Civil Aviation Authority

Safety Plan

2014–16

Updated March 2014

CAP 1100

CAA House, 45-59 Kingsway, London WC2B 6TE
www.caa.co.uk

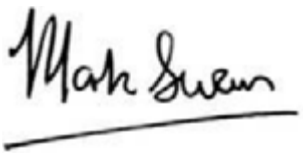
Foreword

Public safety and risks to the consumer are the principal areas of focus for the CAA. Potential threats to safety come in many different forms - specific technical issues, operational and natural events, commercial pressures, human error; the list is long and diverse. By quantifying the relative importance of potential threats, we should be able to create a systematic, effective and proportionate series of action plans that will help us to deal with the highest priority risks.

Some years ago, we began to work to identify the main aviation risks that could cause fatalities; we referred to these in terms of outcomes and they were known as the 'Significant 7'. We set out to identify how these outcomes might occur and what actions could reduce the likelihood of them happening. This work was informed by the CAA's analysis of fatal accidents worldwide (CAP 1036 Global Fatal Accident Review 2002 to 2011) and high risk events in the UK, which highlighted the most frequent scenarios that led to – or could lead to – these lethal outcomes. In most cases, a small number of scenarios account for the majority of events, making it easier to target actions effectively. The actions emerging from this work formed the content of our safety plans in recent years.

Now we are moving into a new phase. We have conducted detailed analysis of the root causes that lie behind these risks. Common to all these scenarios are causal factors such as human performance or technical error; or causes attributable to the environment in its widest sense, such as infrastructure that lacks the latest advances (e.g. dated airspace design or non-precision approaches) or simply bad weather. So, in this Safety Plan, although we retain our focus on factors that could lead to lethal outcomes, we have shifted our attention towards those general root causes that repeatedly underlie these factors i.e. the likelihood rather than the impact of risk occurrence. We have grouped our actions into those relating to people, technology or world.

I see our new Safety Plan as the next progression in a natural evolution towards better safety. I believe that we have identified the right risks, set out the right actions and, with your continued help and support, I believe we will achieve safer outcomes as a result.



Mark Swan
Group Director, Safety and Airspace Regulation

Contents

SECTION 1

Introduction

The safety of UK citizens drives our thinking and directs our activity. We have committed ourselves to enhancing aviation safety performance by pursuing targeted and continuous improvements in systems, culture, processes and capability. The CAA Safety Plan exists to map our journey of safety improvement from 2014 to 2016.

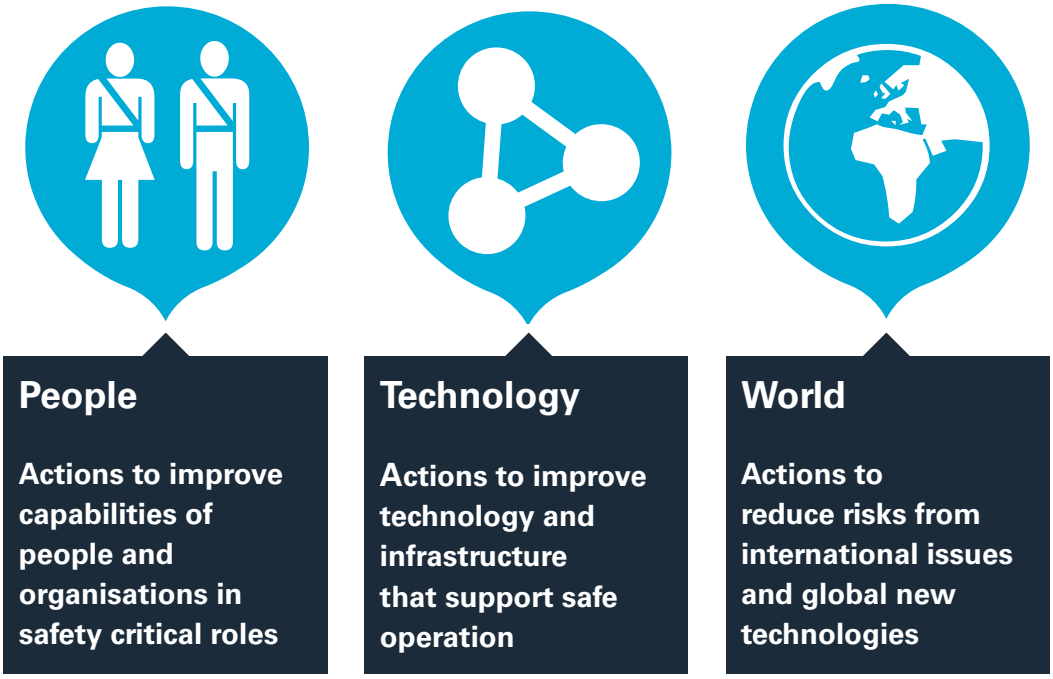
We aim to secure continuing improvements in aviation safety that reflect the increasing expectations of UK citizens and account for changes in the industry and in the global economy in which it operates. Typically, our approach engages with the work of key partners, such as the European Aviation Safety Agency (EASA), International Civil Aviation Organization (ICAO) and, where appropriate, the aviation community itself, to secure the safety improvements that UK citizens should rightfully expect.

In engaging with key partners, the CAA reflects the context of international activity, regulatory change and industry developments in which it works. The CAA is a national regulator within the European system, with EASA at its core, in an international framework provided by ICAO.

Global, European and national economic trends, rising traffic forecasts, increasing environmental awareness and major change projects, such as the Single European Sky and associated developments are some of the significant factors influencing the aviation community. Industry's response has seen new aircraft types entering service with significant changes in technology, air traffic control services featuring higher levels of integration, flexibility and automation, and airports seeking capacity expansion. The impact of security is reaching the technical world with the rise of cyber threats, and social and political attitudes to risk and liability are increasingly raising the bar for safety.

Risk identification is pivotal to our effectiveness. We have a range of sources of data and professional judgement, and we have been working hard to develop our data classification and analysis to ensure that the right information reaches the right people. We are seeking additional measures such as leading indicators of the general safety of the system, better use of flight data monitoring (FDM) and analysis of 'safety barriers' using structured modelling techniques. We have made progress but there is more to do.

In recent years our action plans for safety improvement have focused on prevention of those accidents and serious incidents with potentially lethal outcomes; we referred to them as the Significant 7 accident types. As we, and our partners, have worked on these issues, a number of common root causes have emerged, such as pilot performance, aircraft maintenance errors and the importance of key safety technologies, such as precision approaches at challenging airports. This Safety Plan has refocused our priorities to increase effort on these 'root cause' issues, as an integral part of our continuing actions to reduce the risk of the Significant 7 lethal outcomes. These root cause projects have been broadly categorised into three main areas:



Of course, intentions are nothing without implementation. The Safety Plan is supported by a full business planning and tracking service that will ensure the appropriate resource and delivery is secured. The Significant 7 lethal outcomes continue to be driven by task forces of experts drawn from the CAA and from industry and our 'root cause' projects range from fully funded external programmes to internal workshops with industry and other regulators.

As a regulator, we have substantial projects aimed at improving our own effectiveness and making best use of the resources at our disposal. Under the State Safety Programme (SSP) we are extending our

interest beyond the limits of our regulatory activity to better protect UK citizens. We are shifting our approach to our core regulatory duties and embedding an internal safety management system under the Enhancing Safety Performance programme, and as a result we are reassessing some of our data needs, such as incorporating the findings of audits and industry visits with safety performance. We are investing in more efficient processes, better IT and better customer service. In order to achieve these goals we have changed our organisation structure and revisited our future capability needs.

In this CAA Safety Plan, we set out our view of the key safety priorities and our approach to each.

Context

Air travel is one of the safest modes of transport and the UK has an excellent aviation safety record. In terms of large commercially operated aeroplanes, the UK fatal accident rate is the lowest in the EU and half that of the rest of the world combined.

This does not mean we should relax our safety improvement work. The industry is changing and growing, and on behalf of public safety we aim to maintain and improve on current levels of safety performance. However, aviation is an international industry and working with partners across Europe and beyond has much greater safety benefit than making changes in the UK alone. Accordingly, the CAA is working tirelessly with our colleagues at EASA, ICAO, other National Aviation Authorities (NAAs) and international bodies to collaborate and improve the collective safety performance within the European Union (EU) and globally.

Regulatory environment

The environment in which the CAA operates is complex. A global framework of Standards & Recommended Practices (SARPs) is provided by ICAO; these are embedded into European requirements by EASA and interpreted and applied at a national level through the UK CAA and the UK government. These requirements are not static and continue to develop as the industry changes and best practice evolves.

In addition, the practice of regulation has come under scrutiny in recent years with, in the UK, government initiatives such as the Better Regulation principles and Red Tape Challenge, and of course we must respond to such directives. There are always competing pressures that

must be balanced, such as the need to minimise the burden imposed on the industry while continuing to assure safety on behalf of the public, the need to allow industry the freedom to find its own solutions while defining a uniform standard for safe operations, and the need to allow the industry to take advantage of new business models while ensuring that potential safety risks from such arrangements remain under control. In order to find the right balance for these decisions, we focus on the interests of UK consumers – especially their safety.

The aviation industry is truly global and is continuing to evolve, presenting exciting opportunities for safety improvement. Volume of traffic is increasing, as is the complexity and sophistication of the system as a whole and as new tools and technologies are employed. Developments in airspace for the Single European Sky will be implemented through our Future Airspace Strategy (FAS) and will embed new air traffic procedures such as a common transition altitude, point merge systems and functional airspace blocks. Work is ongoing to expand runway capacity in the south east of England and decisions have yet to be made on how that will be achieved. There are also new types of aviation traffic emerging, such as Very Light Jets (VLJs), Unmanned Aircraft Systems (UAS) and commercial space operations.

It is essential that these innovations are not stifled or restricted unnecessarily but are integrated safely into our aviation system, thereby introducing greater choice for the traveller and consumer and opportunities for growth across the UK aviation industry. The CAA takes a total system view of the aviation sector and new business models such as increased wet leasing, transnational organisations and new commercial arrangements for the provision of services. Aviation security advances may also have safety implications. Consequently, we are able to bring security, commercial and legal expertise to bear in order to improve safety outcomes. Conversely, we are also able to provide safety expertise to improve our security and commercial oversight.

In the UK, the economy is only now emerging from a severe economic recession and we must be responsive to that while at the same time being aware of the safety implications that can result from the need to keep compliance costs to a minimum.

ICAO – the global level

ICAO provides the foundation for mutual recognition of safety standards internationally, and provides the SARPs that all 191 signatory states agree to implement by enacting it into their own national legislation. Although not all states are fully compliant, the ICAO framework provides a common currency through which safety can be developed. The SARPs cover all major areas of aviation and most recently have extended this scope to safety management. It is an ICAO requirement that states establish a SSP to achieve an acceptable level of safety in aviation operations. It has recently published a new Annex 19, which is dedicated to safety management and the responsibilities of states under their SSP. This represents a major shift at ICAO level, from a pure compliance model to one of safety management in aviation, to which we as well as EASA must respond.

The European Aviation Safety Agency (EASA)

EASA is the centrepiece of the European Union's strategy for aviation safety. It develops common rules at the European level, the majority of which are implemented by member state NAAs; EASA monitors their implementation through audits of member states. In short, EASA makes the implementing rules covering all major domains of aviation safety (initial aircraft certification, ongoing airworthiness, flight operations, personnel licensing, air traffic management and aerodromes) while the national authorities apply them in all but initial aircraft certification.

The CAA will continue to support and partner with EASA in its goal to establish performance-based regulation throughout EASA states, targeting resources towards those areas and those activities where the risk is greatest and where the potential safety gains are greatest, to help drive up standards across Europe and promote effective partnership between EASA, the NAAs and, where appropriate, industry for the benefit of the public.

Current challenges

Our current challenges stem from the environmental and technical facets of current operations, emerging technologies, changing business models and societal expectations. While it is beyond the scope of this document to describe all issues that merit our attention, some examples of current issues are outlined below.

Managing regulatory change

With the continuing expansion of EASA's regulatory remit, the opportunity to participate in developing related regulatory material and the requirement to implement these in the UK, plus specific changes in regulation such as new flight time limitation (FTL) standards (see below) and a new ICAO Annex, it is important for the CAA to support the UK industry in making regulatory transition as smooth and unproblematic

as possible. This involves ensuring that our planning accommodates workload peaks, providing for access to advice and taking a pragmatic approach to covering any temporary gaps in coverage or other situations that may affect safety or industry operations. For example, we are running workshops to support industry introducing the new FTLs.

North Sea helicopter safety

The safety of those who rely on offshore helicopter flights is the CAA's absolute priority. Offshore helicopter services provide a vital link to ensure the viability of the UK's oil and gas industry. They transfer the majority of the workforce to and from offshore installations in an open sea environment that is both challenging and hazardous. Recent accidents have understandably given rise to serious concerns, particularly with offshore workers who rely so heavily on these helicopter flights. We therefore initiated a safety review of the sector in September 2013 to examine thoroughly the risks and hazards of operating in the North Sea and consider how these can be managed more effectively. This was conducted in conjunction with the Norwegian Civil Aviation Authority (N CAA) and the European Aviation Safety Agency (EASA) so that a comparison could be made of any safety or operational differences. An independent peer review group was appointed to challenge the work of the review team to ensure that the objectives of the review were appropriate and being met. The review details a set of actions and recommendations that are set out in the helicopter section of this plan.

Implementing European flight time limitation regulations

New European flight time limitation regulations were agreed in 2013. We are clear that the correct implementation of these regulations will enable the UK to maintain its current high safety levels and will provide an improved standardised approach across Europe. The CAA will continue to work with UK airlines to facilitate the introduction of the new system, and take responsibility for enforcing the regulations whilst promoting a robust reporting culture. To that end, we plan to continue to work closely with pilots, the British Airline Pilot Association (BALPA), the European Commission and EASA over aircrew fatigue management issues.

Our preferred approach to fatigue is the implementation of Fatigue Risk Management Systems (FRMS) that are an integrated part of an effective Safety Management System (SMS). However, we do recognise that this is not a simple matter because roster patterns can affect individuals differently and there are no well-accepted measures of fatigue other than self-reporting. Therefore, we are running self-rating studies with major UK operators to begin to monitor the effects of the new FTLs and also seeking improved methods for monitoring fatigue to support operational fatigue risk management systems. We are also exploring tools to help operators assess the impact of fatigue in the context of other factors such as unserviceable items on the aircraft, weather on the sector, experience and crew composition.

Use of portable electronic devices on board aircraft

EASA, following the lead taken by the US Federal Aviation Administration (FAA), has recently published guidance for airlines to expand safely the use of portable electronic devices (PEDs) to all phases of flight – provided the devices are in 'flight' or 'airplane' mode. As a result, UK airlines will be able to seek permission from the CAA to allow their passengers to use PEDs during taxi, take-off and landing. We are providing information for UK airlines to explain the process to follow in order to achieve the required level of safety.

New aircraft technology

Although EASA conducts a thorough safety assessment of new technology applications on aircraft within its certification processes, the day-to-day use of this technology, and its maintenance, can present potential safety issues. We recognise these issues and, as new technology is introduced, we work with the operators and maintenance organisations to ensure that any risks from the new characteristics

are appropriately mitigated. For example, new composite materials are used extensively in modern aircraft structures, and, whereas operators are accustomed to managing aircraft damage from impacts with ground vehicles and equipment, different techniques are required to detect such damage to these new materials. We have worked with airlines, aircraft constructors and maintenance companies on this issue, promoted to ground handling staff the importance of reporting incidents, commissioned research into inspection techniques and liaised with industry to ensure that new technology issues have been adequately accommodated in their processes.

Better regulation for general aviation

A new GA unit is being established within the CAA. The unit will be dedicated to the introduction of more proportionate, effective safety regulation for the GA community that supports and encourages a dynamic general aviation sector for the UK. Fully operational by April 2014, the unit will only regulate where it is best placed to do so or where no-one else can; its regulatory decisions will be guided by the Better Regulation principles of proportionality, accountability, consistency, transparency and targeted.

Protecting the environment

Aviation activity has an impact on the environment, be it a contribution to climate change at the international level or, more locally, noise and air quality impacts. It is clear to all that aviation must continue to make

progress in tackling its environmental impact in order to fully realise its economic potential. Although the industry has taken a positive lead in improving environmental performance, the CAA has a role to play in making an efficient contribution to industry's efforts and through more efficient use of airspace. In our Environmental Plan, we set out the detailed actions to which we have committed, including the use of biofuels, the more efficient use of airspace and de-conflicting the use of renewable technologies with ground-based aviation installations. We continue to assess proposals to improve environmental performance and to work with partners not only to facilitate such improvements but also to secure appropriate safety outcomes.

Improving our effectiveness as a regulator

Like most organisations, we periodically review our own structure and processes. During the period of this plan, four main initiatives underpin our work to improve our effectiveness:

- An SSP that extends beyond conventional boundaries to address the full range of risks in public safety
- A fundamental change in our regulatory approach to realise fully the benefits of a performance-based approach in which we focus our attention on what matters most in safety terms and act to secure the safety outcomes required - our Enhancing Safety Performance (ESP) Programme
- A step change in our processes, skills, tools and systems to support our new regulatory approach and improve the experience of those who interact with us - our Performance and Process Improvement (PPI) Programme
- A restructuring of our organisation to create a solid foundation on which to carry forward SSP and our ESP and PPI Programmes.

The State Safety Programme (SSP)

Working with DfT and other stakeholders, we have produced an update of the SSP as required by ICAO. The basic requirement for an SSP is to set out how an acceptable level of safety performance in aviation is achieved by the state and describe our legislation, our regulatory organisation, our approach to accident investigation and so on. Figure 1 (overleaf) shows how the SSP covers the four elements of state safety policy, state safety management, state safety assurance and state safety promotion in the UK. However, working with government, we have

decided to take a wider perspective for this programme, namely to target the protection of UK citizens from safety risks arising from aviation, recognising that this may require action in areas beyond the traditional scope of the CAA.

It begins by identifying the sources of potential safety risk to citizens and assessing the current extent of the risk contribution.

Our work to address those risks associated with overseas destinations or foreign operators is primarily addressed through the ICAO framework. However, specific issues or hotspots may be identified for a joint project with the state in question, particularly where traffic volumes are high. We address these by forming bilateral partnerships with a small number of key states. Alternatively, we may undertake more limited joint projects with another state to resolve a particular local issue. One example of a successful collaborative partnership with another country has resulted in a dramatic reduction in the number of events involving operators from that country in UK airspace, and now the focus has shifted to events involving UK airlines in that country's airspace.

Similarly, we conducted a short project with a UK airline and air traffic controllers at a major South American destination, where communications were quickly improved and local issues resolved. These projects are characterised by joint workshops that bring together the relevant professionals at the working level (pilots, air traffic controllers) who operate in the location. We are continuing to develop a programme of such partnerships, with a range of local projects now in early stages. This programme of work with other major overseas countries will be progressed during the period of this plan, supplemented by such other local risk projects as may arise.

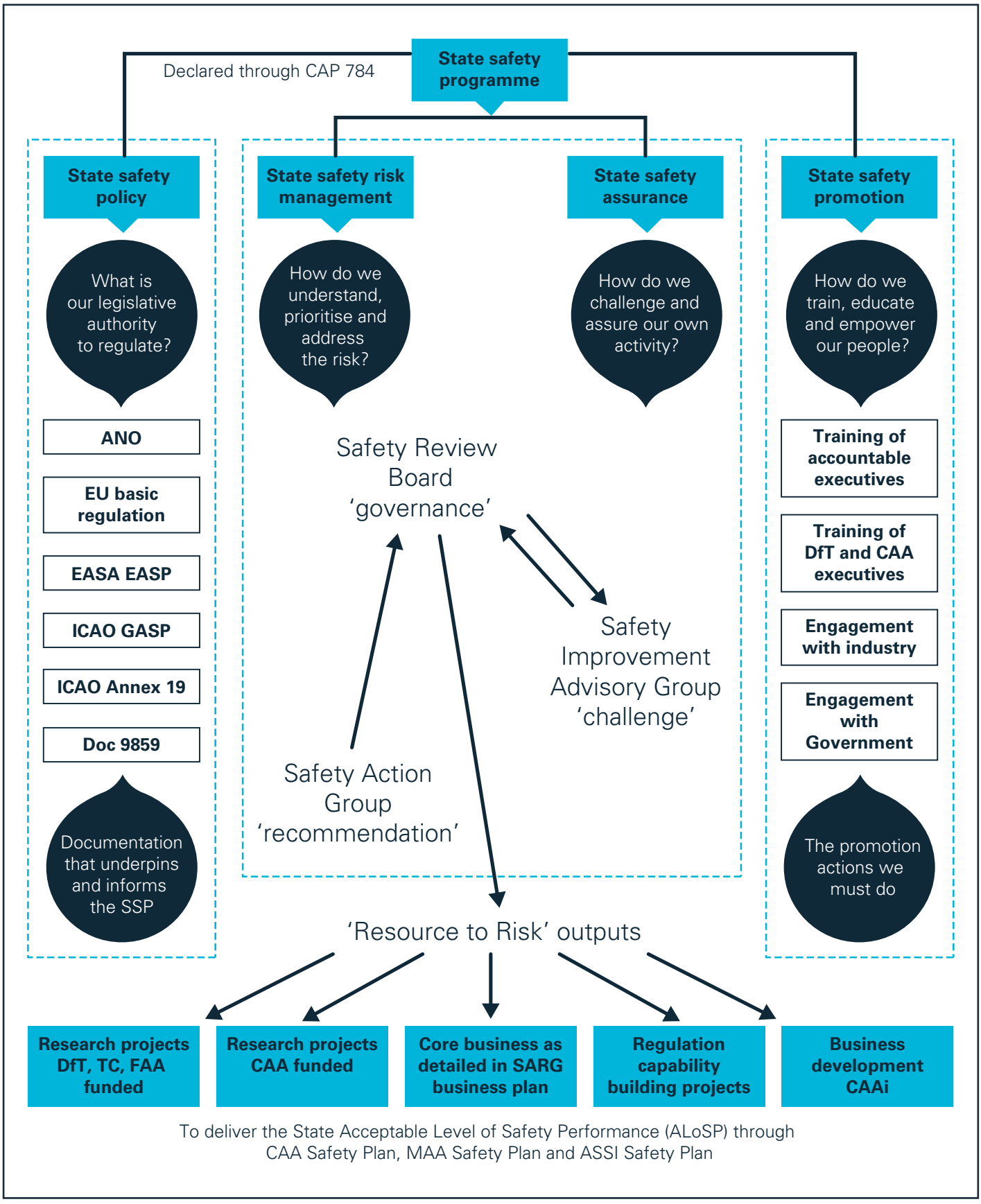


Figure 1: The ICAO SSP structure as implemented for the UK

Work on non-CAA regulated ground services will continue to be addressed through the joint CAA-industry Ground Handling Operations Safety Team (GHOST) and co-ordinated with our colleagues in EASA; further projects may be defined as the reorganisation of the CAA's Safety and Airspace Regulatory Group (SARG) continues. Regulatory change management will be a priority in our core roles and will also be a subject promoted under the ESP programme.

Enhancing Safety Performance (ESP)

ESP is a two-year programme with a dedicated team of 12 seasoned safety professionals that will drive the establishment of our performance-based oversight approach to regulation. It will re-orientate our front line regulatory effort to performance-based regulation, ensuring resources are focused on issues that represent safety risks and reduced where pure compliance checks are less relevant to risk. It aims to integrate the regulatory teams that visit single entities so that, for example, the flight operations and maintenance teams that visit a single airline would present a more joined up regulatory view with a single point of contact, improving clarity and efficiency for the industry. Professional judgement by front line inspectors and surveyors will be incorporated in our data, along with audit findings, to create better data on individual organisations and aggregated for a sector view of issues in the industry. Of course, this requires not only changes to our interface with industry but changes of approach within our own teams; creating this culture shift is an integral part of the ESP programme.

One of the key models used by the programme is the process by which improvement is achieved. This shows that as we work through any activity, we use intelligence from multiple sources to define a specific risk. Once this is determined, we identify the target outcome we are seeking before assessing our options and selecting actions. This is intended to ensure that the nature of our action plans is actually suitable for achieving our goals and not simply an activity related to the subject matter with little real chance of effecting change. We are working to improve flexibility in the workforce to enable new actions to be resourced without disrupting core duties. The final part of the process is to check that the action has had the desired effect using data, and feed the results back to the relevant stakeholders. This is easier to achieve in some cases than others, but it has proved to be a good discipline and is increasingly adopted as a standard approach to problems.

In response to the new stance taken by ICAO on safety management, the ESP programme will establish a fully functioning internal safety management system for the CAA, managing our safety oversight at state level. We have already established a Safety Action Group (SAG) to identify and prioritise safety issues, a Safety Review Board (SRB) to provide governance and direction to the SAG, and a Safety Improvement Advisory Group (SIAG) of senior industry representatives to challenge and advise on our safety priorities, action plans and the ESP programme itself. This also provides the CAA Board with improved visibility and identification and management of safety risks.

Our transition to our new regulatory approach will be complete by 2016 and is expected to:

- improve levels of aviation safety in the UK and of UK airlines operating globally
- ensure our policies and actions are proportionate
- encourage industry to participate in safety improvement initiatives
- improve the value for money of safety regulation.

Performance and Process Improvement Programme (PPI)

In order for the CAA to meet the challenges, and exploit the opportunities, that lie ahead, we have recognised that our internal systems need a significant update.

Over the next four years our PPI Programme will progressively provide the internal systems we need to ensure we can fully implement our ESP programme, helping us to focus on those safety issue that matter most, to make better regulatory decisions and to capitalise on 21st century processes and systems to provide a much better and more efficient service to our stakeholders. To date, the programme has delivered a hub shared services model, combining teams, streamlining processes and offering much expanded online functionality, and has introduced new tools to more effectively capture and collate audit findings, record and track passenger complaints and assist in returning passengers home in the event of a travel operator failure.

Re-structuring our organisation

In order to improve safety performance, the CAA has adapted its structure to address the needs of a changing aviation industry.

We have combined our Safety Regulation and Airspace Policy teams under one management team to form SARG. By bringing these experts together under a single leadership team, we are better placed to improve the coherence of our work across the full spectrum of aviation activities, to deliver the more comprehensive regulatory approach that ESP brings and to take advantage of the improved processes, skills and systems that PPI will offer us.

Within SARG, the new Intelligence, Strategy and Policy team (ISP) provides us with the information needed to focus our resources effectively on the priority safety issues and drive more coherent and consistent safety policy. This will inform the work of our revised capability teams as they work with industry on the key risks across the system. Our business management team secures the required resources for our work, confirms that quality standards are being assured and directs our continuous improvement efforts.

The formation of a General Aviation unit for non-commercial operations of non-complex aircraft again provides us with the platform we need to meet the rightful demands of the aviation community for a more targeted and proportionate approach to our related safety work.

Working alongside SARG, two further changes to our organisation are the formation of a central Policy Programmes Team (PPT) to secure a more holistic approach across the organisation at a strategic policy level and the continued evolution of our new hub customer service unit to serve as a focal point for all enquiries and applications from our stakeholders. Already, the hub is reducing processing time for applications and introducing a range of improvements to our services, such as the continued rollout of online applications and the establishment of a dedicated call centre to provide a one-stop-shop for all enquiries to the CAA.

Not only does our new structure help us to advance our aspiration to improve our effectiveness, it also brings efficiencies in combined administrative support and more flexibility over how our specialists are used.

Much of the change currently underway aims to ensure that CAA embodies the five principles of better regulation identified by a government task force in 1997. Further refinement of our new organisation structure will continue during the course of this plan as we steadily work to more fully embody these principles and to drive forward our key improvement programmes.

Delivery

This plan reflects not only our determination to be clear about the safety outcomes we need to achieve, but also our determination to deliver the plan and so secure those outcomes.

We have recognised that formal project management is important in ensuring the efficient delivery of planned outputs. This includes the recent appointment of a business management team within SARG, which includes a planning and portfolio management office with professionally trained project managers and business planning, assurance and support services, a quality, improvement and business risk team and a resource management and development team. These teams will develop and implement best practice in managing the delivery of safety improvement goals, aligned to corporate objectives. Where a safety improvement project is identified, it is evaluated to determine priority, a mandate

document is raised, resource assigned and delivery milestones tracked. Delivery assurance services support the ongoing projects to ensure that the right outcome is delivered, and performance indicators are being developed to help us assess whether projects have been effective in achieving the target outcomes.

Working in partnership with the industry is one of the key strategies to ensure solutions that are developed are practical and realistic. The task force teams that identify actions to reduce the risk of the Significant 7 lethal accident types are formed of a combination of CAA and industry experts. These will continue as work on these subjects remains an important part of our core safety strategy. New teams to create bowtie analyses of the top-20 risk scenarios have also involved both CAA and industry expertise and these will be made available to industry for customisation and tailoring to individual operational circumstances. Formal liaison groups of industry representatives are well established and functioning for all main aviation areas. The CAA also chairs a UK network of analysts and participates in a European network of analysts to ensure effective data exchange, and we host the UKFDM Operators Group to share and discuss information from FDM programmes.

Resource for improvement projects comes from a range of sources. Expertise and actions may come from core CAA or industry staff resource. If the work is considered to be beyond the defined remit of the CAA, but is required to reduce the risks to UK citizens (for example, working with foreign airlines who fly in UK airspace), then it is supported by additional funding from the Department for Transport (DfT). Some research and improvement work is supported by joint funding with other NAAs such as the FAA or Transport Canada, or may be part of a fully funded EU framework programme that supports the cost of activities and staff time. Externally commissioned work may be funded by the CAA research budget or DfT, depending on whether it is considered part of our core responsibilities. In specialised sectors, project funding may be contributed by the industry. For example, the oil and gas industry, a major user of helicopter transport services in the UK, provides a significant proportion of the funding to improve safety for North Sea helicopters. We also consider actions underway by international safety initiatives and may influence the direction of such work, so that not all issues considered to be a priority have to be undertaken by the CAA itself.

SECTION 2

Risk identification and governance

We are committed to the principle of first understanding and then mitigating risk. We draw upon a range of information sources, analysis techniques and expert groups in order to do so in a targeted and effective way.

Information sources

We receive risk information from a range of sources, including approximately 15,000 Mandatory Occurrence Reports (MORs) each year, multidisciplinary analysis of high risk events (grade A and B MORs) by The High Risk Events Analysis Team (THREAT), analysis of fatal accidents to large public transport aircraft worldwide by a multidisciplinary team of experts in our Accident Analysis Group (AAG), issues raised by the FDM Operators Group, whistleblowers, the Confidential Human Factors Incident Reporting scheme (CHIRP), UK Airprox Board, data from NATS and the findings of our inspectors and surveyors during their industry visits. This will soon be much better quantified and recorded as a result of ESP, making it more accessible to management and safety groups. This range of data can raise a wide array of issues and so it is important for us to find methods to distil this into a coherent risk picture.

Findings

Analysis of some information sources highlights particular risks. AAG showed the prevalence of issues with flight handling and inappropriate actions by crew; THREAT highlighted other specific issues such as Crew Resource Management (CRM) and the rate of airborne conflict at specific locations outside the UK. As the SSP began to draw our attention to risks arising outside our regulated industry, these also began to enter our priorities, with work commencing with the Ground Handling Operational Safety Team (GHOST) and joint safety projects with overseas partners to address risks originating abroad. However, perhaps the most important outcome from these sources was that it drew our attention to the basic accident types that we are trying to avoid.

Almost 10 years ago we began to look for a way of organising our risk priorities and decided to do this by prioritising the most common lethal outcomes (accident types) that could cause a catastrophic loss in aviation (e.g. loss of control in flight, controlled flight into terrain, runway

excursion). These lethal outcomes became known as the 'Significant 7' and have underpinned our safety work in recent years. We ranked them by prevalence of events globally and in the UK fleet and then addressed the main scenarios and issues arising from any area of aviation that directly contribute to these end states. The details of the method are outlined in Appendix 4.

Lethal outcomes

Joint CAA and industry task forces were commissioned and continue to work on the most significant lethal outcomes. The majority of our safety performance indicators align with these risks to monitor events that are precursors to these accidents, such as level busts (potentially leading to airborne conflict risk) or runway incursions. These lethal end states provide the outcome from which to work backwards in order to reverse-engineer identification of the important safety barriers, likely scenarios in which the accident may occur and contributory root causes using bowtie modelling.

Models of all Significant 7 lethal outcomes and the main scenarios that cause them will be available for industry to customise by April 2014. The main scenarios and causal factors that result in these lethal outcomes are known from our AAG and THREAT data, including their relative frequency. Where the important barriers in the bowtie models identify safety critical human actions, these will be the subject of human factors attention, to ensure the human performance upon which safety depends is well supported and realistic.

A shift to root causes

The foundations for considering risk continue to be the Significant 7 and the issues that may lead to them. However, a new perspective has been added to the risk process by establishing the elements of an internal safety management system including the SAG consisting of senior managers from across all areas of SARG.

The SAG has adopted the philosophy that the best method to integrate all of the disparate available data sources is for experts to give them due consideration and then prioritise through a systematic voting method. Of the 84 issues regarded by the group as important to risk, then scoring them using the ARMS method (a well-accepted industry approach for prioritising risk), the top 20 were identified and subjected to further analysis.

For each lethal outcome, a group of experts considered how much an improvement in each of the top 20 risk areas would contribute to preventing that outcome. It became clear which issues, if improved, were likely to make the greatest contribution to preventing each accident type.

By adding the results together, it is possible to show which improvement activities are likely to make the greatest contributions to reducing accident risk generally. Unsurprisingly, the top scoring item is pilot performance.

That does not suggest that we believes pilot performance is very poor and the top risk to aviation safety. What it does mean is that we believe that our best chance of preventing future accidents is to invest in supporting pilot performance because there is a wide range of situations where excellent pilot performance is the most likely asset to mitigate the situation.

Thus, the list of priorities identified by the SAG are the root cause issues that the CAA is prioritising in order to most effectively reduce the risk of the Significant 7 lethal outcomes. This has resulted in a slightly different structure to the Safety Plan, showing emphasis on these root cause elements in terms of people, technology and world, and is a logical development in our ongoing commitment to address the Significant 7 lethal outcomes.

Matching resource to risk

Once the priority list was agreed, the SAG reviewed it to assess whether existing work on the subject was sufficient or whether new additional work should be commissioned. The priority list and proposed additional projects were then presented to the governing Safety Review Board

(SRB) who endorsed the findings of the SAG. It was further validated by industry consultation through the Safety Improvement Advisory Group (SIAG) consisting of senior industry representatives. This is a systematic method to match resource to risk and the projects resulting from this process are included in this Safety Plan.

In addition, the SAG encourages members to raise 'Hot Topics' that arise through their daily work or that simply concern them, even if they have not developed into a tangible safety risk. These have included new airline business models, in service equipment failures, quality of flying instruction, short landing operations, in fact anything that concerns our subject matter experts outside of the formal risk model. These topics are discussed and actions agreed and tracked.

This process is described in more detail in Figure 2. The governance structure is shown in Appendix 4.

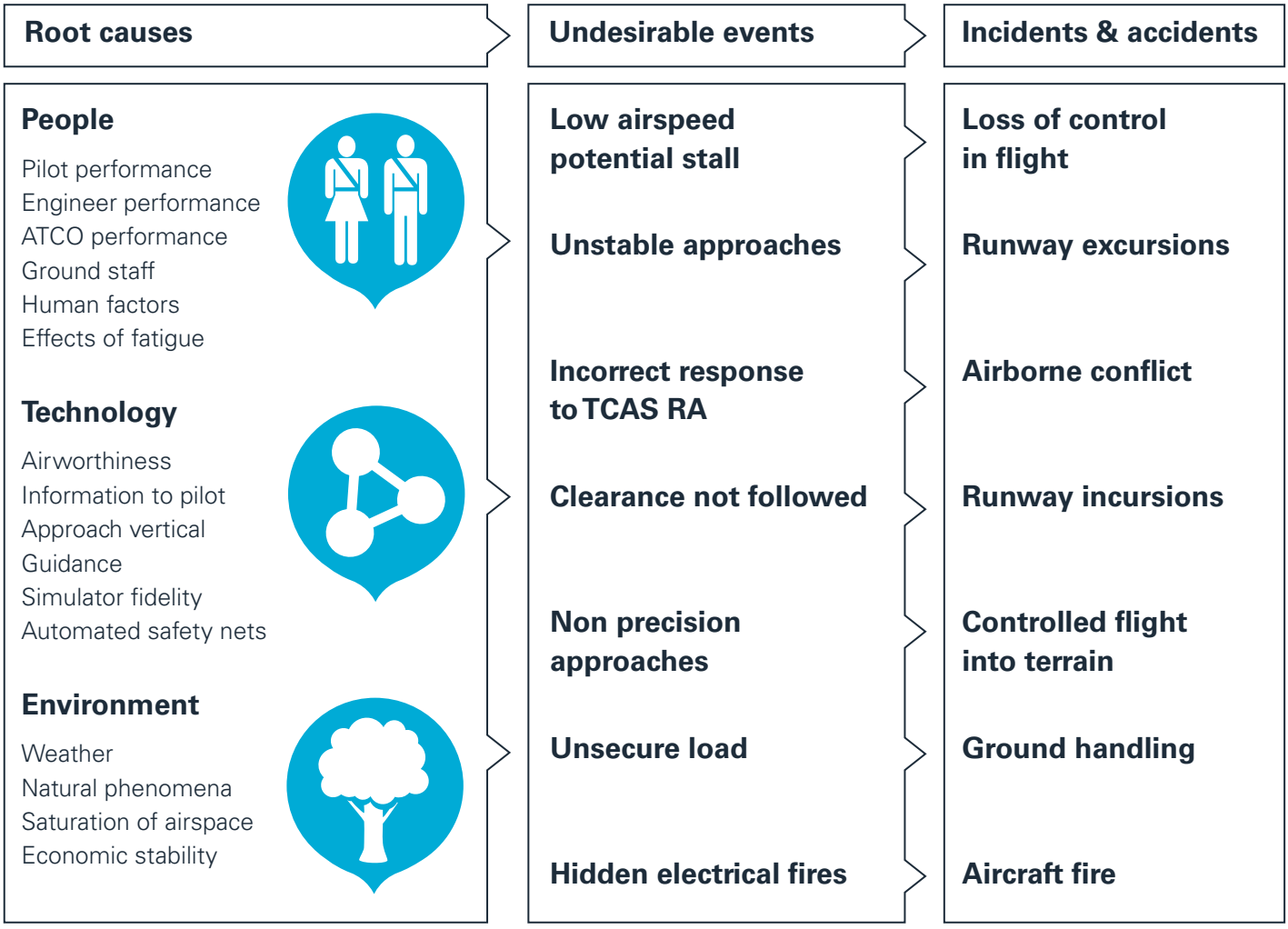


Figure 2 The causal link from root cause to accident types

SECTION 3

Safer people

Aviation relies heavily on the knowledge, skill and professionalism of people – pilots, engineers, air traffic controllers and all those who work on safety critical tasks. We believe that the single most effective way to improve safety is to support the performance of people in these key roles. We believe that such an approach increases the resilience and adaptability of the system. The safer people element describes firstly those things that have the potential to affect all people across the aviation system, the 'human factors', before focussing on the safety improvement activities that refer mainly to particular roles.

Case study 1 – Advance training and qualification programmes

Alternative Training Qualification Programme (ATQP) – introduction

CAA Flight Crew Standards (FCS) has been actively encouraging the uptake of ATQP by UK operators since British Airways started its programme approximately six years ago. Evidence has indicated that, in ATQP operators, pilot skills, both technical and non-technical, have measurably improved (in one example by more than 10%) because checking has been replaced by training that is targeted to need. The upshot of this outcome is that, over time, a reduction in the frequency of safety events can be expected to follow. Although reduced training cost is not a specific objective of ATQP, there is potential for savings. The initial cost of implementation is offset by a 50% reduction in the requirement for line checks and also, potentially, by the lower cost of using a higher instructor:examiner ratio, which ATQP makes possible. ATQP does not require more simulator time than a 'conventional' training/checking programme.

FCS has also been active in trying to encourage smaller operators to implement ATQP by pooling operational data with similar organisations in order to produce the safety data analysis which is a prerequisite to the introduction of an ATQP (see below).

OPS 1.978 makes provision for an operator (i.e. an AOC-holder) with at least two years' continuous experience to develop a training and checking

programme of its own design, to meet its own needs, to replace the more prescriptive 'conventional' training and checking profile specified in EU-OPS.

- An ATQP programme is subject to approval by the national authority. Responsibility for it must be assigned to a nominated post holder.
- The two years' continuous experience qualifying period can be reduced at the discretion of the national authority.
- The content of an ATQP must be based on operational data: FDM programme, line check and simulator pilot performance data, air safety reports etc. In other words, the training programme must be tailored to the company's own operational experience. The proposed implementation plan must be derived from a comprehensive safety data analysis (see Appendix 1 to OPS 1.978).
- An ATQP programme gives no credit towards tests/checks required under Part FCL. Type and instrument rating revalidations must therefore be carried out at normal intervals.
- Under ATQP, all flight crew must undertake an annual Line Orientated Evaluation (LOE) in a full flight simulator. This is not a check as such – it can be conducted by an instructor as distinct from an examiner – but must be performed by the crew to a defined standard of proficiency. If this standard is not met, the pilot(s) are required to undergo remedial training to achieve competence. The pilot(s) may be also required to undertake a further LOE.
- OPS 1.978 require that the level of proficiency established under ATQP must be at least as high as that achieved under 'conventional' training and checking.
- After two years of operating within an ATQP, the validity period of the following EU-OPS checks may be increased:
    - Operator Proficiency Check (OPC) (from 6 to 12 months);
    - Line check and emergency & safety equipment check (both from 12 to 24 months)
- ATQP is based on a closed-loop principle, whereby operational data relating to pilot performance is continuously monitored by the operator and fed back into the training programme.
- To date, UK operators who have implemented ATQP are: British Airways; easyJet; Flybe; Thomas Cook; Thomson; Virgin Atlantic
- ATQP in the UK is regarded as a success story by everyone involved: operators, trainers, the pilot community and CAA inspectors.

Human factors

Aviation uses complex systems and there is evidence that, at times, the level of human performance that these systems demand is simply higher than can be reasonably expected. Even the most professional and competent human beings will occasionally vary performance or do something they did not intend. If people cannot perform their safety critical tasks to the level required, then the circumstances must change to allow them to perform better or the system must change to reduce the reliance on their correct performance and so ensure safety is maintained.

Helping people perform better may include additional training, reducing distractions or time pressure, better equipment design or procedures, new tools, managing fatigue, or improving team dynamics and communications. Where the level of performance required still cannot be achieved reliably, other system features could include checks by a second person, automated systems, alerts or safety nets, making the task simpler, or making errors easier to detect and rectify.

Recognising the significance and scale of this issue, the CAA set out, in 2013, its response in a comprehensive human factors strategy document. Once the current review of the comments received during the consultation process is completed and the document revised, this CAA Strategy for Human Factors (HF) will direct our Human Factors Safety Improvement Programme over the coming years.

- A new HF capability will be established and the HF strategy published (completed by April 2014) with wider HF training for CAA staff (December 2014).
- Bowtie analysis will be undertaken to identify safety critical human tasks (completed by December 2014).
- Performance on those tasks will be examined and any necessary improvements identified (completed by February 2016).

Outcome

To reduce the risk resulting from a mismatch between the human performance that is depended upon for safety and the actual performance likely to be achievable in the situation in which people are working.

Fatigue

Fatigue is an aspect of human performance that is difficult to accurately track; it is complex to measure and forecast with individuals responding differently, and sometimes unpredictably, to factors such as roster patterns. The most publicised area of fatigue is with flight crew, but engineers and ATCOs must also be protected from fatigue. New projects will target:

- Self-rating studies of pilots in two major UK operators, engineers in one major UK operator, and ATCOs in a UK air traffic centre to build a general picture of subjective fatigue and (for pilots) to monitor the situation under new flight time limitation requirements (completed by December 2014).
- Exploratory research to find a more objective, possibly physiological, measure of fatigue that is predictive of task performance (completed by August 2015).
- Development of an experimental tool to assess the combined effect of fatigue in context with additional factors that may challenge crew, such as unserviceable items on the aircraft, poor weather, challenging destinations, training flights (completed by September 2014).
- Education on successful fatigue management for both industry and individuals (completed by December 2014).

Outcome

To improve our ability to measure and monitor the level of fatigue present in safety critical professionals.

To promote effective fatigue management techniques.

Language

Human voice remains the primary means of communication in aviation, so it is crucial that language is clearly understood. With the international nature of aviation, many people are communicating in non-native language and even native speakers may have regional accents or dialects; there are sometimes variations from ICAO standard phraseology or subtle differences in assumptions or understanding of specific terms. All of these could pose a safety risk. Actions to tackle this include:

- research to explore the main issues with language in verbal communication in order to determine whether further action is needed (completed by January 2015)

- working through EUROCONTROL's Safety Regulation Commission (SRC) to secure agreement for English to be the only language used at major international airports, in order to improve situational awareness and common understanding (this will be subject to safety analysis conducted separately in each state) (EUROCONTROL Provisional Council accepted the ruling in December 2013)
- CAAi continuing to provide language assessment globally in compliance with the provisions of ICAO 9835, Language Proficiency Requirements, through the development of the CAAi Expert Level Six Assessment (ELSA) and English for Aviation Language Testing System (EALTS) delivered with Language Testing Assessment Services.
- development of a suite of tools for the training and support of aviation English language proficiency expertise to help raise proficiency and safety standards across the aviation community by CAAi

Outcome

To reduce the risk of safety events arising from poor use of language or use of languages other than English.

Just culture

Just culture can be seen as key to successful implementation of safety regulation; it allows learning from accidents, incidents and occurrences so that appropriate action can be taken to prevent repetition of such events.

The measurement of 'Just Culture' is inherently challenging; it is often simpler to measure the outcomes derived from a lack of it. The issue of just culture cuts across all personnel involved in the aviation industry. We are looking to investigate the issue of under reporting of safety issues as a measure of just culture and to better understand what people report on and why. We have several projects underway, including specific projects to investigate under reporting in flight crew and cultural surveys conducted during oversight inspections. The pathfinder studies in this area are focused on the ground service providers. This is due to the fact that there is a low incident reporting rate by airside workers, even though there is a legal requirement to report safety incidents to the CAA. We believe this is driven by a culture among the ground handling community that tends to apportion blame and discourage open reporting of incidents.

To encourage the reporting of safety events, a joint CAA/industry group - The Ground Handling Operations Safety Team (GHOST) - has collectively developed a just culture statement that is being promoted at UK airports. It states that just culture is considered to be: "A 'culture' that is fair and encourages open reporting of accidents and incidents; however, deliberate harm and wilful damaging behaviour is not tolerated. Everyone is supported in the reporting of accidents and incidents."

A campaign to assist with the roll out of the statement aims to raise awareness of the concept among airport staff and their stakeholders, with the overall aim of improving safety.

Outcome

To reduce risk by enhancing our ability to learn from reports of events and how they occur, particularly in the ground handling area.

Pilot performance

Pilots are absolutely the front line for safety. Data from 250 fatal accidents involving large public transport aircraft shows that 66% of fatal accidents worldwide include flight handling issues and 28% include inappropriate action by crew. In UK high risk events the single most common contributor was CRM (22% of events). Anecdotal evidence, and small-scale sampling activity by the UK CAA, indicated that variations in flight examiner skill testing for professional pilot licence issue may exist across Europe. The introduction of the EASA Aircrew Regulation in 2012, as part of European law, simplified cross-border training and licence testing activity. This change in European law focused attention on the potential safety risks associated with any variation, as pilots taking their skills tests anywhere in Europe may fly UK aircraft and qualify for a UK license. Our work will be initially focussed on:

- working with EASA to collect data on the standards of pilot skills tests across Europe. This will raise any variations and help EASA ensure that the right regulatory measures are in place to assure all pilot skills meet the standards required (completed by April 2015)
- increasing our focus on improving flying instructor quality in the UK (completed by December 2014)
- reviewing the pilot training syllabus (completed by April 2015)
- updating guidance on CRM (completed by April 2014).

Outcome

To reduce risk of the dominant causal factors in fatal accidents (flight handling and inappropriate action by crew) by ensuring that training received is fit for purpose and that skill tests throughout Europe uniformly ensure the required standard has been reached.

To reduce risk from the dominant causal factors in UK high-risk events by updating and enhancing the guidance available for CRM training.

Engineer performance

Engineer performance is essential to provide airworthy aircraft for flight. CAA data shows that in 29% of fatal accidents and 26% of UK high-risk events, technical failure is present. The data suggests that there are a number of recurrent themes: maintenance control, incomplete maintenance and incorrect maintenance. These elements, coupled with the CAA audit findings review which highlighted the need to generally improve the industry quality system, will now be taken forward as part of a new project aimed at delivering real and lasting safety benefit.

New projects will target:

- human factors training and awareness (completed by December 2014)
- ensuring repeat errors are reduced (completed by July 2014)
- production planning using bowtie analysis (completed by September 2014).

Outcome

To reduce risk arising from aircraft technical faults by reducing the frequency and severity of faults due to engineering errors in maintenance and production.

Air traffic controller performance

Air traffic control plays a vital part in managing UK air safety in our busy, complex airspace. This makes the performance of controllers high in our safety priorities.

- We will continue to engage with EASA to ensure that competency standards and fatigue management systems are appropriate. The comment review document for the rule is on the EASA website at http://easa.europa.eu/rulemaking/comment-response-documents-CRDs-and-review-groups.php (ongoing).
- Together with industry, we will review the Flight Information Service Officer (FISO) currency and licence validity requirements, and also develop best practice guidance material on the development of unit training plans and implementation of rostering and fatigue management systems (completed by November 2014).
- The impact of automation in air traffic centres is being explored with industry to increase awareness and provide guidance material (completed by December 2014).
- We will continue to work with EASA on measures to address competency and training requirements for air traffic engineers. Proposals for regulation in this area are included in the proposed Air Traffic Management /Air Navigation Service Implementing Rule (completed by December 2015).

Outcome

To reduce the risk from ATC errors by ensuring that controller training and ATC equipment supports their needs.

SECTION 4

Safer technology

Our safer technology work incorporates all of those elements of the aviation system under our regulatory remit that people interact with in order to deliver safe aviation; 'technology', in this instance, is defined as the application of knowledge for practical purposes and therefore includes technological advances, procedures, airspace structure and design. The work can broadly be considered in terms of relating to airspace, operations and airworthiness. Due to the inter-connected nature of aviation, much of the technology will have implications across all of these.

Case study 2 – offshore helideck lighting

Standards for offshore helideck lighting for night time operations derive from the international minimum standards contained in ICAO Annex 14 Vol.2 and are detailed in CAA's standards material published in CAP 437. As a result of concerns raised within the industry, the CAA determined to investigate ways of improving the lighting of offshore helidecks. Referring to the evidence obtained from the independent offshore helicopter pilot opinion survey reported in CAA Paper 97009, the following three main problems existed with helideck lighting systems:

- The location of the helideck on the platform is often difficult to establish due to the lack of conspicuity of the perimeter lights.
- Helideck floodlighting systems frequently present a source of glare and loss of pilots' night vision on deck, and further reduce the conspicuity of helideck perimeter lights during the approach.
- The performance of most helideck floodlighting systems in illuminating the central landing area is inadequate, leading to the so-called 'black hole' effect.

A research project was defined and instigated via the CAA-run joint industry Helicopter Safety Research Management Committee (HSRMC). This comprised a series of three trials and culminated in the production of a specification for a new offshore helideck lighting scheme comprising revised helideck perimeter lighting and replacement of the floodlighting with illuminated circle and H markings. An early deliverable was a revision to the specification for the helideck perimeter lighting which was adopted by ICAO as a new international minimum standard, mandatory from

January 2009, and which was incorporated in CAA's standards material (CAP 437). All UK offshore helidecks have been equipped with the new perimeter lighting.

The concept of the 'circle and H' lighting was new and, although ICAO had accepted the circle and H lighting as an alternative to floodlighting, further validation by trials at offshore installations was considered to be necessary prior to roll-out. The CAA replaced floodlighting with the new circle and H lighting in its standards material in 2013 (CAP 437, 7th Edition, Amendment 01/2013).

Having been bought into the project from the outset and having participated in the trials, the helicopter operators have always been very supportive of the initiative. The UK oil and gas industry has also supported the work, and the safety benefit of the new lighting was recognised by the UK AAIB in its reports on the accidents to G-BLUN in Morecambe Bay in December 2006 and G-REDU in the North Sea in February 2009, the latter resulting in a safety recommendation to retrofit the new lighting scheme.

The UK oil and gas industry has committed to implement new lighting via the Oil & Gas UK (OGUK) Aviation Safety Technical Group (ASTG). CAA is supporting the retrofit of the new lighting through participation in the OGUK working group, and through support and advice provided to lighting equipment manufacturers.

Airspace

Aviation relies on the scarce resource that is airspace to ensure those passengers, businesses, the military and leisure flyers enjoy the many benefits aviation brings. The basic structure of the UK's airspace was developed over forty years ago. Since then there have been huge changes, including a hundred fold increase in demand for aviation.

Across Europe there is a drive to modernise airspace and ATM through the Single European Sky (SES) programme. The UK and Ireland are meeting those and other issues through the FAS which set out a plan to modernise airspace by 2020. In the UK the CAA established the FAS initiative to coordinate the local delivery of SES, focusing on early deployment of the solutions developed through the technology pillar SESAR. The UK is well placed to realise the benefits of SESAR solutions and the FAS Deployment Plan was referred to as 'the first tangible step towards SESAR deployment across Europe' by the executive director of the SESAR joint undertaking.

Multiple initiatives are required to improve the way air traffic is managed and moves around the network, including:

- implementing a fundamentally more efficient route network in the busy terminal environment
- removing fixed structures in the upper airspace enabling more direct routes
- streaming traffic through speed control and improving arrival punctuality to manage queuing and reduce stack holding
- redesigning departure procedures to allow aircraft to climb continuously and increase runway throughput
- connecting airports electronically into the network to share accurate information and better sequence departures and arrivals.

The FAS is expected to deliver benefits in excess of £2bn by 2030 for passengers, industry and the wider community. By 2020 over £0.5bn will be realised through 10 core initiatives that aim to reduce fuel burn by 160,000 tonnes a year, CO2 emissions by 500,000 tonnes a year and passenger delays by 1.1m minutes a year.

The future system will allow increased automation of air traffic control resulting in more direct routes for aircraft in a more flexible and safer system. The CAA will identify appropriate processes and procedures to ensure the complex projects initiated under the FAS, for example those that involve the transfer of risk accountability from ground to cockpit, are implemented safely and any safety impacts of the changes are closely monitored.

Controlled airspace

Within the UK Future Airspace Strategy (FAS) there are proposals for a fundamental redesign of controlled airspace, in particular within Terminal Manoeuvring Areas (TMAs), to produce safety, capacity, efficiency and environmental gains. This re-design will incorporate the goal to move away from tactical ATC interventions, towards a more system wide approach. The work will consider the following:

- Raising the Transition Altitude (TA) in the UK would improve the safe and efficient use of the UK's airspace. A higher TA provides more opportunities for continuous climbs on the busiest routes, effectively 'lifting the lid' on the busy terminal airspace. A higher TA has also long been requested by pilots to remove the need to change altimeter settings during the busy departure phase (ongoing).

- A UK state Transition Altitude (TA) safety plan will ensure that the future TA public consultation is supported by a safety rationale, and we provide advice and guidance to industry on required safety assurance activities. (ongoing).

Outcome

To reduce the risk of airborne conflict by improving the efficiency of airspace design.

Uncontrolled (class G) airspace

We are committed to reducing airborne conflict events in class G airspace. Providing pilots with information on other aircraft in their vicinity may help to reduce the risk of airborne conflict in uncontrolled airspace and may also help to reduce the risks arising from unintended entry into controlled airspace. We are exploring the potential for new technologies and are conducting research into how this equipment could be more easily approved for use while ensuring there will not be any unintended consequences such as distracting or misleading indications to users, or interference with communications. The FAS also envisages improvements to uncontrolled airspace. New projects include:

- removal of the use of class F airspace, ensuring that, where traffic levels warrant it, a higher level of service is available (underway but for delivery by November 2014)
- building on the earlier recommendations of the 21st century class G project, we have recently initiated a piece of work to consider what the requirements might be for a class G environment that safely meets the needs of all users (completed by June 2014)
- under the Airspace and Safety Initiative (ASI) umbrella, all stakeholders continuing to address the risks in the class G environment with a view to improving the compatibility of operations (ongoing)
- trials to enhance the visual conspicuity of light, low cross-section composite aircraft, which have already been commissioned. The results of this trial are currently being analysed before determining the appropriate course of action (completed by April 2015)
- a project to gain a better understanding of why infringements occur. The results will be used to inform targeted actions to improve pilot airmanship and navigation skills. This will help inform a review of the PPL/LAPL pilot training syllabus and training methodologies (completed by April 2016).

Outcome

To reduce risk in class G airspace by making use of better training and technology available, in order to reduce collisions or near collisions and reduce significantly the number and risk of airspace infringements.

Electronic conspicuity

As part of the suite of projects to reduce airborne conflict, electronic conspicuity would enable aircraft to be more easily identified and located. This work is funded through the DfT SSP with the aim of making technological solutions more cost effective for users. The deliverables will be:

- to research the use of uncertified Global Positioning System (GPS) devices: a performance study, looking at the development of an application for mobile devices (completed by December 2015)
- development of a device to deliver electronic conspicuity with proof of concept flight testing and analysis (completed by December 2016).

Outcome

To reduce the risk of airborne conflict in class G airspace, but importantly also inside controlled airspace when an infringement occurs, by exploiting the potential of emerging technology.

New navigation performance standards

Implementing a Performance Based Navigation (PBN) system is key to delivering the safety benefits and modernisation of airspace. As part of FAS, projects include:

- implementing satellite-based approaches to runways (completed by December 2016). This will be reinforced by the Single European Sky rule, which will require PBN implementation by the end of 2018
- continued promotion of Approach with Vertical Guidance (APV) to UK airports and selected overseas destinations (ongoing)
- the potential to introduce satellite approaches to non-instrument runways and at aerodromes without air traffic control is being consulted on (April 2014).

Outcome

Reduce the risk of airborne conflict, controlled flight into terrain and runway excursions by introducing technology.

Airworthiness

Airworthiness issues occur in a significant number of high risk events. In order to minimise these risks we have devised a new central approach to Aircraft Continuing Airworthiness Monitoring (ACAM) audits which are being implemented and monitored for effectiveness. Similar plans for the oversight of line stations and the supply chain are being considered to address risks in these areas.

The need for priority action on engineer performance has been highlighted, particularly in maintenance. Data suggests that there are three broad themes: maintenance control, incomplete maintenance and incorrect maintenance. These elements coupled with our findings, which highlighted the need to generally improve the quality system, will now be taken forward as part of a new project aimed at delivering real and lasting safety benefit. Actions in this area are shown in the engineer performance section.

The CAA has also identified potential issues and hazards associated with new technologies, particularly the introduction of new types of aircraft. We have therefore introduced a new process to highlight these issues.

Outcome

To reduce the risk from airworthiness issues by reducing the risks from human error in maintenance and production engineering activities.

To improve the effectiveness of our oversight by reviewing the safety impact of previous findings and increasing our focus on risk.

SECTION 5

Safer world

Our 'Safer World' work aims to address aviation safety issues for which we do not have direct regulatory authority. These issues may be controlled or regulated by others, they may be global issues (e.g. space weather or volcanic events) or they may be new capabilities (e.g. remotely piloted aerial systems or space planes).

Much of this work is done in close collaboration with industry and UK Government. The DfT, in particular, provides significant support to meet these external challenges.

The Residual Risk Wheel (RRW) (Fig 3) imagines the UK citizen at the centre and places all the factors that may affect their safety in a wheel around them. In order to provide comprehensive protection to the UK citizen, some activities outside of the core remit of the CAA must be considered. The size of the slices in the diagram represents the estimated extent of current risk to the UK citizen (including their flights on non-UK operators). This wheel shows the importance of considering non-UK operators and overseas destinations as part of the risk to the UK consumer.

Changing regulations have been identified as a significant part of the risk picture. The practical implementation of new regulatory frameworks at national and international levels presents a unique set of challenges for both industry and regulators. The initial transition period requires considerable resource to be applied by all involved and the maturity of these systems takes time to be fully established. The effects of such change can be reduced by effective forward planning and close cooperation between stakeholders.

At a pan-European level, the major focus for advancing aviation regulation is the continuing development of EASA and the progressive extension of its remit to all aviation sectors. The potential for this process of regulatory change to impact business is well recognised and are working with EASA to minimise the burden on industry in implementing these changes. These changes also impact on the capabilities and activities required within the regulator; this too is being addressed. Our goal is to evolve the best national regulatory service in the context of EASA and to support the UK industry through the transition process.

Figure 3: Residual risk wheel with regulated areas (with blue outline)

1. Ground handling /non CAA regulated

2. Military

3. Crown dependencies

4. Overseas territories

5. Regulatory change management

6. International civil aviation organisation

7. Neighbouring states and FABs

8. Foreign accident investigations

9. Foreign airlines in the UK

10. UK airlines overseas

11. UK CAA risk capability

12. General aviation

13. Training organisations

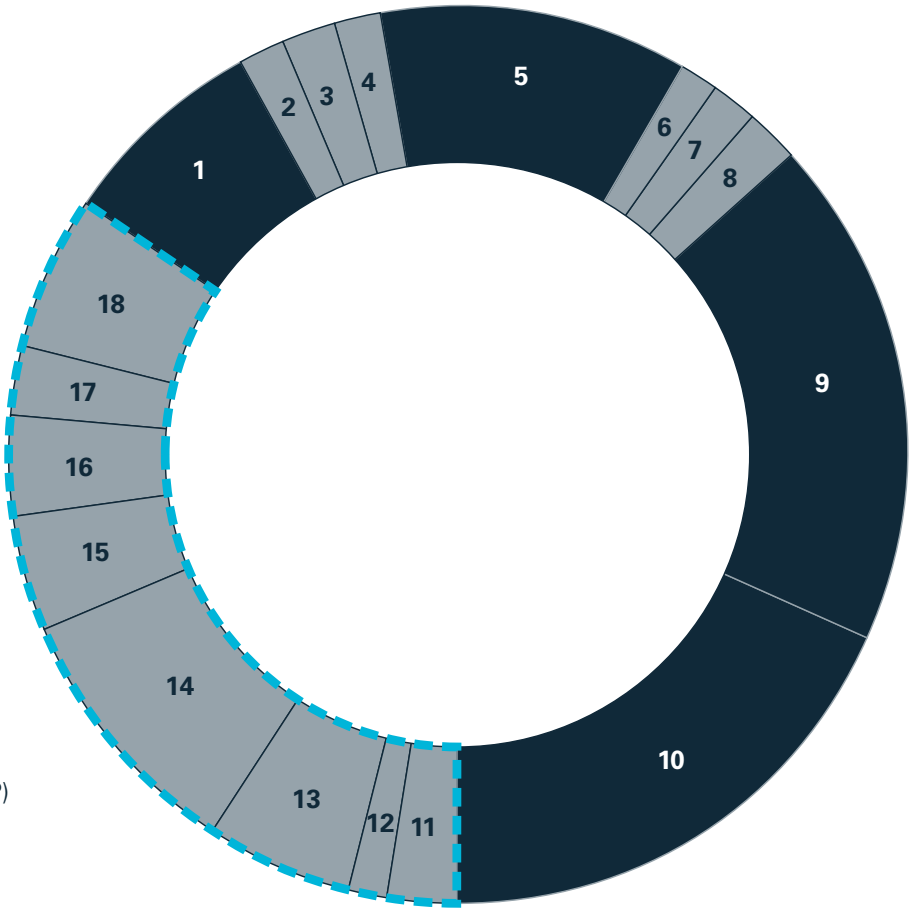
14. Airlines

15. Airports

16. Air Navigation Service Providers (ANSP)

17. Design and production

18. Aircraft maintenance



At a global level, the new ICAO Annex 19 Safety Management is now applicable to all states; it sets out internationally-applicable standards covering state safety programmes, safety management systems and protection of safety data. While the UK has been proactive in preparing for this new annex, there are additional measures that will have to be implemented.

What is immediately apparent from assessing the overall risk to the UK citizen is the scale of opportunity for safety improvement activity outside of our regulated responsibilities, particularly with non-UK operators flying in the UK and UK operators flying to overseas destinations. This is progressed through state safety partnerships work as part of the UK SSP, where issues raised through analysis of occurrences are targeted and agreements on actions reached. Central to success of the partnerships is the overall aim of working together to raise safety standards.

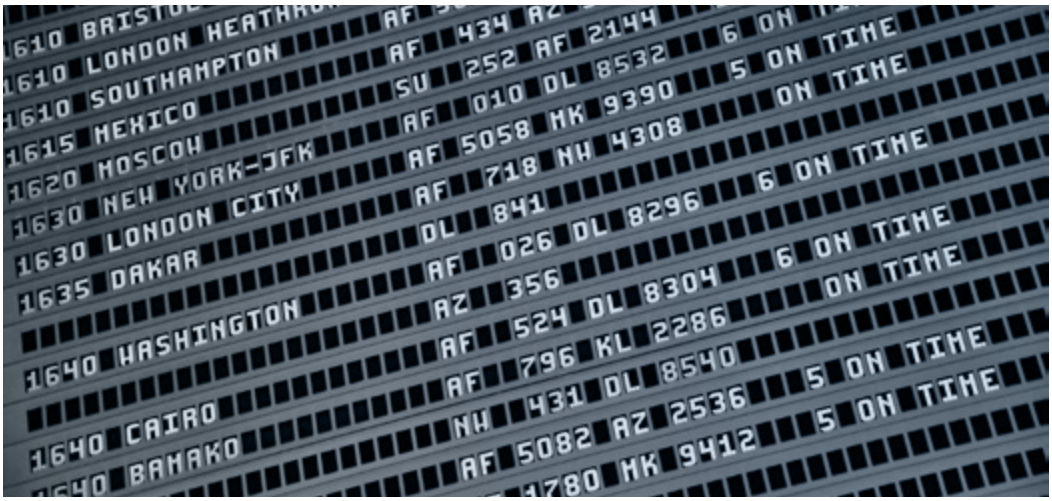
CAA International (CAAi)

CAAi, a wholly owned subsidiary of the UK Civil Aviation Authority (UK CAA), is a leading and globally recognised aviation consultancy company. It provides training and consultancy services to aviation clients worldwide, with experience of operating in over 140 countries.

The aim of CAAi is to deliver and promote best practice in aviation safety and education, helping to create a flying world fit for the 21st century. Customers can include anyone in the aviation industry - from governments, national, defence and military aviation authorities to airports, air navigation service providers and airlines. CAAi also works with training organisations, flight simulation training device manufacturers and operators, and aircraft design, production and maintenance organisations.

CAAi comprises a strong team of technical professionals and project management specialists who provide advice across the complete range of aviation related activities. CAAi assembles multi-disciplinary teams who work collaboratively with clients to deliver tailored solutions for technical advisory services, environmental consulting, professional training, aviation examination services and certification against internationally recognised quality management standards.

By supporting safety improvements around the world, CAAi makes a major contribution to the CAA's ability to influence safety and to reduce risks to UK citizens who may fly on non-UK airlines, visit overseas destinations or fly from point to point between countries. Even UK airlines inside the UK share airspace with non-UK operators who could affect their safety if not operated correctly. CAAi ia helping to protect UK citizens and as a commercial, self-funded subsidiary, it is not reliant on financial support from the UK industry or government.



Total system threats

Aviation is a complex international system that can be affected by numerous outside influences such as solar super-storms or epidemics. That means it is not practicable or possible to provide 100% aviation system reliability.

Any change is a potential safety risk and some current major issues include the development of new airline and operators business models and new generation aircraft that embody significant technology differences. We are reviewing emerging threats as a way to direct future safety improvement activity. Our work includes:

- improvements to the identification of current, emerging and future safety issues, including how to capture and analyse results from industry trends and horizon scanning (ongoing)
- providing a leading role in the International Airways Volcano Watch Operations Group (IAVWOPSG) within ICAO (ongoing)
- contribution to the EU seventh framework Weather Hazards for Aeronautics (WEZARD) project, which will include a review of the current knowledge on volcanic ash, mineral dust and ice crystals as potential threats to aviation (April 2015)
- investigation and publication of information about the risk posed by space weather through the CAA's Space Weather Working Group (ongoing)
- identification and mitigation of potential failure points in the aviation system, e.g. reliance on satellite navigation (ongoing)
- creation of a CAA crisis information management team to support the command and control teams that lead CAA crisis response (April 2014)
- support for the European Aviation Crisis Coordination Cell (EACCC) to ensure timely response to any future pan-European aviation crisis (ongoing).

Outcome

To reduce the risk from total system threats by ensuring that we are well prepared to react to events arising from both the natural and business environment.

Case study 3 – Collaboration with another country

Following a serious incident in UK airspace, a review of the safety performance indicators identified that the operational safety performance of the five airlines from one country that operate into the UK was sufficiently poor that action needed to be taken to safeguard UK public safety.

All non-EU member air carriers must apply formally to the DfT for permission to operate into the UK. Once notified by the CAA that safety concerns exist, the DfT has the power to withdraw the permit. However, this is not the preferred course of action because it could damage relationships and has not generated sustained improvement in the past. As a result, the DfT funded groundbreaking work to establish how working in safety partnership with other states could improve operational safety performance in UK airspace.

We were receiving, on average, two serious mandatory occurrence reports (MORs) involving one of this country's carriers each week and analysis showed an at fault ratio in UK airspace of 80%, which was the highest of any visiting state. This was supported by independent NATS analysis that demonstrated a rate of 491 events per 100,000 movements compared to major UK airlines performance of 133/100,000.

This was particularly concerning because the state in question is expanding quite rapidly in their aviation activities. In addition ICAO had identified a number of deficiencies with the country's regulators which were mirrored by an EASA standardisation report.

Following a series of meetings in the UK and at the state regulator's premises, it was agreed that a workshop would be run there. This was well attended by the country's industry and a challenging action plan was agreed. A huge amount of work, mainly by the country's airlines, produced an outstanding improvement in their operational safety performance in UK airspace in a very short period of time.

There have been three further safety partnership workshops, each introducing new areas where we can work together to improve operational safety.

Today we receive less than two MORs a month involving an airline from the same country and NATS independent data show that they are outperforming the UK industry and have sustained a performance below 71/100,000 for the last 18 months.

Last year BA, easyJet, Thomas Cook, Thomson and Jet2 joined the safety partnership, which had already enjoyed strong support from NATS and the AAIB. This shifted the focus to include the safety performance within the country's airspace and particularly to some of their airfields. The most significant of these is achieving an approach with vertical guidance into an airfield surrounded by high ground that has been a high risk airfield for many years. As a result of the partnership, work is now at the final stages of producing new procedures for it.

The UK airlines are delighted with the progress made by this initiative and are keen to support future safety partnerships as globalisation and European liberalisation continues to generate new challenges and prospective safety partnership candidates.

International co-operation

To enable the UK CAA to be proactive about safety outcomes worldwide we are developing a Travel Risks for UK and Safety Threat Evaluation Database (TRUSTED) so that we can make informed decisions about where best to focus our efforts on behalf of the UK public.

The safety of all airlines flying into the UK is important, as is the safety of all overseas destinations serviced from the UK. In general this safety level is achieved by meeting ICAO standards. In addition, the European Commission's Air Safety Committee does ban operators from European airspace if their safety performance is poor. However, we recognise that the use of non-UK aviation services by other states is particularly focussed on a small number of states and so we seek to establish an ongoing bilateral safety relationship with these states. We may approach the state's aviation regulator to form such a relationship for a number of reasons, such as high or increasing volumes of traffic, a high rate of safety events, or to manage adjacent airspace. In other cases, where we observe a specific local safety issue at a particular location outside of the UK, we will approach the relevant National Aviation Authority (NAA) to suggest an initiative to address it. In either case the goal is to work together to resolve important issues and it continues to be a very successful option, with significant performance improvement for minimal investment. This process will be further developed in the coming years.

This collaborative approach with other NAAs seeks to be outcome focussed and performance based, meeting the principles of our SSP work.

- TRUSTED will be further developed to form a more complete picture of risk to UK citizens from all routes and destinations (December 2015).

Outcome

- A new source of risk information to better support our SSP aspiration to put the UK consumer at the heart of all we do.

State safety partnerships

State safety partnerships are a vital component of our overseas engagement. Working directly with other states, we tackle several issues together that would otherwise represent increased risk to UK citizens as they travel globally or as overseas airlines operate in our airspace.

Within our most successful partnership there were several aspects that were selected for improvement:

- the performance of the aircraft visiting the UK, particularly operating within the complex airspace around London
- the difficulty our operators were encountering overseas, specifically Non Precision Approaches (NPA) – that posed an inherently greater risk due to the lack of technological safeguards inherent in their design

To address the first issue we conducted joint workshops to increase understanding of the contributory factors that could make our airspace feel challenging for visiting crews from this state. To deal with the second issue, that is certainly more widespread than this single partner state, we are working with those overseas airports that deploy NPAs and that are most frequently visited by UK operators or raised by industry as higher risk, in order to facilitate the introduction of precision approaches and so improve the safety of UK airlines and UK citizens visiting that destination.

The most notable recent success of this method is with a partner state where an impressive reduction in safety occurrences has been achieved. The work of the NAA of the country and its operators on this project deserves special mention as does the support and co-operation of NATS which has been invaluable; we very much appreciated their strong participation.

Over the course of the period of this plan, further focussed partnerships will be initiated as we seek to address a range of specific issues at further individual locations. These more concentrated arrangements focus on single activities and are shorter in duration than a full SSP. This approach will be used where MORs, safety occurrences and industry reports indicate a specific local issue.

– At least three additional partnerships will be established with key states to work together on improving safety (December 2015).

Outcome

A marked reduction in the rate of safety events arising from either UK flights at specific overseas destinations or from aircraft of that State when visiting the UK.

Close encounter workshops

In our international work, close encounter workshops may be used to bring together front line professionals from all parties involved to share experiences, discuss local situations and find practical solutions. Bringing together pilots and ATCOs who interact at a particular airport has revealed simple differences in understanding and yielded significant benefits in reducing events. A recent example, focussing on a major South American destination, combined the expertise of local ATC with that of UK airlines and ATC professionals to quickly identify and implement straightforward solutions to address specific safety concerns and so enhance the safety of UK arrivals.

- At least three further 'Close Encounter' workshops will be held with key partners and/or key professionals at UK destinations (December 2015).

Outcome

A measurably reduced risk to UK citizens from non-UK airlines operating in the UK and at overseas destinations visited by UK airlines.

Unmanned Aircraft Systems (UAS)

Military use of UAS has expanded rapidly in recent years and demand for test and development flying of both military and civilian systems within the UK has led to the implementation of segregated airspace to accommodate this. Procedures have been developed to allow other aircraft to safely cross these areas. Operations involving smaller UAS, primarily by aerial photography/survey companies and flown within visual line of sight, have increased exponentially over the past few years in the UK and indications are that this growth will continue. In addition, a number of manufacturers are now initiating projects to develop larger UAS, particularly in the 20kg to 150kg bracket, and those intended to operate beyond visual line of sight where technical alternatives to the manned aviation 'see and avoid' principle (known as detect and avoid) must be developed and certificated.

The CAA and UK Government are fully committed to encouraging growth by actively participating in both EASA and ICAO rulemaking fora. In addition, the CAA will be contributing to phase 3 of the Autonomous Systems Technology Related Airborne Evaluation & Assessment (ASTRAEA) programme, and also to Project CLAIRE (Civil Airspace Integration of RPAS in Europe), a SESAR JU sponsored project aimed at demonstrating the safe flight of a UAS within Controlled Airspace. Maintaining appropriate safety levels for all users of the airspace structure and those on the ground will be a critical part of this work. CAA policy on the use of UAS is in CAP 722.

Actions

- to fully contribute to, and influence, the development of ICAO draft SARPS (specifically Annexes 1, 6, 8 and 10) for Remotely Piloted Aircraft Systems (RPAS) by March 2016, for adoption in early 2018

- to fully contribute to, and influence, the development of harmonised international UAS regulations through active participation of the JARUS (Joint Authorities for Rulemaking on Unmanned Systems) group. The output from JARUS will form the basis of the initial EC RPAS regulations, scheduled for publication between 2015 and 2018

- to actively contribute to the output of ASTRAEA phase 3a (June 2015) and ASTRAEA phase 3b (2015-18)
- to fully assist with the development and execution of the Project CLAIRE UAS demonstration flight activities, scheduled for autumn 2015 (December 2015)
- revise and expand the guidance offered within CAP 722, particularly airworthiness requirements (October 2014).

Outcome

To reduce the potential for unacceptable risk from UAS to manned aviation and the general public by making timely preparations and setting appropriate standards.

Spaceplanes

In 2013 the UK government commissioned us to undertake a detailed review to better understand the operational requirements of the commercial spaceplane and spaceport industry and so allow us to inform the aerospace and space industry, and other key stakeholders, how the UK might accommodate and support future operations from this emerging sector, including the appropriate enabling regulatory framework.

The UK government's 'Plan for Growth' (2011) stated that it wanted 'the UK to be the European centre for space tourism and will work with regulatory authorities to define regulations applicable for novel space vehicles that offer low cost access to space'. Similarly the UK Space Agency (UKSA) in its main strategy document states 'we will work with the Civil Aviation Authority and the European Aviation Safety Agency to ensure the right regulatory framework is in place to facilitate UK launch capabilities and space tourism'. The UK CAA Strategic Plan 2011-16 does briefly mention commercial space operations under the strategic objective of Enhancing Aviation Safety with the need to assess new risks and ensure the right mitigations can be developed. The FAS also acknowledges the need to address the regulatory requirements to enable sub-orbital flights in the UK and to exploit existing airspace measures or develop novel flexible use of airspace arrangements to accommodate commercial space operations.

- The CAA will present to UK government (BIS, DfT and UKSA) a report of the findings and outcomes of this review, with specific recommendations on how the framework for commercial operations and suitable locations for a spaceport in the UK can be provided. (April 2014)
- Such further actions as emerge from the consideration of the CAA report.

Outcome

Confidence in the safety of spaceplanes, and other traffic with which it will share airspace, without causing unnecessarily delay or constraint to industry ambitions for this technology.

SECTION 6

The Significant 7 - lethal outcomes

The CAA established task forces for each of the Significant 7, involving industry experts, are working to reduce the risk of each to an acceptable level. By examining the specific scenarios and events that most commonly result in these outcomes, they are able to develop programmes of work aimed specifically at these issues. Most involve a surprisingly small number of factors; for example, 'loss of control in flight' is most commonly the result of allowing airspeed to drop too low and, where small twin engine aircraft are involved, mishandling of engine failures. This task force approach helps us to ensure that our actions are cross disciplinary and proportionate to the relative risk. The relative importance of these lethal outcomes was agreed at a CAA-industry conference in 2010. The sequence in which they are listed below reflects that agreed priority, which is also supported by accident data.

Many areas of industry have adopted the Significant 7 lethal outcomes approach when looking at their own risks, and international organisations such as EASA, ICAO and Flight Safety Foundation, and the GA community, use similar classifications (see CAP 1076).

We have included among our significant lethal outcomes one item not adopted by EASA – that of ground handling. We understand EASA's rationale given that this is not an outcome in its own right; however, we believe that it is useful to increase the profile of ground handling to ensure that this sector of the industry gets involved and understands that it makes a vital contribution to safety. For more information regarding the lethal outcomes and the associated analysis see appendix two, and, in addition, CAP 1036 (Global Fatal Accident Review) provides more data.

Progress on risk reduction

The actions in this plan aim to improve safety and many directly target each of the significant lethal outcomes and their respective safety improvement outcomes. Figure 4 is one measurement of safety performance across the significant lethal outcomes. It shows the trend of high severity MORs involving UK airlines split by potential lethal outcomes.

Since September 2008 there has been a continuous improvement in safety performance, as reflected in the decreasing rate of high severity MORs. The dominant outcomes are now airborne conflict and loss of control; this reflects our target for work.

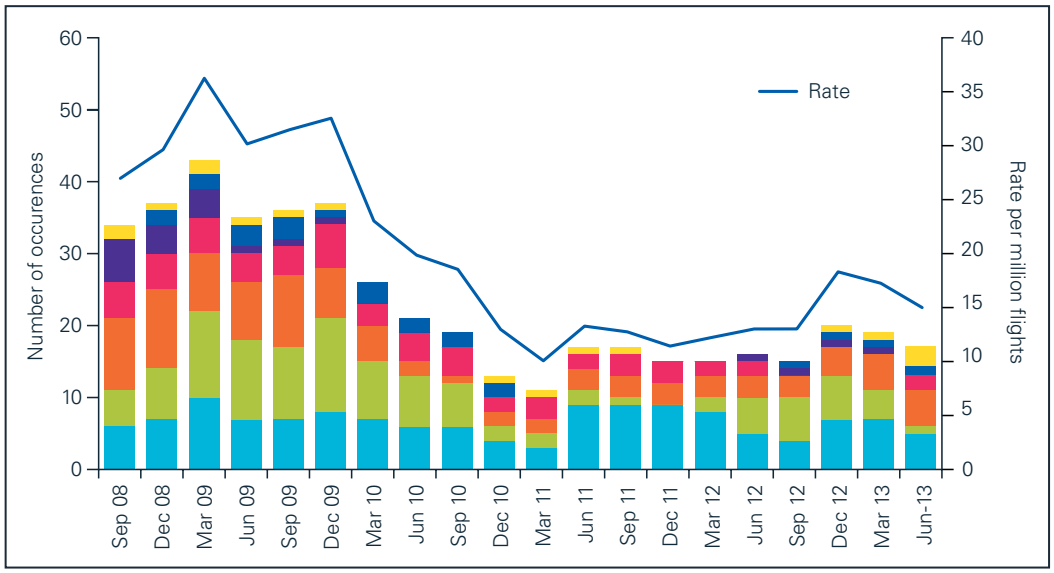


Figure 4 Number and rate of high severity MORs involving UK airliners, by significant lethal outcome

Colour key:

Root causes, scenarios and risks

Almost any safety event will include three elements:

1. the root causes, such as 'pilot performance'
2. the scenario - 'aircraft came close to stall'
3. the lethal outcome - 'loss of control'.

The following illustration shows this sequence using a real safety event for each of the lethal outcomes.

Figure 5 Illustration of root cause, scenario and lethal outcome for example events

Event casual and contributory factors	Actual event scenario	Lethal outcome risk
Technology: Obstruction of aircraft pilot probes by ice crystals leading to airspeed indication inconsistencies **Technology:** Lack of a clear display in the cockpit of the airspeed inconsistencies **Pilot performance:** Flight crew do not identify approach to and subsequent recovery from stall	**Fully developed stall on airliner whilst en-route following undetected loss of airspeed**	**Loss of control** Aircraft unintentionally deviates from normal in-flight parameters
Information to crew: Airport authority had not installed any taxiway or holding point signs on the airfield **Pilot performance:** Flight crew misidentified taxiways leading them onto the runway at incorrect point **ACTO performance:** Trainee Air Traffic Controller did not inform flight crew of their incorrect positioning	**UK airliner takes off from incorrect point on runway with limited runway length remaining**	**Runway excursion** A veer off overrun off the runway surface
Technology: Discrepancy between aircraft navigation database and approach chart **Pilot performance:** Inappropriate auto-pilot selections by flight crew resulting in unstable approach that was continued **Technology:** EGPWS would not have provided sufficient warning to avoid ground collision with terrain	**UK airliner descends below minimum safety altitude (to 121 ft) during final approach**	**Controlled flight into terrain** In-flight collision with terrain, water or obstacle without indication of loss of control
Pilot performance: Flight crew misperceived position of another aircraft resulting in degraded positional awareness **Pilot performance:** Flight crew taxied to incorrect hold point **Pilot performance:** Reflection of sunlight on wet runway prevented flight crew seeing runway ground lighting	**UK airliner enters runway in-front of departing airliner resulting in high speed rejected take-off (at 120 kts)**	**Runway incursion** Incorrect presence on the protected area of a surface designated for the landing and take-off of aircraft

Figure 6 Illustration of root cause, scenario and lethal outcomes for example events

Developing performance indicators

In our previous CAA Safety Plan we stated our ambitions to improve our existing measures of safety performance and to develop new measures too.

Occurrence-based safety performance indicators (SPIs) have been established for some time with the full template for each lethal outcome shown in Fig 6. Progress in populating these templates has caused us to revisit our methods.

Our desired improvements to safety performance measures can be achieved through collecting and integrating multiple sources of electronically generated data to produce a more complete safety risk picture. Such data can include electronic radar data and data from aircraft systems such as TAWS and ACAS. Other useful data sources include hazard reporting and operational safety audits.

We have recognised that MORs, as our primary source of safety data, are often incomplete in terms of contributory factors and, when tracking very specific risks such as low airspeed events, the sample size may be small and therefore difficult to analyse. Steps are being taken to address both of these issues. Furthermore, we have had to refine the method by which we grade MORs for their risk level and address the effect that the variance in occurrence reporting rates between different organisations has in obscuring other effects.

Looking to the future, we are now seeking to collect more data relating to leading (also called 'activity') indicators, rather than focus solely on lagging, outcome-based indicators. Leading indicators are those reflecting the inherent safety level of the operating environment, such as 'what proportion of UK AOC holders have implemented pilot monitoring skills training' or 'how many airports have implemented the latest guidance'. Almost all such measures require industry input. To date, this information has been sought through industry surveys, although the response rate has been incomplete. Therefore, we are exploring new ways to collect such data.

In the realm of flight data monitoring, our development of precursor algorithms to share with industry met some challenges, including reconciliation of the differences among various FDM vendors and, therefore, the capability to achieve a common standard as initially planned. Where flight data analysis algorithms have been made available

to operators, uptake has been variable due to the customisation effort required to implement into individual FDM systems.

Actions to develop performance indicators include:

- a new method of risk grading for MORs has been developed and promoted internationally, and it will be implemented in the UK (May 2014)
- establish new ways of collecting leading (activity) indicators, through the front line Inspectors and Surveyors (April 2014)
- work with industry to develop better measures of airworthiness-related safety measures of risk relating to lethal outcomes. A trial will be conducted (July 2014) and guidance published (December 2014)
- work in collaboration with the industry, EASA and ICAO to improve the capacity of FDM programmes to identify and monitor operational safety risks. This will include supporting the EOFDM, EAFDM and ICAO FDA-SG work initiatives. The goal will be the development of comprehensive guidance material regarding flight data analysis techniques and improved integration of FDM in the operator's SMS (January 2016)
- enhancements in CAA capability for oversight of FDM as part of an organisation's effective SMS (March 2015)
- investigate means of collecting, integrating and analysing multiple sources of electronically generated data (June 2014).

Outcome

To reduce the risk of making decisions based on an incomplete picture of the safety issues or inadequate knowledge of the situation, such that CAA actions can be most effectively targeted.

Illustration of complete set of safety performance indicators used to track runway excursion risk including effectiveness of mitigating actions (aligned with the linear model)

Intelligence	Risk	Outcome analysis	Options	Actions	Check
Lagging SPIs Tells us there is a safety issue	**Precursor SPIs** Tells us the scale of the issue, i.e. the risk	Tells us what safety outcomes we want to achieve	Tells us what possible actions could be taken and their cost effectiveness	Tells us what actions are being taken to achieve the desired outcomes	**Leading SPIs** Tells us that the right actions have been implemented
Number and rate of runway excursions (MOR data)	• Number and rate of unstable approaches that continue to landing (MOR, FDM data) • Number and rate of deep/ fast landings (FDM data)	Reduce the risk of runway excursions through an 5% reduction in deep or fast landings	**Data:** highlights main causes of runway excursions: e.g. deep or fast landings **Action options:** what actions could achieve the ambition **Ambition:** 5% reduction in deep or fast landing events **Cost-effectiveness:** what is the approximate cost of these actions, and select those that achieve the best balance of safety improvement vs cost-effectiveness	Implement best practice at UK aerodromes/ANSPs: • promotion and implementation of relevant EAPPRE recommendations • check for accurate PAPI alignment • check for effective procedures in place for temporarily reduced declared distances Support AOCs to effectively manage runway excursion risk within their SMS by: • development of an FDM event that provides a standardised measure of unstable approaches • promote the implementation of this event by AOC holders and its use to mitigate runway excursion risk	Proportion of UK licensed aerodromes/ANSPs that have: • reviewed and implemented relevant EAPPRE recommendations • checked PAPI alignment for runways with ILS • procedures in place for temporarily reduced declared distances • measures in place to monitor runway excursion risk Proportion of UK AOC holders that have: • implemented the unstable approach FDM event • an active runway excursion risk reduction activity in place • measures in place to monitor runway excursion risk (e.g. deep landings)

An increase in the leading SPIs should precede a reduction in the precursor and lagging SPIs – check that this occurs, if not then review Actions

Feedback

Loss of control

If the introduction of new technology and automation in the aircraft cockpit is not supported by corresponding changes in pilot training, it may lead to an increase in the risk of 'loss of control' events. Increasing pilot focus on monitoring each others' actions should improve the chance of events being recognised and avoided. Activities to mitigate the risk of loss of control events focus on the following areas:

- pilot training and assessment of monitoring skills
- how automation is used in aircraft
- maintenance and competence of pilot manual flying skills.

Training material has been published on pilot monitoring skills and jet upset recovery, which has been well received both in the UK and overseas and there is evidence that it is already in widespread use in pilot training. As training in these areas fully matures, it is expected that there will be a reduction in loss of control incidents and accidents where deficient pilot monitoring and/or jet upsets are factors.

Loss of control - projects completed

- additional loss of control multimedia training material published
- enhanced training for CAA inspectors to support industry with practical guidance on pilot monitoring skills training and testing.

Achievements

The additional loss of control multimedia training material has been well received both in the UK and overseas. There is evidence that it is already in widespread use in pilot training environments.

Loss of control - new projects

New projects will focus on delivery of:

- analysing current aircraft upset recovery training and how this may be improved (December 2014)
- encouraging simulator manufacturers to improve the realism of simulating aircraft close to the stall (March 2015)
- work with the industry through EOFDM WGs to develop FDM precursors for loss of control scenarios (January 2016)

- A review of a major report from the Automation Working Group of the US Commercial Aviation Safety Team; hold a workshop to raise awareness of the report (February 2014) and identify which recommendations we would wish to implement in the UK (September 2014).

Rationale

In the majority of cases, the capability of flight simulators to provide comprehensive and representative training on jet upset recovery techniques, for example in a fully developed stall, is limited. Improving this will enable more effective training, which should then reduce the number of loss of control incidents and accidents where poor pilot action is a factor. Influencing simulator manufacturers to invest in such developments may require changes to regulation and/or pressure from industry.

The capability of FDM software to identify common factors leading to loss of control events will enable aircraft operators to be alerted to both specific events and trends. Operators will then be able to review procedures and training programmes to reduce incidents.

Outcome

To reduce the risk of loss of control occurrences and serious incidents where inadequate or ineffective flight crew monitoring, understanding of aircraft automation or maintenance of manual flying skills were factors.

Key performance metrics

Loss of Control mitigation actions will be tracked using the following key performance metrics:

- number of loss of control events
- number of stick-shake and alpha floor events (auto-thrust to prevent stalling)
- number of take-off configuration warning events
- number of low speed during approach events
- number of low speed during cruise events
- proportion of UK aircraft operators to have implemented and actively monitored loss of control precursor measures
- proportion of UK AOC holders to have implemented pilot monitoring skills training such as that suggested by the CAA's 'Monitoring Matters' programme
- proportion of pilots employed by UK AOC holders that have received pilot monitoring skills training as suggested by the CAA's 'Monitoring Matters' programme.

Runway excursion

Activities to mitigate the risk of runway excursion will continue to focus on the following three areas:

- reducing unstable/de-stabilised approaches
- improving information to pilots on expected braking action on contaminated runways e.g. snow or slush
- improving safety areas around runways.

The CAA has supported the development of the European Action Plan for Prevention of Runway Excursion (EAPPRE), which has now been published by EUROCONTROL.

Runway excursion - projects completed

- FDM unstable/de-stabilised approach parameters developed and shared with industry
- guidance provided to industry to raise awareness and reduce occurrences of ATC contributing to unstable approaches
- a trial to standardise the reporting of runway contamination and provide an estimated braking action to pilots
- guidance produced to support aerodromes completing a risk assessment where the runway end safety areas (RESA) only meet the minimum requirements
- a survey on unstabilised approaches conducted with AOC holders.
- New work will focus on publishing guidance material to enable aerodromes to standardise the reporting of runway contamination, such as snow and slush, and provide an estimate of its impact on aircraft braking action to pilots (completed February 2014)

Runway excursion - new projects

New work will focus on:

- supporting efforts to align international standards/practices associated with both runway braking action and aircraft performance so that clear, appropriate information is passed to operators (December 2014)
- supporting organisations in the implementation of relevant recommendations contained in the EAPPRE (December 2014
- developing the use of safety performance indicators related to runway excursions (May 2014).

Rationale

New projects will focus on supporting stakeholders in the implementation of recommendations contained in the EAPPRE.

Outcome

To reduce the risk of runway excursions linked to unstabilised approaches by:

- improving the use of flight data monitoring information in ensuring adherence to stabilised approach standard operating procedures
- improving the standardisation of the reporting of runway contamination to provide meaningful data to pilots on expected braking action.

Key performance metrics

Runway excursion mitigation actions will be tracked using these key performance metrics:

- number of runway excursions and overruns
- number of unstable/de-stabilised approaches that continue to a landing
- number of events where runway contamination is a contributory or causal factor
- proportion of UK aircraft operators to have implemented and actively monitored runway excursion precursor measures
- proportion of Air Navigation Service Providers to have completed unstable approach awareness training through Training in Unusual Circumstances and Emergencies (TRUCE)
- proportion of UK licensed aerodromes using new reporting criteria for runway surface condition.

Controlled Flight Into Terrain (CFIT)

The risk of CFIT was found to be greatest during non-precision approaches. There are also many destinations around the world that combine difficult terrain at high altitude that present a CFIT risk. Terrain Awareness and Warning System (TAWS) alerts are an effective mitigation, but they rely on the correct flight crew response, up-to-date terrain databases and software, and an accurate source of position information.

Safety improvement activities to mitigate the risk of CFIT will focus on the following three areas:

- reducing the risk of non-precision approaches
- improving CFIT alerts
- improvements to TAWS.

CFIT projects - completed

- guidance provided to industry on the benefits of Approach with Vertical Guidance (APV)
- our process for gaining APV approval has been improved
- aerodrome safety hotspots have been identified in order to prioritise implementation of new APVs.

Achievements

The focus of our CFIT activity has been to improve our processes for the implementation of APV approaches and to identify aerodromes where these approaches would be of the greatest safety benefit.

CFIT - new projects

- use technology and training to reduce the risk of serious incidents that occur during NPAs (December 2014)
- study how poor CRM can contribute to altitude setting errors (December 2014)
- launch an education campaign aimed at operators, highlighting the need for awareness of terrain clearance while under radar control (September 2014)
- develop a comprehensive HF strategy to tackle relevant contributory factors to CFIT and positional awareness in the cockpit (January 2015)
- encourage and facilitate the availability of radar vectoring charts for all destinations served by UK operators (October 2014)

- launch a feasibility study of new technologies that may reduce CFIT events (January 2015).

Rationale

The future strategy is to continue to mitigate CFIT by focussing on training and the supporting information available to crews and operators. The training element will include reviewing and expanding both CRM and HF activity. This will be supported by further research into technological developments to reduce the risk.

Outcome

Reduce the risk of serious incidents that occur during NPAs by replacing traditional NPAs with APV approaches.

Key performance metrics

CFIT mitigation actions will be tracked using the following key performance metrics:

- number of Enhanced Ground Proximity Warning System (EGPWS) alerts
- number of unstable/de-stabilised approaches
- number of significant deviation below glide slope events
- number of gross position error events
- number of deviations below minimum safety altitude events
- number of UK aircraft operators to have implemented and actively monitored CFIT precursor measures
- number of APV-type approaches available in the UK compared with traditional NPAs
- number of APV-type approaches at EU and third-country aerodromes, used by UK operators
- proportion of relevant UK fleet approved for APV-type approaches
- proportion of approaches flown by UK operators, which have some form of vertical guidance.

Runway incursion

The Runway Incursions Steering Group (RISG) has built an excellent working relationship with industry and the EUROCONTROL Runway Incursion Prevention Working Group. This has contributed to the development of the revised European Action Plan for the Prevention of Runway Incursions version 2.0 (EAPPRI2). An on-going key action to mitigate the runway incursion risk is the promotion of recommendations from EAPPRI2 to industry.

Runway incursion - projects completed

- EAPPRI2 disseminated to industry
- implementation of appropriate EAPPRI2 recommendations by aerodromes and operators audited
- strategy, standards and guidance for airside driver training developed and implemented (CAP 790).
- reviewing radio communication procedures used around runways (completed January 2014)

Achievements

Runway incursion by airside drivers have reduced across the reporting period.

Runway incursion - new projects

Future runway incursion activities will include:

- investigating how runway incursion can be reduced at non-UK aerodromes (January 2015)
- facilitating and supporting trials of runway incursion prevention technology at airports (March 2015)
- establishing aerodrome leading indicators to help mitigate the risk of runway incursion (April 2014).

Rationale

The current approach examines radio communication procedures relating to runway use support for a trial of new technologies and works to investigate potential areas of overseas influence.

Outcome

Reduce the risk of incursion by tackling non-standard or ambiguous radio phraseology.

Introduce new technology at airports to reduce the runway incursion risk.

Key performance metrics

Runway incursion mitigation actions will be tracked using the following key performance metrics:

- number of runway incursions at UK aerodromes or involving UK operators worldwide (analysed by severity grade)
- number of UK licensed aerodromes that have implemented recommendations from and/or audited internally against EAPPRI2
- licensed aerodromes will be audited against the new airside driving standard detailed in 'Requirement for an Airside Driving Permit (ADP) Scheme - CAP790' www.caa.co.uk/cap790.

Airborne conflict

The risks associated with airborne conflict in the UK stem from busy, complex airspace and, in uncontrolled airspace, the variety of operations. Flights operating overseas may encounter different ATC practices, language issues and geographical constraints. Across the CAA, there are a number of projects in this area. A major initiative that is aimed at reducing airborne conflict in the face of rising traffic is the FAS project to redesign airspace, outlined at the beginning of the technology section of this plan. Other teams are addressing airspace infringements, electronic conspicuity and the future of class G airspace. There are projects seeking ways to make gliders more visible and analysing the conflicts between GA aircraft. In addition, the world section describes our international work with partner states which is frequently targeted at airborne conflict risk. This is partly because it is the risk that is most easily measured for visiting aircraft, and partly because it is often the risk that our operators raise most strongly in relation to overseas destinations. However, as these projects are covered in more detail elsewhere, this section focuses on the specific activities of the action group addressing airborne conflict.

A new Airborne Conflict Action Group (ACAG) is co-ordinating work for all types of air operations within and outside UK airspace. Key performance metrics are a reduction of Airborne Collision Avoidance Systems (ACAS) warnings, collision risk in the aerodrome visual circuit, airspace infringements and AIRPROX in class G airspace.

Airborne conflict - projects completed

- guidance on ACAS use published
- articles published on how aircraft should best join the airfield circuit
- guidance published on the implications of reduced radar and procedural air traffic control provision on aircraft operations in class G airspace
- develop guidance material to reduce level busts and introduce an enhanced feedback questionnaire
- develop ways to understanding and reduce level bust events.

Airborne conflict - new projects

New projects to develop mitigations against the airborne conflict risk are:

- measuring the success of training initiatives for correct responses to ACAS (December 2014)

- improving guidance on aerodrome circuit joining procedures (July 2014)
- publishing guidance aimed at reducing AIRPROX events in class G airspace (March 2014)
- research to improve the visibility of light aircraft and gliders (September 2014)
- continuing engagement and awareness activities with the business aviation community to ensure a collaborative approach to mitigating airborne conflict events (ongoing)
- new DfT-funded research into lightweight transponders and position broadcasting technologies (March 2015).

Outcome

To reduce airborne conflict risk through improved responses to ACAS warnings, international initiatives to address specific issues at overseas destinations, a more holistic approach to reduce the risk of mid-air collisions, operations in class G airspace circuit joining procedures, airspace infringements and improved visual conspicuity of light aircraft and gliders.

Key performance metrics:

Airborne conflict mitigation actions will be tracked using the following key performance metrics:

- number of risk-bearing AIRPROX events
- number of AIRPROX in the visual circuit
- number of correct responses to Terminal Collision Avoidance System Resolution Advisories (TCAS RAs)
- number of level busts
- number of airspace infringements
- number of losses of separation due to airspace infringements.

Ground handling

The CAA considers that ground handling incidents are vastly under-reported. The Ground Handling Operations Safety Team (GHOST) HF subgroup acknowledges that the ground-handling community does not always have an open/just reporting culture, so the Just Culture statement is a first step in gaining public support from accountable managers and CEOs. Ground handling is unique among the Significant 7 as a cause and not a resultant effect. Ground handling safety is managed through the GHOST, a group whose aim is to work with global partners to develop strategies to mitigate ground handling issues and support activity to reduce risks.

With the exception of dangerous goods, ground-handling activities in the UK are currently not subject to direct CAA regulation.

The majority of occurrences classified under the ground-handling criteria are low risk. However, those with the potential to cause the greatest harm to aircraft safety are:

- loading errors
- serious collisions between vehicles and aircraft undetected before flight.

The majority of GHOST's recent activities have been focused on fostering a just reporting culture and reducing loading errors, to reduce the potential incidents that may cause greatest harm to aircraft safety either through damage to the aircraft hull or by causing a handling problem in flight.

Ground handling - projects completed

- educational DVD ('Safety in the Balance') distributed to help ground crew understand the safety implications of their role in order to mitigate the risk of loss of control due to loading errors.
- UK Ground Handling Human Factors Forum established (subgroup of GHOST) with the aim of identifying the actions that could help reduce the risks from human errors
- guidance and DVD published on the safe loading of electric mobility aids
- guidance issued for completing 'gross error checks' and 'last minute changes'
- checklists for ground handling self-inspection/audits developed for industry
- guidance provided to aircraft de-icing personnel to prevent loss of control events due to contaminated control surfaces

- guidance published for front line supervisors on the types of ground handling incidents that must be reported through the MOR scheme
- Just Culture toolkit developed to assist all organisations involved in ground-handling activities to implement and maintain a just reporting and safety culture
- the signing and endorsement of the just culture statement by all GHOST member organisations.

Achievements

The 'Safety in the Balance' DVD has reached a wide international audience promoting awareness of the types of events that can cause inaccuracies in aircraft's mass and balance calculations and what the potential consequences of these are. The Ground Handling HF Forum has focussed on the culture prevalent on the aircraft apron, which is often characterised by a reluctance to report errors and incidents. The scope of the group's work is to establish a culture of open, just reporting. The publication of new material to industry raised awareness of changes in the law on responsibilities for ensuring electric wheelchairs are safely loaded. This guidance was released before the Paralympics to ensure it reached as wide an audience as possible. Other guidance issued shares best practice methods for completing a gross error check. This work aims to increase the understanding of the risk and in turn encourage ground service providers to reduce the chance of loading errors due to last-minute changes.

Ground handling - new projects

New projects to develop mitigation against the ground-handling risk are:

- reviewing with industry loading error data to determine future work (ongoing).

Rationale

The Just Culture toolkit is being used to assist aerodromes and ground handlers in implementing a just reporting culture. Campaigns using the core material have begun at a number of major UK airports and ground service providers.

The CAA and industry have been tackling loading errors for a number of years, yet they continue to occur. The review is designed to identify areas that can complement the activity already underway, including a mixture of medium and long-term proposals.

Outcome

To reduce the number and severity of loading errors and to improve the reporting and safety culture on the ramp.

Key performance metrics

Ground-handling work will be tracked using the following key performance metrics:

- the number and location of loading errors by error type, including dangerous goods events
- the number of collisions involving vehicles and parked aircraft at UK reporting aerodromes
- the number of collisions, near-collisions and conflicts involving vehicles and taxiing aircraft at UK reporting aerodromes
- number of de-icing related occurrences.

Aircraft fire

Most fatal aircraft fires occur after a crash. We therefore prioritise addressing the causes of crashes, but continue to collaborate with others on post-crash survivability.

Although less frequent, fires on board the aircraft are also an important risk. When analysing the occurrences of fire on board aircraft, hidden area fires, whether they are in the cargo area or within the aircraft structure, have a far greater potential for a catastrophic outcome than visible fires in the cabin (e.g. oven fires). More recently there have also been several accidents/incidents associated with carriage/use of lithium batteries.

Fire - projects completed

- publication of a training video on preventing hidden fires by following published maintenance practices
- publication of research results on the flammability of dust and lint in aircraft.
- an awareness campaign to reduce the risks of carriage of lithium batteries through passenger surveys and video material targeted at passengers, shippers, ground handlers etc (November 2013).

Achievements

A reduction in the risk of in-flight fires by improving maintenance practices through enhanced training of aircraft engineering professionals.

Fire - new projects

New projects to develop mitigation against the fire risk are:

- continuing international collaboration on fire and cabin safety issues including formal agreements (ICAO, FAA and Transport Canada) (May 2015)
- comprehensive analysis of fire incident data (May 2015)
- research into improved detection technologies to provide warning to crew of an onboard fire (August 2015)
- collaborating with industry to research detection methods of bulk lithium battery shipments, including a technology trial at a large airport (March 2015)

Rationale

Providing guidance on fire safety, including:

- methods for detecting on board fires in hidden areas
- the required technology to detect and reduce the risk of in-flight fire from undeclared dangerous goods
- the correct methods for handling, declaring and carrying lithium batteries.

Outcome

To reduce the risk of an in-flight hidden fire through reduction of wiring-related fire/smoke events. Improved awareness and compliance with the packaging and transportation safeguards/requirements of lithium batteries collaboration on research into aircraft fire risks.

Key performance metrics:

Fire mitigation actions will be tracked using the following metrics:

- number of aircraft fires
- number of aircraft smoke events
- number of maintenance-related events involving aircraft wiring
- number of viewings of internet training material.

SECTION 7

Large public transport helicopters

The safety of those who rely on offshore helicopter flights is the CAA's absolute priority. Offshore helicopter services provide a vital link to ensure the viability of the UK's oil and gas industry. They transfer the majority of the workforce to and from offshore installations in an open sea environment that is both challenging and hazardous.

Recent accidents have understandably given rise to serious concerns, particularly with offshore workers who rely so heavily on these helicopter flights. We therefore initiated a comprehensive review in September 2013 to examine thoroughly the risks and hazards of operating in the North Sea and consider how these can be managed more effectively.

The CAA decided to conduct the review in conjunction with the Norwegian Civil Aviation Authority (N CAA) and the European Aviation Safety Agency (EASA) so that a comparison could be made of any safety or operational differences. An independent peer review group was appointed to challenge the work of the review team to ensure that the objectives of the review were appropriate and being met.

Key are actions to improve the survivability of accidents including:

- Prohibiting helicopter flights in the most severe sea conditions, except in response to an emergency, so that the chance of a ditched helicopter capsizing is reduced and a rescue can be safely undertaken.
- Imposing restrictions on helicopter flights in serious sea conditions relative to the sea conditions that the helicopter has been certificated to.
- Only allowing passengers to be seated next to push out window, unless all passengers have enhanced emergency breathing equipment or the helicopter is fitted with side floats.

The review also identified training and ongoing skills of aircrew as another key factor in the prevention of accidents. In common with commercial airline operations, the review found that loss of control associated with the sophistication and automation of modern aircraft and helicopters is an issue requiring attention.

Harmonisation of training and procedures for pilots in these areas is recommended as well as improvements on how the two pilots work together to monitor the flight. There will also be a review of the instrument flying training that pilots receive.

The process of preventing accidents starts by establishing high technical design standards that enable safe products through a robust certification process with high production and maintenance standards. The root cause of three of the last five UK North Sea accidents has been failure of a critical part within the helicopter main gearbox transmission. The review therefore recommends that EASA's helicopter design requirements should be enhanced. The review also calls for improved information exchange between manufacturer, maintainer, operator, design authority and regulators, such as the UK CAA, to ensure that the design assumptions are validated in-service and that offshore helicopters continue to meet acceptable design and maintenance standards.

The report highlights that accident causes related to maintenance is small by comparison to design, however, maintenance error is an area that is worthy of further analysis and action to ensure that wherever possible we minimise the effects of human factors and improve engineer and organisation performance.

Improving maintenance standards is a CAA priority and needs a different approach by industry and regulator if real and lasting benefits are to be truly realised. Improvements can only be achieved by cultural change where high standards are the norm, safety culture is not only preached

but applied and there is a low tolerance of; non compliance, short cuts and repeat findings.

Part of the review was a comparison between offshore operations in the UK and in Norway. While the UK experienced more accidents between 1992 and 2013 the joint UK / Norwegian review team did not identify any material differences in operations, maintenance practices or regulation that could account for this. The actions and recommendations in this report will improve safety in both countries.

We will implement changes directly under our control and engage directly with other organisations and bodies, such as the European Aviation Safety Agency (EASA), to make sure changes happen. A number of the recommendations are beyond the CAA's powers to enforce but we would expect a positive safety culture within the oil and gas industry and operators mean they will be actioned. We will monitor and report publicly on the progress of all actions and recommendations.

A new offshore helicopter safety forum will be established by the CAA to drive forward the recommendations and actions identified. It will also work for a substantial, and continuing, improvement in the safety of offshore helicopter operations and liaise with Norway to share experiences and best practice.

CAA actions

An outline timescale for the CAA actions is given below:

Action		Delivery
A1	The CAA will establish and lead a new offshore operations safety forum to work for a substantial improvement in the safety of helicopter operations on the UK continental shelf.	Q3/2014
A2	The CAA will accelerate its work with industry to develop and apply Safety Performance Indicators to improve the effectiveness of helicopter operators' Flight Data Monitoring programmes.	Q3/2014
A3	The CAA will analyse lower risk occurrences (i.e. serious incidents and incidents) for the main areas of risk, technical and external cause occurrences in particular, in order to increase the 'resolution' of the analysis. This analysis will take the form of a rolling annual review of the last five years of occurrence reports.	Q3/2014
A4	The CAA will work with the helicopter operators via the newly established Helicopter Flight Data Monitoring (FDM) User Group to obtain further objective information on operational issues from the FDM programme.	Q4/2014

Action		Delivery
A5	With effect from 01 June 2014, the CAA will prohibit helicopter operators from conducting offshore flights, except in response to an offshore emergency, if the sea state at the offshore location that the helicopter is operating to/from exceeds sea state 6 in order to ensure a good prospect of recovery of survivors.	01 Jun 14
A6	With effect from 01 September 2014, the CAA will prohibit helicopter operators from conducting offshore flights, except in response to an offshore emergency, if the sea state at the offshore location that the helicopter is operating to/from exceeds the certificated ditching performance of the helicopter.	01 Sep 14
A7	With effect from 01 June 2014, the CAA will require helicopter operators to amend their operational procedures to ensure that Emergency Floatation Systems are armed for all over-water departures and arrivals	01 Jun 14
A8	With effect from 01 June 2014, the CAA will prohibit the occupation of passenger seats not adjacent to push-out window emergency exits during offshore helicopter operations, except in response to an offshore emergency, unless the consequences of capsize are mitigated by at least one of the following: a) all passengers on offshore flights wearing Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time; b) fitment of the side-floating helicopter scheme in order to remove the time pressure to escape.	01 Jun 14
A9	With effect from 01 April 2015, the CAA will prohibit helicopter operators from carrying passengers on offshore flights, except in response to an offshore emergency, whose body size, including required safety and survival equipment, is incompatible with push-out window emergency exit size.	01 Apr 15
A10	With effect from 01 April 2016, the CAA will prohibit helicopter operators from conducting offshore helicopter operations, except in response to an offshore emergency, unless all occupants wear Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time. This restriction will not apply when the helicopter is equipped with the side-floating helicopter scheme.	01 Apr 16
A11	The CAA will organise and chair an operator symposium on Safety Management to identify generic hazards, mitigations and Safety Performance Indicators for offshore operations.	Q2/2014
A12	The CAA will review whether operations should continue at helidecks where the overall dimensions and/or loading values as notified for the helideck are insufficient to accommodate the helicopter types in use and take the necessary action.	Q3/2014
A13	The CAA intends to assume responsibility for the certification of UK helidecks and will consult with industry to achieve this.	Q1/2015
A14	The CAA will review the conditions applicable to the issue of offshore 'exposure' approvals with a view to making them appropriate to the intended types of operation.	Q3/2014
A15	The CAA will commission a report to review offshore communication, handling and flight monitoring procedures from an air traffic control perspective and act on its outcomes.	Q4/2014

Action		Delivery
A16	The CAA will, with industry, review the instrument flying training element for all EFIS-equipped offshore helicopter type rating courses to be satisfied that candidates have a firm understanding of the displays and techniques required for basic instrument flight. The CAA will propose to EASA any necessary improvements to the syllabus requirements.	Q4/2014
A17	The CAA will review all helicopter AOC recurrent training programmes to ensure that basic instrument flight skills are maintained so that crews can readily deal with manual flight if required.	Q2/2014
A18	The CAA will review the requirement for instructor tutor training and, if appropriate, make proposals to EASA to incorporate within Part-Aircrew.	Q4/2014
A19	The CAA will examine the output of its review into the safety of large UK commercial air transport aeroplane operations for relevance and applicability to ensure that any appropriate safety initiatives have been extended to the offshore helicopter environment.	Q4/2014
A20	The CAA will amend its examiner assessment protocols (CAA Standards Document 24) to require specific 'de-identified' candidate performance indicators so that any trends in common failings are visible for proactive attention.	Q4/2014
A21	The CAA will review the pilot recency requirements for helideck operations that have been incorporated into the draft requirements for the EASA Ops Specific Approval for Offshore Helicopter Operations and require operators to implement them to an agreed schedule.	Q3/2014
A22	The CAA will review helicopter operators' safety cases for night operations to bow decks to assess operator procedures and mitigations and determine whether such operations should continue.	Q2/2014
A23	The CAA will continue to develop its working relationship with EASA, in particular in the areas of sharing airworthiness information and the management of operator in-service issues. This will be achieved by periodic meetings and reviews with the appropriate EASA and CAA technical staff.	Ongoing
A24	The CAA will review CAA Paper 2003/1 (Helicopter Tail Rotor Failures) to determine how well the recommendations have been taken forward and to assess if further action is necessary. The conclusions of this review will be discussed with EASA.	Q3/2014
A25	The CAA will review the human performance aspects of flight crew responses to engine bay fire warnings, specifically within the offshore operations environment.	Q3/2014
A26	CAA Airworthiness will meet with offshore operators periodically to compare the trends of MORs with operator inservice difficulty / reliability data to ensure that the complete risk picture is captured, addressed and that the desired outcomes are being achieved.	Q2/2014
A27	The CAA will focus on Vibration Health Monitoring (VHM) download procedures, system/component reliability, the handling of VHM management of alerts and defects during audits of UK offshore operators.	Q2/2014
A28	The CAA will review CAP 753 to clarify alert generation and management, to ensure it is consistent and a system of amber/red warning thresholds is established to allow maintenance staff to identify the severity of the alert.	Q4/2014

Action		Delivery
A29	The CAA will work with operators and their contracted engine and component maintainers to review processes that define when strip reports are required and determine necessary improvements to assure these are provided and thus ensure that potential safety information is not lost.	Q2/2014
A30	The CAA will carry out a further review of Human Factors Maintenance Error data referred to in this report and publish the results to seek improvements in this important area.	Q4/2014
A31	The CAA will form an Offshore Maintenance Standards Improvement Team with the offshore helicopter operators with the objective of reviewing the findings at Annex F to the CAA Strategic Review of the Safety of Offshore Helicopter Operations and making proposals to achieve a step change in maintenance standards.	Q3/2014 Report Q1/2015
A32	The CAA will: ■ promote and support the implementation of the results of the research on helideck lighting, operations to moving helidecks, Differential GPS-guided offshore approaches and helicopter terrain awareness warning systems; ■ seek to ensure funding for the research on operations to moving helidecks, Differential GPS-guided offshore approaches and helicopter terrain awareness warning systems to allow timely progress to completion and once completed promote and support the implementation of the results.	Ongoing

SECTION 8

Business aviation and GA activities

Business aviation

The Business Aviation Safety Partnership is investigating the extent of illegal public transport in business aviation, and has raised awareness and understanding of the issue by operators and customers.

The CAA has funded an industry trialling of Quick Access Recorders (QARs) in order to gather more safety data on the sector. This is done under Corporate Aviation Safety Executive (CASE) as part of the DfT-funded SSP.

The success of this data capture and analysis activity will be the number of UK business jet operators running FDM programmes.

- For business jet pilots, the use of Quick Access Recorders is being trialled to bring the advantages of performance feedback to the business jet community (November 2014).
- For non-UK business jet pilots, guidance is provided through Business Aviation Safety Partnership (BASP) to improve their level of knowledge and preparedness of operating in the UK.
- The results of the analysis of the data collected will drive the establishment of further steps to promote FDM for the business jet community (July 2014).

Outcome

Introduce the use of FDM to business jets and encourage operators to use the recorded data for pilot education.

Provide information to non-UK based operators on UK specific issues.

General aviation

The safety performance of UK GA over the period 2000-11 showed the risk to uninformed third parties on the ground to be very low; however, airspace infringement risk exposure remains high and approximately three per year are resolved only through providence. The risks to private pilots, passengers and those involved in aerial work are broadly equivalent to major international levels and will all benefit from safety improvements driven through the CAA Safety Plan.

During the latter half of 2013 the CAA responded to the UK government's GA Red Tape Challenge by committing to set up within its SARG function a general aviation unit, dedicated to more proportionate, effective regulation that supports and encourages a dynamic general aviation sector for the UK. The unit will be fully operational by April 2014. It will oversee the risk-based and proportionate regulation of non-complex EASA and national Annex II aircraft, their general non-commercial operation, the oversight of associated design, production and maintenance plus pilot training organisations and small non-public transport airfields.

The aim is that we will in future only regulate where it is best placed to do so or where no-one else can. We are very keen to encourage the GA sector and its representative associations to take responsibility for the area and its activities. We recognise that both nationally and international there is a relative lack of operational and safety outcome data, apart from fatal/serious incident, in the GA sector which make it difficult to assess the cumulative impact of regulation on the sector. The GA unit has an ambitious project portfolio addressing both safety and operation needs, many of which are closely aligned to the 'GA Safety Six' recommendations which resulted from our internal review of the regulation of recreational aviation during 2012.

Examples of initiatives presently underway include:

- airspace infringements – continued emphasis on GA stakeholder communications, particularly through CAA-funded GASCo Safety programme and Clued Up magazine (ongoing)
- airborne conflict events – e.g. implementation of the simplified approval process for hand-held radios completed in November 2013, and review of low-cost conspicuity opportunities (ongoing)

- controlled flight into terrain – e.g. permitting IFR ops for certain permit aircraft (in progress), and simplified process for IAP approvals (June 2014)
- loss of control in flight, runway excursions and human factors in the GA cockpit – enhancement to Part-FCL training syllabus (June 2014), and in-depth 10-year review of GA safety data (March 2014).

Under-pinning these specific initiatives, the GA Unit will adopt as its guiding principle a performance-based approach to regulatory oversight, working in conjunction with stakeholders to target resources towards areas of greatest safety opportunity.

SECTION 9

Conclusions

The science of safety management is relatively new and continuously evolving. This Safety Plan has drawn upon the work of our previous plans in analysing the root causes of the Significant 7 lethal outcomes.

The current work has been systematic in using safety data, bow ties and expert groups, and has given us confidence in the selection of the best root causes to address and the right projects to undertake. This does not negate previous work on avoiding lethal outcomes – it remains a valuable approach and work is continuing within our task forces to address issues specific to these risks. The current plan builds upon this and uses what we have learned from the process to address fundamental concerns of inherent safety in aviation. It also takes account of the changing context in which the CAA operates.

The pace of change in aviation, and the economic and regulatory environment in which it operates, is substantial. New requirements and safety initiatives from ICAO and EASA, industry advances, new transnational business models, rising traffic, a tough economy and environmental concerns are all factors to be considered in the development of our plans.

People are both the most valuable elements of the aviation system and the source of greatest risk. They have a unique ability to adapt to new situations and to solve problems that occur in complex and dynamic situations and find ways to recover the most challenging of circumstances, yet human error remains the most prevalent source of risk. It is clearly worth investment to support the performance of the key safety critical professionals in the aviation system.

Technology has given aviation many of the advances in operational and safety performance it enjoys today, with improvements in aircraft design, navigation equipment, airport and airspace infrastructure. We want to take full advantage of the capability of technology to reduce risk while being vigilant to its potential to introduce new risks.

Aviation is a global industry, and UK citizens travel on UK and foreign airlines to many destinations around the world. It makes sense that we should see our safety risks in this international context. That does not mean we should be taking on the safety issues of the world, but it does suggest that where our data highlights an important issue we should find a way to address it, even if it involves elements arising overseas and is beyond our conventional remit. This is a new approach currently in the initial stages, but achievements so far have been encouraging.

Our action plans are targeted at the priorities we see as providing the best safety benefit, and the CAA is working hard to both improve our internal effectiveness and enhance safety performance in the industry. This includes implementing an internal SMS, improving our customer service and strengthening our ability to deliver with a project management office and improved resource allocation management.

Aviation safety in the UK has an excellent safety record. In the face of relentless change and turbulent economic pressures, maintaining and improving it requires sustained effort from CAA and the industry. This is why we have continued to push forward and further develop our thinking. We will review and adjust our approach as we begin to see the results of this work.

APPENDIX 1

Safety Action Group (SAG)

The CAA SAG is responsible for identifying the top safety issues that drive the CAA's resource decisions and safety improvement projects. The SAG consists of the heads of all key technical functions plus Significant 7 task force leaders, but the members are invited to contribute as subject matter experts rather than purely representing their technical areas. The members of this group have visibility of a wide range of safety data and information from front line inspecting staff, and they use the combination of these sources to inform their judgement.

There are already teams working on actions relating to the Significant 7 lethal outcomes. Therefore, the SAG focus on the most important flight scenarios and root causes that precede them and assesses which are likely to be most effective in reducing the risk of those accident types (see Figure 7). The SAG's top priorities were identified through a rigorous system of assessment. It initially raised 84 issues, and these were each rated as risks; only those that were rated in the top-risk category were then considered in depth.

The priorities were allocated on the basis of the greatest potential to prevent future accidents. The performance of key professionals has been high on the list. This does not mean SAG considers their performance is currently 'poor' or that their current performance constitutes a 'high risk'. What it does mean is that if we want to prevent future accidents, investing in supporting key professionals' performance is the most likely activity to improve safety.

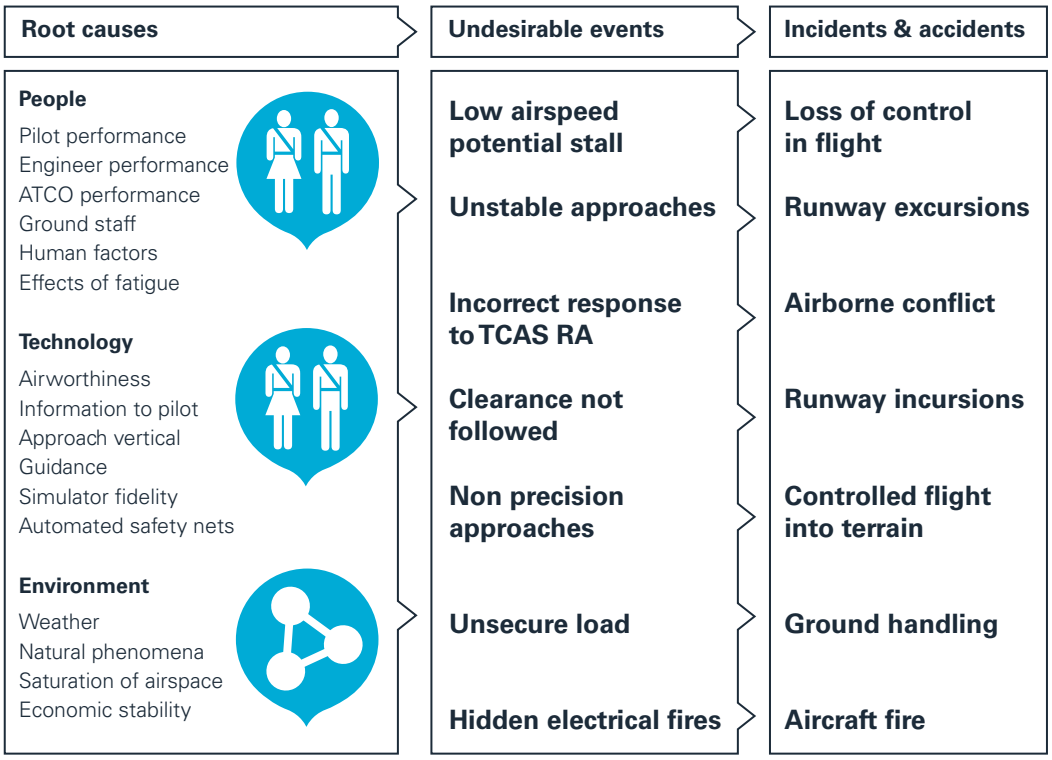


Figure 7 Root causes contribute to scenarios, which may lead to one of the Significant 7 accidents

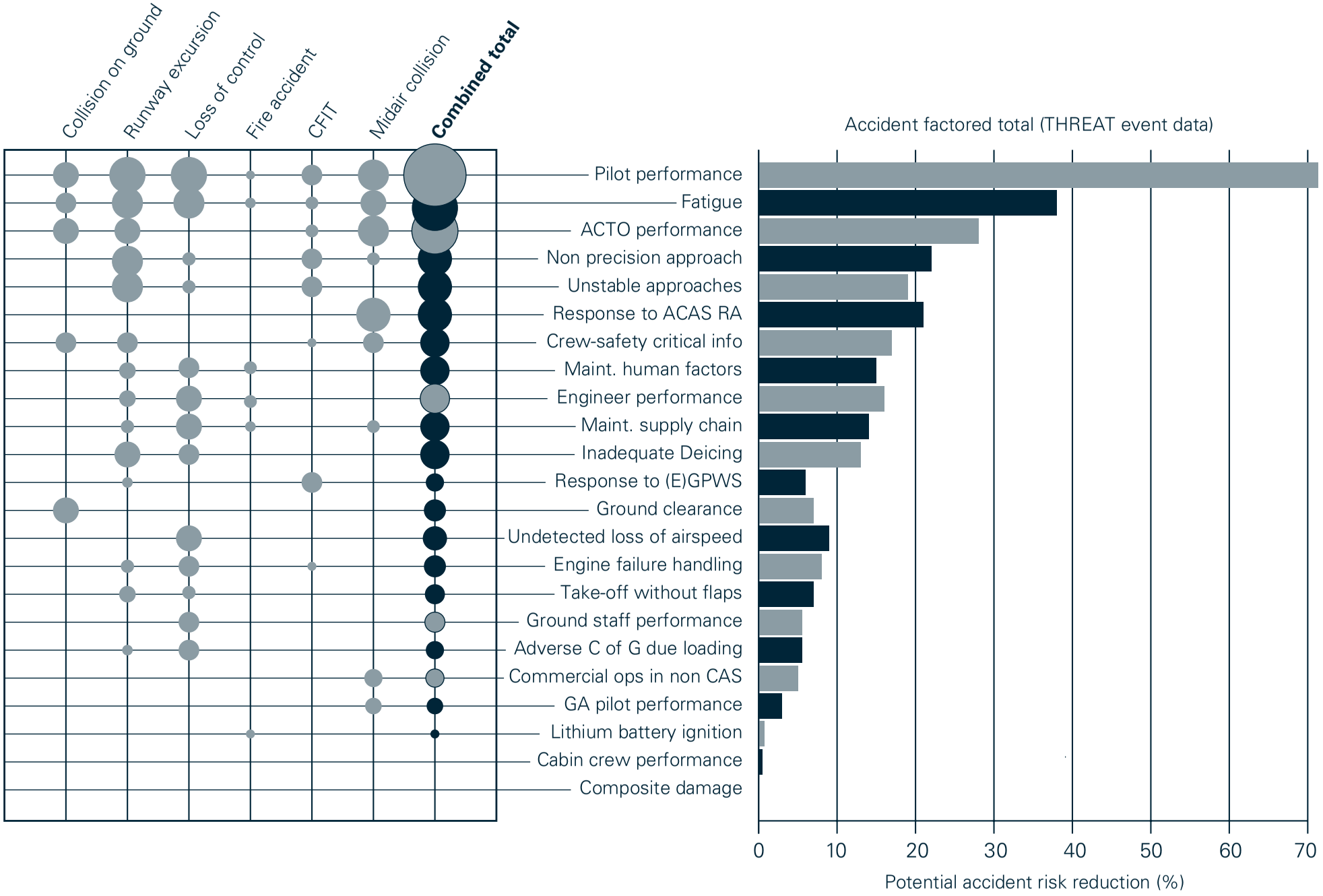


Figure 8 The SAG priority list and likely contribution to reducing Significant 7 accident types

The circle sizes on the left were based upon ratings by expert groups, concerning the likely magnitude and specific benefit of improvements for each risk item. Expert groups are informed by event data and other sources but ultimately make their own judgement. For example, inadequate de-icing was rated as more likely to reduce runway excursions than loss of control, although either is an operational possibility depending on circumstances. This rating may be influenced by some UK events where aircraft have accelerated for take-off but not lifted due to ice, while there have been fewer loss of control events due to icing in flight. In addition, the groups consider the safety barriers present in each situation and what they know of their performance. In any situation where events are relatively rare, there must be an element of judgement and this was used to produce the data in Figure 8.

The SAG priority list and its relationship to the Significant 7 is shown in Figure 2. (For example, investing in pilot performance is more likely to reduce loss of control events than aircraft fire events). Headline priorities included:

- pilot performance
- ATCO performance
- engineer performance
- effective management of fatigue across all disciplines
- non-precision approaches (NPAs) and unstabilised approaches
- correct pilot responses to Airborne Collision Avoidance System (ACAS) Resolution Advisory, and Enhanced Ground Proximity Warning System (EGPWS) alerts.

Airborne conflict in class G was highlighted mainly because of the perceived lack of robust multiple safety barriers. Once the priorities were agreed, the SAG reviewed the actions already underway on each of the priority subjects and considered whether they were sufficient given the priority assigned to them. Having considered existing actions, the SAG made its first recommendations for new action to the Safety Review Board (SRB), which were all accepted. Priority action items included:

- a new programme of work on pilot performance, including a review of pilot training (fitness for purpose)
- data collection on standardisation of flying skills examinations (working with EASA)
- increased attention and standardisation training for CAA inspectors on instructor quality

- new updated guidance on CRM
- a review of common issues in engineer performance including production planning, human factors training and repeat errors
- development of improved fatigue risk monitoring, including self-rating studies, research into more objective measures and further education on fatigue management
- progression of new technology issues to support better conspicuity in class G, such as researching regulatory issues associated with pilots' use of unapproved GPS sources.

APPENDIX 2

The Significant 7

The CAA Significant 7 safety issues were identified in 2009. This was achieved from analysis by multi-disciplinary expert teams of:

- more than 1,000 global fatal accidents dating back to 1980
- over 100 high-risk occurrences involving UK AOC operators with large CAT aeroplanes.

These safety issues were detailed in the CAA's Safety Plan 2011 to 2013.

For each of the Significant 7 risks, joint CAA/industry task forces were created to make recommendations on how each risk could be mitigated. The task force output was consolidated then debated with industry at a safety conference in October 2010.

The key conference outcome was an agreed prioritisation of loss of control and runway safety (primarily runway excursions) risks. Also identified was the need to further develop understanding of:

- influence of human factors
- effects of the organisational culture and safety culture relationship
- need to join-up Safety Management Systems (SMS) across all aviation disciplines.

These priorities are reflected in the actions contained in this plan.

The Significant 7 classification was the starting point. The risks to the total aviation system in the UK need to be better understood as each individual and organisation in the system has a unique risk profile. To continue to improve aviation safety, the direction is now moving towards a performance-based oversight model - Enhancing Safety Performance (ESP). Once fully developed, this model will address risks in a transparent way, in collaboration with industry, throughout the whole UK aviation system. This document deals with those risks that can be managed directly by the CAA in partnership with industry.

As a parallel to the SMS structures in industry, in 2012 the CAA created a Safety Action Group (SAG) overseen by the Safety Review Board (SRB). The SAG consists of senior managers from all the main regulatory areas, tasked to review their top risks using both available data and professional judgement. The initial proposals for action have been approved by the

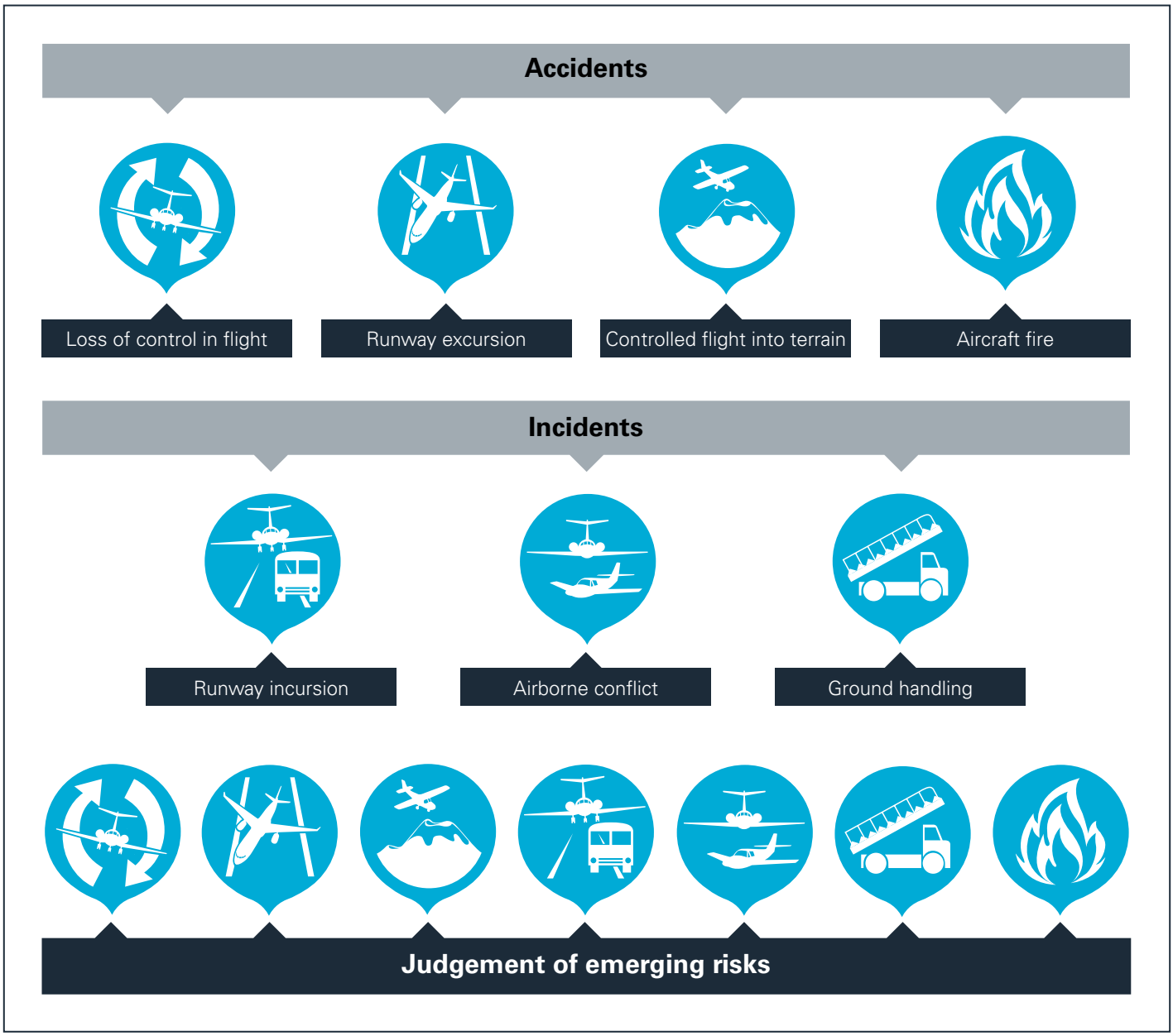


Figure 9 The development of the Significant 7 risks from fatal accidents and The High Risk Events Analysis Team (THREAT) data.

SRB and work will continue to further identify risks and develop actions. Approved projects include:

- pilot performance, including focused support to EASA on standardisation of flight crew competency
- review of fitness for purpose of pilot training
- research to improve fatigue measurement capability and monitor the impact of regulation changes
- promotion of fatigue management
- enhancements to CRM guidance
- enhanced data analysis of specific HF issues
- promotion of improved monitoring and alerting functions for air traffic issues
- development of a model to assess the additive effect of factors affecting individual flight risk e.g. multiple aircraft acceptable deferred defects
- increased availability of Global Navigation Satellite System (GNSS) type approaches
- review of general emergent economic and demographic pressures on the UK pilot population
- improving aircraft maintenance HF issues
- improving capability in FDM programmes to identify operational safety risks
- sharing airspace safely
- electronic conspicuity improvements
- exploring technology to enhance safety in class G airspace and reduce infringement risk.

APPENDIX 3

Bowtie analysis

The Significant 7 safety risks are also the subject of bowtie models, which are being created by joint CAA/industry groups. The bowtie methodology was chosen because of its effectiveness in visually depicting risk and for the ability to identify and assess the key safety barriers (or lack of them) in place between a safety event and an unsafe outcome. Bowtie models are a key component of the Enhancing Safety Programme (ESP) knowledge base and provide:

- an effective, visual depiction of risk
- a balanced risk overview for the whole aviation system between internal and external stakeholders (including third party risks)
- an increased awareness and understanding of the safety risk leading to 'Significant 7' outcomes
- the best practice guidance material for safety risk management at an operational and regulatory level
- an identification of critical risk controls and an assessment of their effectiveness
- an Identification of SPIs to monitor performance of risk control (including leading indicators).

How does it work?

The bowtie model consists of different elements that build up the risk picture. The risk picture revolves around the **hazard** (something in, around or part of an organisation or activity which has the potential to cause damage or harm) and the **top event** (the release or loss of control over a hazard known as the undesired system state).

Consideration is then turned to the **threats** (a possible direct cause for the top event), **consequences** (results of the top event which directly results in loss or damage) and the **controls** (any measure taken which acts against some undesirable force or intention). The controls can be populated on either side of the model showing preventative measures which eliminate the threat entirely or prevent the threat from causing the top event or recovery measures which reduce the likelihood of the consequence owing to the top event being 'live' or mitigate the severity of the consequence.

The bowtie model explores the **escalation** factors (the reasoning to why a control may not be defeated or less effective) of all controls allowing the allocation of **escalation factor controls**, which prevent the escalation factor having an impact on the prevention or recovery controls.

Further attributes can be allocated to the bowtie model to evaluate the risk picture as part of an effective SMS.

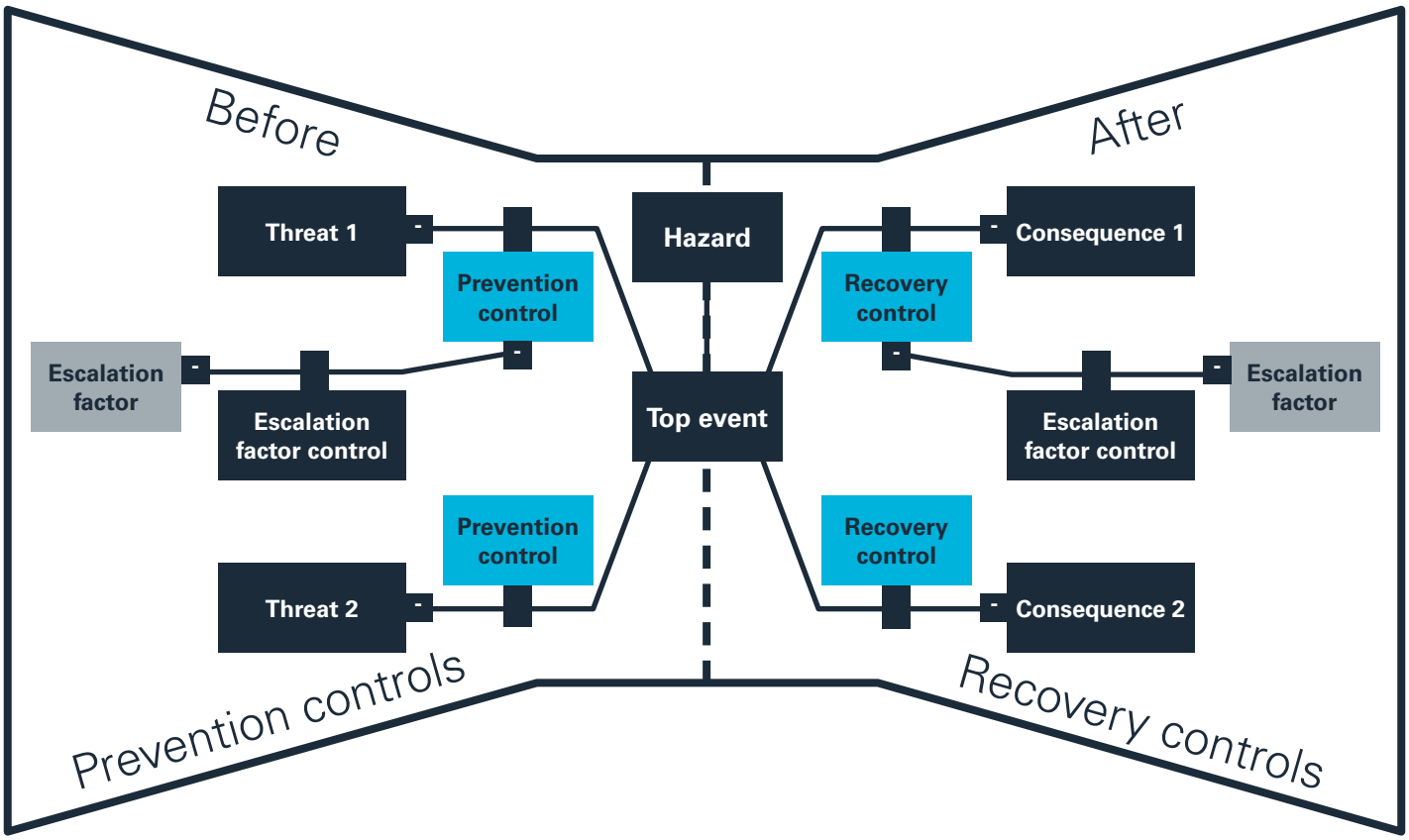
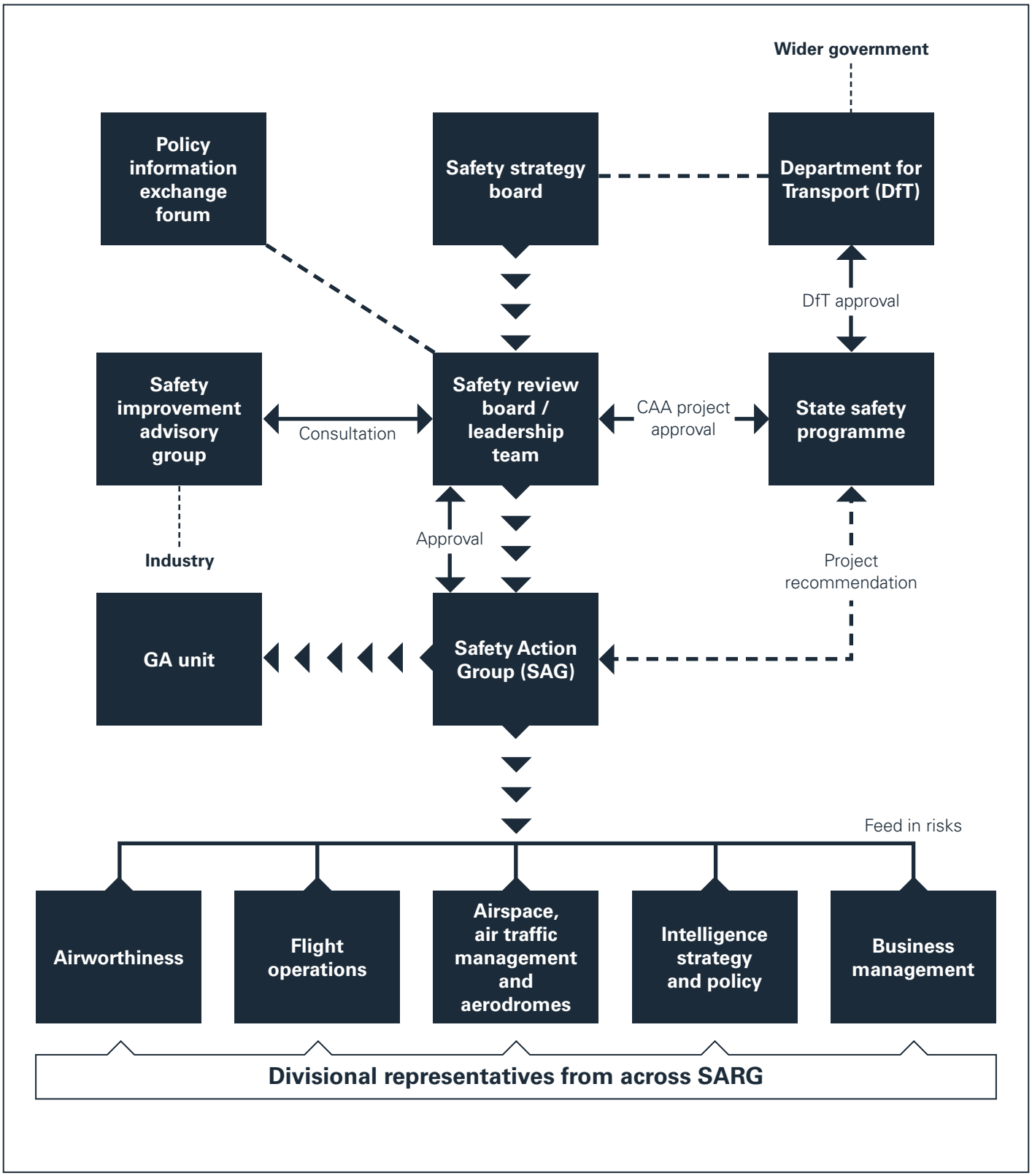


Figure 10 Layout of a Bowtie model

APPENDIX 4

The safety governance plan



Glossary

AAD	Advanced Anomaly Detection
AAG	CAA Accident Analysis Group
AAIB	UK DfT Air Accidents Investigation Branch
AAD	Additional Airworthiness Directive
ACAM	Aircraft Continuing Airworthiness Monitoring
ACAS	Airborne Collision Avoidance System
AD	DfT Aviation Directorate
ADREP	ICAO Accident/Incident Data Report
AGNA	EASA Advisory Group of National Authorities
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
ALARP	As Low As Reasonably Practicable
ALoSP	Acceptable Level of Safety Performance
ANO	The UK Air Navigation Order
ANSP	Air Navigation Service Provider
APV	Approach with Vertical Guidance
ARCC	UK Aeronautical Rescue Co-ordination Centre
ARE	CAA Aviation Regulation Enforcement Department
ASSI	Air Safety Support International.
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATQP	Advanced Training & Qualification Programme
BALPA	British Airline Pilots Association
BASP	Business Aviation Safety Partnership
BAT	British Antarctic Territory
BIOT	British Indian Ocean Territory
BIS	UK Department for Business, Innovation and Skills
CAA	UK Civil Aviation Authority
CAP	CAA Civil Aviation Publication
CD	Crown Dependencies
CFIT	Controlled Flight into Terrain

CHIRP	Confidential Human Factors Incident Reporting Programme.
CAAi	CAA International
CR	Common Requirement
CRM	Crew Resource Management
CSP	EASA Community Safety Programme
DAP	CAA Directorate of Airspace Policy
DASMS	Defence Aviation Safety Management System
DCA	Director of Civil Aviation
DfT	UK Department for Transport
DGCA	DfT Director General Civil Aviation
EASA	European Aviation Safety Agency
EASP	European Aviation Safety Plan
EAPPRE	European Action Plan for the Prevention of Runway Excursions
EAPPRI	European Action Plan for the Prevention of Runway Incursions
EC	European Commission
ECAC	European Civil Aviation Conference
ECCAIRS	European Coordination Centre for Accident and Incident Reporting Systems
EGPWS	Enhanced Ground Proximity Warning System
EHEST	European Helicopter Safety Team
EOFDM WG	European Operators Flight Data Monitoring Working Group
ER	Essential Requirements
ESARR	Eurocontrol Safety Regulatory Requirement
ESP	Enhancing Safety Performance
ESSI	European Strategic Safety Initiative
EU	European Union
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FAS	Future Airspace Strategy
FAST	Future Aviation Safety Team

FCO	Foreign and Commonwealth Office
FDM	Flight Data Monitoring
FTL	Flight Time Limitations
GA	General Aviation
GASIL	General Aviation Safety Information Leaflet
GASCo	General Aviation Safety Council
GHOST	Ground Handling Operations Safety Team
GNSS	Global Navigation Satellite System
HF	Human Factors
HUMS	Health and Usage Monitoring System
IAIP	Integrated Aeronautical Information Package
IAP	Instrument Approach Procedure
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IR	Implementing Rule
JAA	Joint Aviation Authorities
JSP	Joint Service Publication
LPAT	Low Power ADSB Transceiver
MAA	Military Aviation Authority
MCA	UK DfT Maritime and Coastguard Agency
MoD	Ministry of Defence
MOR	Mandatory Occurrence Report
MORS	CAA Mandatory Occurrence Reporting Scheme
MoU	Memoranda of Understanding
MRP	MAA Regulatory Publications
NATS	National Air Traffic Services
NAA	National Aviation Authority
NPA	Non Precision Approach
OT	UK Overseas Territories
OTAA	Overseas Territories Aviation Authorities
OTACs	Overseas Territories Aviation Circulars
OTARs	Overseas Territories Aviation Requirements
PBO	Performance Based Oversight
PBR	Performance Based Regulation

PED	Portable Electronic Device
PPI	Performance and Process Improvement
PPT	Policy Programmes Team
QAR	Quick Access Recorders
RAF	UK Royal Air Force
RESA	Runway End Safety Area
RPAS	Remotely Piloted Aerial System
SAFA	Safety Assessment of Foreign Aircraft
SAG	CAA Safety Action Group
SAR	Search and Rescue
SARG	Safety and Airspace Regulation Group
SARPs	ICAO Standards, Recommended Practices and Procedures
SES	Single European Sky
SIAG	Safety Improvement Advisory Group
SMS	Safety Management System
SPC	CAA SRG Policy Committee
SPI	Safety Performance Indicator
SRB	CAA Safety Review Board
SRC	Eurocontrol Safety Regulation Commission
SRG	CAA Safety Regulation Group
SRMP	Safety Risk Management Process
SRMS	CAA Safety Regulatory Management System
SRR	Search and Rescue Region
SRT	CAA Safety Risk Team
SSP	State Safety Programme
TAWS	Terrain Awareness and Warning System
THREAT	CAA The High Risk Events Analysis Team
UAS	Unmanned Aircraft Systems
UK	United Kingdom
UKBSC	UK Bird Strike Committee
UKMCC	UK Mission Control Centre
UKSA	UK Space Agency
USOAP	ICAO Universal Safety Oversight Audit Programme