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The safety culture stack – the next evolution of safety culture?

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ABSTRACT

Since its inception following the Chernobyl nuclear power plant disaster in 1986, safety culture has impacted a number of industries, including nuclear power, the oil and gas industry, rail, healthcare, and most recently aviation. In a number of these industries, it has become commonplace, and even integrated into the Safety Management Systems of concerned organisations. Yet there is a sense in some quarters that safety culture, while stabilised into a relatively mature process, has perhaps diminished in terms of the returns on investment for added safety. A new, inter-organisational approach to safety culture, called the Safety Culture Stack, may offer a way to rejuvenate safety culture and yield tangible safety benefits. This evolving approach is evidenced by a case study carried out at a medium-sized airport, currently involving fifteen organisations who are collaborating on safety.

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Origins of safety culture

Safety culture has its roots in key accidents across a range of industries: nuclear power (Chernobyl, 1986; Fukushima Daiichi, 2011), space (Challenger, 1986; Columbia; 2003), chemical (Bhopal, 1984), oil and gas (Piper Alpha, 1988; BP Texas oil refinery, 2007; Deepwater Horizon, 2010), maritime (Herald of Free Enterprise, 1987) rail (King's Cross, 1988; Clapham Junction, 1989; Ladbroke Grove, 1999), and aviation (Kegworth, 1989; Milan Linate, 2001; Uberlingen, 2002; Air France 447, 2009). In all these cases, there were strong organisational contributions to the accidents that were

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seen as evidencing insufficient safety culture. In most of these industries, safety culture programmes – often endorsed or imposed by regulatory authorities – have been developed and implemented to prevent recurrence of these or similar consequences. Clearly, from the above list, this has not always been successful. However, despite recurrence of safety culture accidents in certain industry sectors, perhaps these programmes are now 'fit-for-purpose', and some might argue that no more needs to be done, other than to maintain a watchful eye on the safety culture of organisations, and 'repair' if necessary. But in aviation at least, there is growing concern that looking at individual organisations alone is not enough, because the industry is heavily fragmented, with many different companies relying on each other in order to prevent accidents. Aviation has therefore been experimenting with a more joined-up (inter-organisational) approach to safety culture, known as the Safety Culture Stack. First, however, before advancing this new concept, it is useful to go back to the roots of safety culture and trace its developments to the state of the art today.

What is safety culture?

After Chernobyl, INSAG[1] coined the term Safety Culture, seen as a more enduring form of the already-existing concept of safety climate. Safety culture is defined variously as:

- that assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance [INSAG, 1991].
- the way we do things [safety] around here.
- the shared values, actions and behaviours that demonstrate a commitment to safety over competing goals and demands.
- a sub-facet of organisational culture [Reason, 1997].
- made up of safety-related norms (or basic assumptions), values, and practices shared by groups [Guldenmund, 2000].
- how people feel (psychological aspects), what they do (behavioural aspects) and how the organisation operates (situational aspects) in relation to safety [Cooper, 2000].

Additionally, one more definition highlights what positive safety culture looks like:

- Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures [ACSNI[2], 1999].

There are three key aspects the new Stack approach takes from these definitions:

- Safety culture does not exist in a vacuum – it sits within an organisational culture, and so is influenced by the company culture.
- Safety culture is not ethereal, but is bound in practices (the way we do things around here).
- Our values are influenced by our peers.

The way culture works is through personal experience and interaction with our peers. We learn in any society what is acceptable behaviour (norms), and also what to value. In safety culture when we talk of peers, we are usually speaking of peers inside our own organisations, or else professional peers e.g. pilots from one airline talking to pilots in another. The Stack approach aims to enlarge and enrich the peers who can inform and influence our safety culture, by exposing people to different organisations, and hence different company cultures, norms, values, and practices. This means there is a wider pool from which to draw upon when aiming to improve safety culture, and so it enables organisations to both 'raise their game' in safety culture, as well as to help each other when safety is a mutually-dependent process. This inter-reliance to achieve safety is the case in aviation at an airport for example, where perhaps fifty or a hundred different organisations are all working at the same fixed location, and where the desired product is smooth, efficient and above-all safe flights for passengers and businesses. A single accident at an airport has an impact on more than the organisations directly involved, as the financial repercussions of subsequently lost business can be airport-wide, so all organisations have a vested interest in optimising safety and safety culture across the entire airport system.

Today, there is an implicit argument that, if each organisation looks after its own safety culture, all will be okay. But is this the correct, and is it the best 'business model' for safety culture and safety management? This will be returned to, but first, it is necessary to consider the state of the art of safety culture, since if it is purely a theoretical construct, or is not mature as a process, then such issues remain academic.

The state of the art in measuring and improving safety culture

In the early years following Chernobyl, safety culture seemed to be on the one hand all-encompassing, and on the other hand difficult to tie down and concretise. This meant it was difficult to measure, and if you cannot measure something, how are you supposed to manage it? People could

Figure 1. European Air Traffic Management Safety Culture Programme 2003–2017.

recognise *poor* safety culture, but they were not sure what amounted to good safety culture, and whether this was any different to safety leadership, good training, and proper team-working. This added to the problem, since even if you could measure it, you did not necessarily know how to fix it.

But in the ensuing decades since Chernobyl, scientific progress was made, and a number of robust safety culture survey tools have been scientifically validated, e.g. (Reader et al 2015), and processes for periodic measurement and improvement have been implemented (e.g. Mearns et al, 2013). Almost all safety culture processes today rely on a survey tool – a set of psychologically-validated questions that can tease out the various strands of attitudes and values concerning safety in an organisation. The results of such surveys can be analysed and then, via focus groups or interviews, sense-making of the results is further validated, and improvement measures can be derived and implemented, with many of the ideas coming from the organisation itself. Safety culture can be seen as a self-healing process, wherein the analysts help the different layers and sub-groups inside an organisation reflect upon each other's safety values, attitudes and behaviours – including what is going wrong, and what is going right – and then determine how to re-align and reconstruct their safety culture 'architecture'.

One of the largest safety culture programmes in aviation has been that developed and implemented by EUROCONTROL (Kirwan and Shorrock, 2015), who have now surveyed the air navigation service providers (ANSPs, who provide air traffic services) of more than thirty European states (see Figure 1), many of them more than once and some countries as many as four times since the beginning of the programme in 2003. ANSPs are typically surveyed every 3–5 years, so it is possible to see if improvement has occurred. Usually it has, though at least in one case it was showed to slip backwards between the third and fourth survey, when the CEO admitted 'the leadership of the organisation took its eye off safety'.

CEOs at a safety gathering in Belgrade in 2010 were asked what the principal benefit of the safety culture approach was. One CEO stated that it was the only way to know your true risk picture, as well as being a sure-fire way to hear bad news. This is because safety culture, via the anonymous surveys (which include the ability to make free-form comments), and the confidential workshops or focus groups (which do not mix staff with their managers), allows people, particularly at the sharp end to express their safety concerns. There is, of course, a danger that such an approach can turn into a 'grievance survey', but by exploring the statistics of the survey, whose questions have been refined over more than a decade to point towards key safety culture facets in an unbiased way, and by running multiple workshops, the survey team can triangulate towards a realistic picture of safety culture and navigate around grievances or other non-safety-related concerns.

It is not fool-proof, especially if there is no Just Culture (a Just Culture is one where people are not blamed for honest mistakes), and people in workshops fear that if they speak up then certain 'spies' will tell management who said what, with consequences for their career prospects. This indicates a retrograde safety culture, and has been seen during the programme more than once, though it is by no means the norm. Also, management may reject what the survey finds, and again this can and has happened, but usually management reluctantly realises they have to do something. In both these cases, usually by the time of the next survey, things have improved. This is where regulation can perhaps help. In European air traffic, for example, in order to maintain a certain level of safety management maturity on a five-point scale from A (worst) to E (world-class), each ANSP should carry out at least one safety culture survey in order to reach level C, which is the target set by the European safety regulator (EASA). In order to reach level D, the surveys must happen periodically, e.g. every 3–5 years – more frequent is not seen to help since it takes time for safety culture improvement actions to take effect and 'bed in'. A question some ANSPs have been asking recently, particularly those who

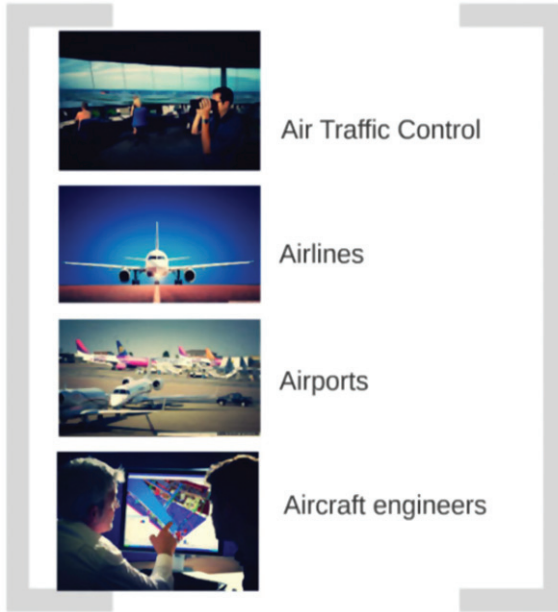

Figure 2. The Stack Concept.

have carried out several successive surveys over the past decade, is what is 'Level E' for safety culture?

The origins of the stack concept

During the ANSP surveys, it was often noticed that there were risks not completely under the control of the ANSP, but rather were to do with one of the stakeholders. For example, at one airport in Eastern Europe, a number of controllers complained that their biggest fear was related to the operations of an adjacent military airport, which occasionally launched aircraft with little warning, very close to the regular civil airline departure stream, causing significant stress as civil controllers tried to make sure there were no airborne conflicts. At another ANSP, certain airlines were adapting their flight profiles to optimise fuel efficiency in new ways, but this was leading to 'surprise' for the controllers concerned, who need to predict aircraft behaviour when they give an instruction to climb or descend, and expect a certain rate of climb or descent depending on the aircraft type. Such events could lead to a loss of standard separation of aircraft, with the controller reporting it being investigated, while the pilots and airlines involved may have been oblivious to the fact that a reportable incident had occurred. At a third ANSP, respect of vehicles crossing the airport runway and taxiways was insufficient, leading to delays as the controller would

have to stop a take-off or taxiing aircraft while a vehicle crossed without proper coordination.

In all these cases there was a lack of coordination, and perhaps even a lack of shared understanding of the potential safety consequences of one organisation's actions on the other. It became clear that unless this inter-organisational issue was addressed in some way, there would be a degree of 'residual risk' that was not being sufficiently controlled. The idea of the Stack, therefore, was to bring all the partners together. It is called a Stack (see Figure 2) because there is a vertical integration of organisations, from the ground upwards[3]. From the outset, there were several key principles, which could lead to improved safety outcomes:

- Each organisation may have '*blind spots*', where they are doing something that can affect another organisation's control of its safety, without knowing it. The only way to resolve this is to bring different partners together and discuss their safety concerns, and see if there are better (safer-all-around) ways of working together.
- Each organisation may have a smarter way of doing safety in a particular area, whether of a technical nature, or to do with safety culture aspects such as Just Culture, reporting, risk awareness, lesson learning, etc. Being involved in a Stack facilitates the principles of *leverage*, and of *accelerated learning*, simply via pointing out that 'similar organisations do it better, so why can't we?'
- Different organisations carrying out similar operations, e.g. ground handlers, can *harmonise* procedures. This means less variation at the airport, e.g. there can be multiple ways to chock an aircraft depending on the ground handling company and the airline. Reducing this variability can help reduce errors. There is also a business benefit since if personnel move from one ground handling company to another, the amount of re-training can be significantly reduced.
- Although the top risks globally for an airport are typically focussed on runway incursions, mid-air collisions, and crashes into the ground, for an individual airport these are very rare and hopefully 'never-events'. More likely are individual fatalities e.g. from falls, or injuries and hazards associated with lower-impact collisions between vehicles. The Stack focuses on *all hazards*, not just the ones that make big headlines. This is important, as otherwise certain services (e.g. cleaning, catering, fuelling, de-icing etc.) may not feel their hazards are as important as those of the airlines and air traffic control. It is important that all staff focus on the risks they encounter in their day-to-day work. Additionally, ground-handling errors (including 'bumps' of equipment into aircraft) are increasingly seen as important, as they can lead to problems for the aircraft once in flight.

- At its core, safety culture is about people's values concerning safety. Values cannot be imposed, but largely arise from their personal experience and peer influence. A more inter-organisational approach allows greater exposure to different organisational cultures and safety value structures. This exposure to different ways of valuing safety can *enrich* safety culture, effectively organisations and people can learn from each other and refine the ways in which they value safety.

These potential benefits of the Stack approach can be seen as safety *affordances*, in that they are new ways of enhancing safety, both at the interfaces between organisations, and within the partner organisations' own safety cultures.

The future sky safety initiative

In 2015, with European Commission funding via the Horizon 2020 framework, a four-year aviation safety research programme was launched, called Future Sky Safety[4]. Of the five safety projects inside this programme, one was concerned with 'resolving the organisational accident'. A principal aim of this project was to export the successful ATM safety culture approach to other segments of the aviation industry, in particular airlines, airports and airframe manufacturers. These segments would often talk about the importance of having a positive safety culture at safety conferences etc., but they did not usually carry out any form of safety culture surveys.

The Future Sky safety culture work occurred in several overlapping phases from 2015–2017:

1. A safety culture survey with a major low-cost airline, at their airport base, surveying all operational groups and some support staff.
2. A safety culture survey of a major global airline, attracting >11,000 replies.
3. A pan-European safety culture survey of pilots[5], which attracted 7200 replies from 33 airlines.
4. Two focused safety culture surveys of two large airframe manufacturers.
5. Six independent and parallel safety culture surveys at a single airport including the airport authority, an airline, a ground-handling service, the air traffic management authority, a de-icing service, and fire services. This led to the formation and development of the Stack process, initially with the six organisations concerned, growing to fifteen organisations by the end of 2017.

The above studies showed successfully that the safety culture approach developed in air traffic and elsewhere could be applied to other segments

Table 1. Safety culture questionnaire items.

Demographics

- What is your primary role?
- How long have you been working in your company?
- Are you a full-time or part-time employee?

Management commitment to safety

- My direct manager is committed to safety.
- My direct manager takes action on the safety issues we raise.
- My direct manager would always support me if I had a concern about safety.
- Employees have a high degree of trust in management with regard to safety.
- Senior management takes appropriate action on the safety issues that we raise.

Collaboration and involvement

- My involvement in safety engagement activities (e.g. safety meetings) is sufficient.
- People who raise safety issues are seen as troublemaker (R).
- There are people who I do not want to work with because of their negative attitudes to safety (R).
- Other people in this organisation understand how my job contributes to safety.
- We are sufficiently involved in safety risk assessments.
- We are sufficiently involved in changes to procedures.

Just culture and reporting

- Voicing concerns about safety is encouraged.
- People who report safety-related occurrences are treated in a just and fair manner.
- We get timely feedback on the safety issues we raise.
- If I see unsafe behaviour by any of my colleagues I would talk to them about it.
- I am prepared to speak to my direct manager when unsafe situations are developing.
- Incidents or occurrences that could affect safety are properly investigated.
- I am satisfied with the level of confidentiality of the reporting and investigation process.
- A staff member who was involved in an error would be supported by the management of this organisation.
- Incident or occurrence reporting leads to safety improvements in this organisation.
- A staff member who regularly took unacceptable risks would be disciplined in this organisation.

Communication and learning

- Information about safety-related changes within this organisation is clearly communicated to staff.
- There is good communication up and down the organisation about safety.
- We learn lessons from safety-related incident or occurrence investigations.
- I know what the future plans are for our company.
- I read reports of incidents or occurrences that are relevant to our work.
- We openly discuss incidents or occurrences in an attempt to learn from them.

Risk handling

- Changes to the organisation, systems and procedures are properly assessed for safety risk.
- We often have to deviate from procedures.
- I often have to take risks that make me feel uncomfortable about safety (R).

Colleague commitment to safety

- My colleagues are committed to safety.

(*continued*)

Table 1. Continued.

- Everyone I work with in this organisation feels that safety is their personal responsibility.
- I have confidence in the people that I interact with.
- My team works well with the other teams within the organisation.
- I can comfortably challenge my colleagues on safety issues.

Staff and equipment

- We have sufficient staff to do our work safely.
- People in this organisation share safety-related information.
- We have sufficient support from safety specialists.
- We have the equipment needed to do our work safely.

Procedures and training

- The procedures describe the way in which I actually do my job.
- I receive sufficient safety-related refresher training.
- Adequate training is provided when new systems and procedures are introduced.
- The procedures associated with my work are appropriate.
- I have sufficient training to understand the procedures associated with my work.

Fatigue

- I have received sufficient training to understand the risk of fatigue.
- The issue of fatigue is taken seriously by this organisation.
- I would feel comfortable reporting fatigue.

in the aviation spectrum, particularly airlines, but also airports and airframe manufacturers. The reports provided useful insights for the organisations concerned, and some of those organisations have been putting in place safety culture improvement plans. However, the last initiative – the Safety Culture Stack – became an ongoing process, one that is still running and has recently been incorporated into the Safety Plan for the airport. This evolution of the safety culture process is described next.

The stack: from individual surveys to collaborative safety culture

The six surveys used a survey tool based on the one developed and validated by EUROCONTROL (Mearns et al, 2011, Reader et al, 2015, Kirwan and Shorrock, 2015), who had at the time surveyed more than 19,000 air traffic controllers from twenty-seven countries across Europe. The survey was tailored to the airline, airport and services contexts. The final survey comprised a total of 51 items (see Table 1 of question items[6]) covering nine safety culture dimensions:

- Management Commitment to Safety;
- Collaboration and Involvement;
- Just Culture and Incident Reporting;
- Communication and Learning;
- Colleague Commitment to Safety;
- Risk Handling;

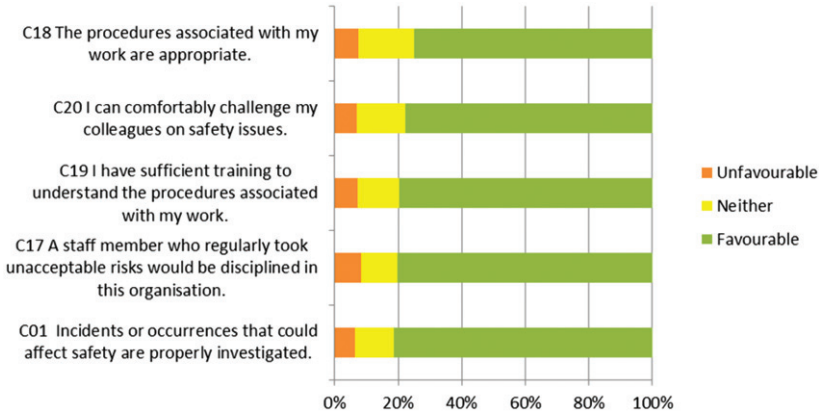

Figure 3. Top 5 most favourable responses in Section C (operational items).

- Procedures and Training;
- Staff and Equipment;
- Fatigue.

The six organisations located at a single airport location were surveyed during the first half of 2016, and all operated out of a single airport. The participating organisations were: Airport; Commercial airline; Ground Handlers; Air Traffic Services; Fire services; and De-icing services. The survey was electronic, and managed through the 'Qualtrics' survey platform. In each organisation, the survey was distributed via an online link. In total, the six organisations had a total population of 1716. These were Airport ($n = 64$); Airline ($n = 1164$); Ground Handlers ($n = 400$); Air Traffic Services ($n = 35$); Fire services ($n = 43$); De-icing services ($n = 10$). For each company involved, the survey was promoted through newsletters, company emails, and social media. There were a total of 594 valid responses included in the study and subsequent analyses. This was equivalent to 34.6% of the total population.

In terms of responses by organisation, these were as follows: Airport ($n = 57$, 64% of population); Airline ($n = 428$, 37%); Ground Handlers ($n = 49$, 12%); Air Traffic Services ($n = 21$, 60%); Fire services ($n = 30$, 46%); De-icing services ($n = 9$, 90%). Within the sample, there were some missing responses (e.g. to a single item).

Figure 3 above reports on the five items that elicited the most favourable responses (i.e. agreed with a positive statement on safety culture, and disagreed with a negative statement) across the six organisations. This reveals the strongest aspects of safety culture across the stack for the operational section (Section C). For the item C01 '*Incidents or occurrences that could affect safety are properly investigated*', 82% of participants responded favourably to this item. This was followed by the item C17 '*A staff member*

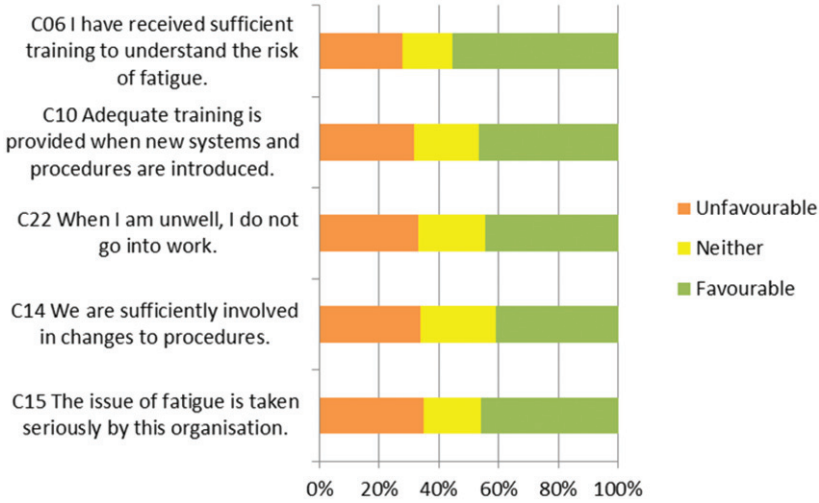

Figure 4. Bottom 5 least favourable items in Section C (operational items).

who regularly took unacceptable risks would be disciplined in this organisation' (80%). Participants also reported (80%) feeling '*I have sufficient training to understand the procedures associated with my work*' (C19).

Figure 4 reports on the five Section C items that elicited the *least* favourable responses (i.e. participants disagreed with a positive statement on safety culture, and agreed with a negative statement). This reveals the weakest aspects of safety culture across the six stack organisations for the operational section. For the item C15 '*The issue of fatigue is taken seriously by this organisation*', only 46% of respondents gave a favourable response. For the item C14, only 41% of participants responded favourably to '*We are sufficiently involved in changes to procedures*'. For the item C10, only 47% of participants responded favourably to '*Adequate training is provided when new systems and procedures are introduced*'.

Figure 5 shows the overall scores on the nine safety culture dimensions for the six organisations (in the figure, 1 is very poor safety culture, 5 is very positive safety culture). This high-level figure shows generally positive responses, but clear variation around most of the dimensions, suggesting that some organisations are doing better than others in certain areas.

Following the surveys, a one-day meeting was held with the six participating organisations. Whilst each one had their own report, and so knew their own safety culture strengths and areas for improvement, no organisation had seen any other's results. After a brief introduction on the survey, Figure 5 was presented to the group. The representatives of each organisation stated that they wished to waive their confidentiality and know which line on the spider-web diagram represented each organisation. This was unanimous, and so the presenters showed them 'who was who'.

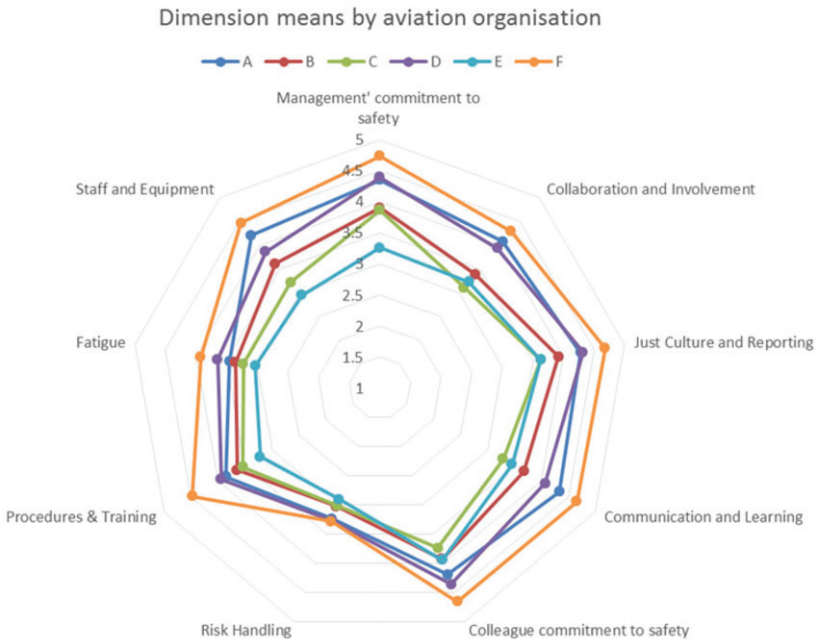

Figure 5. Safety culture dimension means scores by organisation.

A good deal of discussion followed, focussing on who was performing best on each respective element, and why. People wanted to know, for example, what the 'leader' was doing in the area of Just Culture, in practical terms. During the ensuing conversations, it became clear that they all had something to learn from each other. There was not necessarily a 'best' safety culture, and furthermore, in certain areas, they all shared similar problems. There was also discussion around the size and complexity of the organisations, ranging from fairly small companies to large organisations, and how this factor affected the nature of the measures that could be taken to improve or sustain a positive safety culture.

The conclusion of this pivotal meeting was that the study could not end there, and in fact needed to be the beginning of something larger, and more regular. Therefore, a two-day workshop was planned, in which the six surveyed organisations got together to discuss in more detail where they wished to improve and 'borrow' from each other. Three more workshops were held in 2017, each one attracting a larger cluster of airport organisations, the current membership being fifteen organisations, including more airlines, more ground handling services, and more airport services (e.g. fuelling, catering, cleaning, etc.). Experience from the current stack suggests that a workshop/meeting every three months, on average, maintains momentum and focus of the collaborative safety efforts, and that it may

take a year for the membership (i.e. who attends from each organisation each time) to stabilise. Although there is a natural tendency to focus initially on safety-relevant organisations (airlines, ATC, ground-handling etc.), the aim of the Stack is to have a broad membership including diverse services.

What does the stack do?

In terms of early topics for discussion, these were a combination of technical issues, such as determining what are the key risks and areas where collaboration could be most useful for collective safety, and more inter-organisational, focussing on creating e.g. a 'brand' as well as a common mission statement and ways of working so that collaboration between legal entities can actually happen. The approach has used a combination of meetings and workshops, the latter leading to collaboration between the different parties, as a means of working together. As an example, an early workshop focussed on each organisation stating its top 5 key risk concerns, and then the group (the members were divided into several groups) considering how they could help each other.

Each workshop/meeting has been of 1–2 days duration and comprised a plenary session discussing progress on key issues, and a workshop element. The workshops have been jointly run by the head of airport safety and the EUROCONTROL representative from Future Sky Safety (the P5 Project Manager). The workshops typically break into small groups of different organisations, to ensure that no one is left out, and to ensure that the smaller ones can give their contributions. Early on there was a danger of self-censorship since the 'key risks' are always seen as runway incursion and excursion, or an air crash in the vicinity of the airport. Yet, as pointed out by the airport safety manager, the more likely safety events for the airport (and many others) are for example falls and other occupational accidents. This valid concern for the safety of all staff at airport helped 'legitimize' the concerns of those services who might otherwise have felt their safety concerns were not as important.

This, in turn, led to the need to have an overview of all the risks for the airport, and to share these risks amongst the organisations, from slips, trips and falls, to oil and fuel spillages, to ground handling events, to near misses between aircraft on the taxiways and runways. The need to have this shared risk awareness (which would be relevant to any stacks developed elsewhere) was facilitated by four over-arching actions:

i. **Formal recognition of the 'Stack'** group as a transversal safety function at the airport. This, in turn, meant having a stable group of organisations and members, a mission statement, and terms of reference for the group (i.e. role definition and scope).
ii. **Informal recognition of the 'Stack'** was also essential, as otherwise it could be seen as 'simply' another safety management function. Since the central aim of the groups concerned safety culture, the Stack activities needed to outreach to all staff at the airport, whether on the ground or in the air. To this end, there has been a degree of 'branding', with the Stack falling under the umbrella of the 'We are Safety' brand, but also involving the development of a video by mid-2018 showing how the different roles at the airport collectively serve safety[7].
iii. **A designated safety representative** from each organisation able to interface with the airport 'Stack' group, to share incident and accident data and information. The aim is that safety information can be fast-tracked by an information hub that does not require the usual formal processes, which can take significant amounts of time before information is shared to neighbouring organisations. For example, if one airline or ground handling company sees something of concern, it can be transmitted to others very quickly. Underpinning this sharing of safety information amongst competitive organisations is a safety culture understanding that competition must not be allowed to impede safety. This, in turn, is seen as good for business, as any incident at an airport ultimately reflects on all the organisations. The actual implementation of this is still in progress.
iv. **A shared safety dashboard**, where the key safety data for the airport as a whole are available. Furthermore, in line with item (ii) above, the intent is to have this information available on a mobile phone application via an 'App', so that any safety observation, which might be relevant to current staff or those on subsequent shifts, whether pilots, cabin crew, air traffic controllers, de-icers, fuellers, catering staff etc., can be shared within minutes and seen by those concerned (e.g. using 'push notifications' that users can self-select). This can help with the 'Risk Handling' dimension, which was rated as low across the board for all six organisations.

The other principal activity of this Stack has been a focus on a particular area of safety associated with ground-handling safety, already noted by EASA and the European Commission as an area of increasing safety importance (and also linked to the safety culture dimensions of *Procedures and Training*, as well as *Staffing and Equipment*). As with many airports, ground

handling procedures are variable depending on both the ground-handling organisation and the airline. This can lead to a very diverse set of procedures at a single airport, which itself can breed error. The Stack has therefore been focussing on the harmonisation and clarification of ground-handling procedures, producing a series of one-page summaries to achieve common ground handling activities, and therefore to reduce error and bolster safety. Other future 'stacks' may choose different areas of interest, but it is recommended that one is selected per year to ensure there is focus on a key collaborative operational safety issue.

One more area the Stack organisations are now focussing on is Just Culture. This was one of the areas that sparked the formation of the stack, and is quite an issue for the larger aggregation of organisations. The Stack organisations are aiming to consider each organisation's approach to Just Culture, from policy to practice, and to consider whether there could be harmonisation of principles, and even processes.

Concluding comments

What has been compelling about this study is how the organisations have worked together since the surveys, in order to enhance safety culture and operational safety across the airport. The focus on harmonising and clarifying ground handling procedures has been noticed by other airports and by larger inter-organisational governing bodies such as IATA (the International Air Transport Association). The most recent workshop had fifteen organisations, and work is occurring between the workshops (e.g. on harmonising ground handling procedures and developing a safety risk dashboard) so that the Stack is not simply a 'talking shop'. This is no doubt due in part to the commitment and leadership from certain individuals in the Stack. The work of the Stack so far has already impacted on operational procedures for ground handling, and is likely to deliver more agile and rapid risk awareness sharing processes across organisations at the airport via the Dashboard and its associated mobile phone platform 'App'.

Although the six surveys were the impetus for the Stack, and oriented the collective in terms of where to start and what to focus on, to an extent the surveys were more a springboard than an architectural plan for future activities. This has been discussed inside the Stack, since only six of the fifteen organisations have completed a safety culture survey. Whilst the Stack has the intention of an airport-wide survey in the future, the study suggests that not every organisation needs to have completed a survey. However, it is recommended that certain core partners have carried out a survey, to ensure that the activities remain grounded in improving safety culture, rather than for example losing sight of this central aim and instead focussing purely on

particular operational safety issues. The Stack is well aware of this danger, and while it does wish to focus on key operational areas (e.g. ground handling safety), there is a balanced focus on 'softer' but equally important aspects including Just Culture, rewards for safety, shared understanding of each other's roles and job constraints, and awareness of emerging hazards.

The Safety Culture Stack represents an evolution of the safety culture approach. Often, after several surveys over a period of years in an organisation, safety culture can be seen as 'losing its edge', particularly where the organisation has been implementing ever-improving safety culture practices. The question then becomes 'what next?' The Safety Culture Stack can inject new life into the process. Furthermore, with respect to resolving the organisational accident, accidents are not always down to a single organisation. This is particularly so at an airport, where operational safety depends on synchronised and safe operations between multiple organisations – joined up safety – creating a 'safety chain'. In such systems, any organisation is only as safe as the weakest link in that chain. In such a system, it is no longer enough for an organisation to say 'we're safe, if another organisation isn't that's not our problem.' Rather, if one organisation can see how to help another improve its safety and safety culture, it should do so. Passengers and other air transport users should expect no less. A more collaborative and practical approach to safety culture will help aviation maintain its hard-won reputation as the safest form of air transport, in Europe and beyond.

Notes

1. International Safety Advisory Group (INSAG) 1991, Safety Series No. 75-INSAG 4, IAEA Vienna.
2. http://www.hse.gov.uk/humanfactors/topics/common4.pdf
3. A stack in air traffic terms also refers to a number of aircraft in a holding pattern above an airport, waiting to land in sequence.
4. https://www.futuresky-safety.eu/project-5/
5. https://www.futuresky-safety.eu/wp-content/uploads/2016/12/FSS_P5_LSE_D5.4_v2.0.pdf
6. These are the principal questions – there were minor variations for the companies concerned to fit with their organisational characteristics.
7. https://www.futuresky-safety.eu/the-luton-safety-stack/

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