replacing."

"A stylish, thoughtful, and scrupulously fair-minded account of what the software that increasingly governs our lives can and cannot do ... A beautifully accessible guide that leaps lightly from one story to the next without sparing the reader hard questions... deserves a place in the bestseller charts." (Oliver Moody, The Times)

Would you like to write for HindSight magazine?

HindSight is a magazine aimed primarily at air traffic controllers and professional pilots, on the safety of air traffic management.

As such, we especially welcome articles from air traffic controllers and professional pilots, as well as others involved in supporting them.

Here are some tips on writing articles that readers appreciate.

1. Articles can be around 1500 words (maximum), around 1000 words, or around 500 words in length. You can also share your local good practice on what works well for you and your colleagues, on the theme of each Issue, in up to 200 words (for the 'What we do' section).

2. Practical articles that are widely applicable work well. Writing from experience often helps to create articles that others can relate to.

3. Readers appreciate simple and straightforward language, short sentences, and concepts that are familiar or can be explained easily.

4. Use a clear structure. This could be a story of something that you have experienced. It helps to write the 'key points' before writing the article.

5. Consider both positive and negative influences on safety, concerning day-to-day work and unusual circumstances, sharp-end and blunt-end.

If you have an idea for an article that might be of benefit to others, we would like to hear from you.
Please write to **steven.shorrock@eurocontrol.int**

HindSight

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

The theme for HindSight 29 will be

GOAL CONFLICTS AND TRADE-OFFS

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

We welcome articles and short good practice examples by **Friday 3 May 2019**.
We especially welcome articles written by or with front-line controllers and professional pilots. Some suggested subject areas include:

- stories involving goal conflicts and trade-offs (safety and cost-efficiency, safety and fuel/ CO_2 emission, safety and noise reduction, safety and security, safety and capacity, etc)
- unforeseen and unintended consequences on safety of a focus on other goals
- the use of operational expertise to manage goal conflicts
- training, instruction and communication regarding goals conflicts and trade-offs
- effects of regulations and performance targets emphasising different goals.
- stories of how people, teams and organisations adapted to changes
- assessing and investigating the goals conflicts and trade-offs.

Draft articles (1500 words maximum, but may be around 1000 or 500 words) 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 management
- be presented in 'light language' keeping in mind that most readers are 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.

If you are interested in downloading back issues of the **HindSight collection**
http://www.skybrary.aero/index.php/HindSight_-_EUROCONTROL

In the next issue of HindSight:
"GOAL CONFLICTS AND TRADE-OFFS"

This edition is printed in 8000 copies