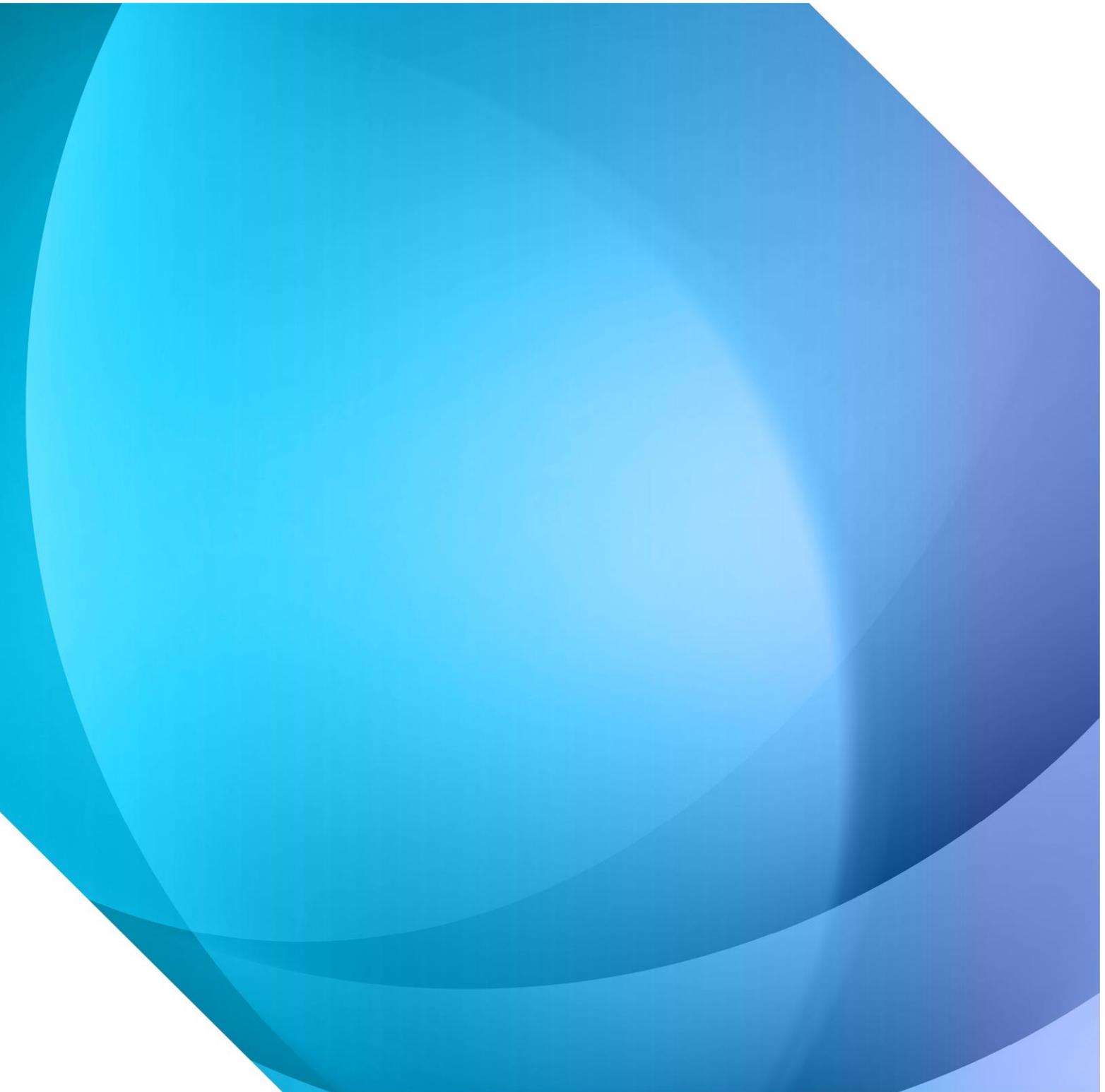


Pilot training review – interim report: task 2 interview study

CAP 1581c



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Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

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Preface

This independent research, initiated and funded by the CAA, and part of the CAA's strategic approach to improving safety, reviews UK pilot training in the wider international context. Against a background of increasingly highly automated aircraft, with air travel as a major UK industry with a consumer expectation of the highest safety standards, it is essential that pilots receive effective, evidence-based training that keeps pace with technological, operational and organisational change. This report, together with associated reports below, detail current research directions, current training issues and opportunities. We will explore with the aviation industry how potential safety improvements may be achieved to maximise the benefits of this study.

Related publications

- [CAP 1581 – Recommendations and Conclusions](#)
- [CAP 1581a – Gap Analysis](#)
- [CAP 1581b – Literature Review](#)



Pilot Training Review
Interim Report: Task 2 Interview Study

FNC 46243/46563R Issue 2
Prepared for Civil Aviation Authority (CAA)

SYSTEMS AND ENGINEERING TECHNOLOGY

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Originating Office: FRAZER-NASH CONSULTANCY LIMITED
The Cube, 1 Lower Lamb Street, Bristol, BS1 5UD
T: +44 (0)117 9226242 F: +44 (0)117 3169686 W: www.fnc.co.uk

EXECUTIVE SUMMARY

This document is the second Interim Report from CAA project 2217: Pilot Training Review. It describes the findings of interviews conducted with aviation community stakeholders to establish current practice amongst air operators and training establishments for the delivery of pilot training against current regulatory requirements. The output of these interviews will be utilised for the Gap Analysis in the next step of the work. A Final Report at the end of the project will provide overall conclusions and recommendations.

Following a number of air accidents where pilot training has been cited as a contributory factor, the effectiveness of pilot training has come under increased scrutiny. In response, the aviation community has been exploring approaches to address problem areas, and the CAA was keen to understand the extent of such activities, their impact, and any remaining issues not being addressed. To this end, the CAA commissioned a project to conduct a review of “recent training studies and activities and potential improvements in order to inform policy on taking the matter forward internationally.” (CAA Research Specification, July 2014).

The first task in the project was to establish the current state of the art in pilot training through a review of published training, human factors and aviation psychology literature. The current task was to identify current practises and issues for pilot training in the UK through interviews with a broad range of aviation community stakeholders. This document describes the findings from these interviews.

A semi-structured interview schedule was developed based on the findings from the literature review. Key topic areas in the interview were: overall approaches to training, content, instructors, pilots/careers, support, changes and challenges. Interview participants were from 16 organisations including: airlines, helicopter operators, training organisation, military aviation, professional and trade associations and regulators.

The results from the interviews were analysed to identify issues, concerns, new approaches and current activities from the organisations. The findings are discussed in the report with a summary presented as a table to provide a snapshot sample of current practise and issues in UK pilot training. The key highlights from across this and the surveyed organisations are:

- ▶ Strong desire to move away from traditional technical proficiencies and time-base measurement of training to competence- and risk-based content and assessment for all operator types and across a pilot’s career. Some organisations already report following Training Needs Analysis (TNA) approaches to inform this training content but the exact details of these processes were not identified;
- ▶ Military flight training organisations adopt a systems approach to training that provides clear processes for identifying requirements and structuring development, delivery and evaluation all within a broader quality assurance and governance framework;
- ▶ The advantages of simulation are widely recognised and exploited but, with minimal training footprints, time for training and practice are limited. Lower-fidelity devices could be utilised, however, resources to invest in alternative technologies are limited; also there would need to be more flexibility in the regulation around use of flight training devices;
- ▶ There seems to be a common understanding as to the general content required for training; for example, integration of technical and non-technical skills was highlighted. Detail on specific techniques from training competencies were not covered but the need for more specific approaches to train elements of cognitive skills, e.g. decision making was identified. It also appears that knowledge for understanding and using automation is still a challenge for pilots, although this is a strong focus in simulator training and increasingly considered in early training. Specific approaches for maintaining manual flying skills – other than regular practice – were not identified although again this is recognised as important;

- ▶ A significant challenge and concern is the increasing demand for pilots and the falling supply, and how to manage this without reducing quality and safety standards. There is a perception that standards vary across training establishments with the EASA region and that there is no longer any central control for this from the CAA or ability to check up on training history. Military organisations face similar challenges with numbers but they have very strong selection and performance management mechanisms to manage standards, which other organisations may not be able to sustain;
- ▶ As with other professional areas, there is a growth in flexible working. This may have an impact on pilot training that needs to be considered;
- ▶ As with the increasing demand for pilots so there is an increasing demand for training instructors and a challenge in some areas with attracting people to the role. Improved salaries and reward was thought would be helpful. The need for instructors to have broader capabilities to address the greater demands of competence-based training (less prescriptive) and the growing complexities of the pilot role and aircraft operations was highlighted. The need for this is further reinforced given the reducing level of overall flying experience in the aviation community. Two anomalies were identified as regards training and qualification of instructors. It appears there is no formal regulatory requirement for either of these for Ground School Instructors and Line Training Captains which, given the importance of these roles, is surprising;
- ▶ Following the move to EASA, the role of the CAA has changed, as has its capacity. As a result, operators and training organisations report experience of reduced staff numbers, high turnover and, importantly, access to less expertise and guidance. EASA itself is viewed as reducing the pace of change in regulation and there is concern it has increased variability in standards. There was no sense that the levels of expert support and guidance previously provided by the CAA are now being provided by EASA or elsewhere, which may be particularly challenging for smaller or less developed organisations;
- ▶ Change is an ongoing challenge for aviation training. The need to be able to adapt training to address operational risks is critical not least because changes in ATM, continuing developments in aircraft automation and growing globalisation all influence the pilot's role and, therefore, the competences needed to support that safely and effectively.

Interestingly, most of the focus of discussion in the interviews was on the challenges facing organisations in delivering training than the training content itself. This is different to the findings from the literature review when the focus was more on the detailed content and training for specific skills rather than on the broader training system. Change is an ongoing challenge for aviation training. The need to be able to adapt training to address operational risks is critical not least because changes in ATM, continuing developments in aircraft automation and growing globalisation all influence the pilot's role and, therefore, the competences needed to support that safely and effectively

A significant finding from the interviews is that none of the organisations interviewed indicated that they thought current pilot training practise in the UK was unsafe, although there was a perception amongst organisations that it would be difficult for UK organisations to protect themselves from lower standards of training if supplied from elsewhere in the EASA community. However, to ensure safety going forward, given the demands placed on pilots and the modern aviation system, there are clear areas for continuing improvement, scope for rationalisation and further development. The main concerns and challenges identified relate to the capability of the current training system to meet increasing demands going forward whilst, importantly, maintaining high performance and safety standards in an ever more complex, global and commercially-driven aviation environment. Ultimately, if the training footprint cannot be increased to address the growing demands on pilots then the training provided and the system around that must be absolutely optimal. A number of clear messages were identified around organisations' concerns, or opportunities for improvement, such as: the requirement for some form of Evidence Based Training (EBT) to be fully supported by EASA regulations for both airlines and helicopter operators (as is currently being developed

under Rule Making Task .0599), and a stronger competence-based approach flowing back down the training pipeline; simulation is recognised as providing enormous benefit in aviation training, and could be used further for 'non-jeopardy' (i.e. no assessment) training and practice perhaps through lower cost devices; the need to continually refresh training for automation; the need to update ground school training; the challenge of managing variation in standards across training suppliers; and, importantly, the desire for knowledgeable, experienced support from the UK regulator.

The next step in the project is to conduct a gap analysis on the results from the interviews and from the literature review to identify any shortfalls, and the residual risks associated with these, on aviation training. Responses from the interviews, that discuss anticipated changes in future aviation and barriers and enablers to change in training, will be used to support the development of recommendations. The recommendations for changes to training and future research activities will be proposed, based upon the findings of the gap analysis.

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1. INTRODUCTION

1.1 PURPOSE

This document is the second Interim Report from CAA project 2217: Pilot Training Review. It describes the findings of interviews conducted with aviation community stakeholders to establish current practice amongst air operators and training establishments for the delivery of pilot training against current regulatory requirements. The output of these interviews will be utilised for the Gap Analysis in the next step of the work. A Final Report at the end of the project will provide overall conclusions and recommendations.

1.2 PROJECT BACKGROUND AND AIMS

Following a number of air accidents where pilot training has been cited as a contributory factor, the effectiveness of pilot training has come under increased scrutiny. In response, the aviation community has been exploring approaches to address problem areas, and the CAA was keen to understand the extent of such activities, their impact, and any remaining issues not being addressed. To this end, the CAA commissioned a project to conduct a review of “recent training studies and activities and potential improvements in order to inform policy on taking the matter forward internationally” (CAA, 2014). The project is divided into two main information collection phases: a Literature Review and Interviews with aviation community stakeholders. From these, a Gap Analysis shall explore shortfalls and any residual risk before making recommendations to address these. The overall project output will be a set of recommendations for interventions and/or further developments to improve training-related safety outcomes for UK aviation.

The project scope considers the breadth of civil commercial aviation including fixed- and rotary-wing aircraft, different operator types and training organisations, and it also explores future changes in military aviation that could influence the pilot training pipeline.

The objective of the interview study was to establish the state of current practice and issues for pilot training in the UK.

1.3 REPORT STRUCTURE

This Report is divided into the following sections:

- ▶ Literature Review Findings;
- ▶ Interview Methodology;
- ▶ Interview Findings;
- ▶ Next Steps - Gap Analysis;
- ▶ Conclusions.

The Report also contains two annexes: one contains the interview schedule; and the other contains data from the interviews grouped by organisation type.

2. LITERATURE REVIEW FINDINGS

2.1 SUMMARY

The objective of the literature review was to establish the 'state of the art' in pilot training, including to identify the current and latest training techniques, design philosophies and recommended content, including the results of training effectiveness evaluations, skill fade studies and consideration of issues around instructor training. This was achieved through reviewing recent training, human factors and aviation psychology literature on pilot training and associated topics. The regulations themselves were not reviewed but a number of guidance documents and manuals from the broader aviation community were included at a high level, e.g. guidance on EBT from both ICAO and IATA. The literature review has been reported previously as a separate report (McDougall and Fletcher, 2014).

The key findings from the literature review were:

- ▶ The literature identifies a wide range of 'state-of-the-art' training activities; however, the extent to which these are implemented in the aviation training community is not known;
- ▶ There is an increasing use of Competence-Based Approaches in training, supporting trainee resilience, as it becomes impossible to train for every eventuality possible in a modern cockpit;
- ▶ Training that provides pilots with resilient skills enables the pilot to be adaptive to a wide catalogue of situations.

The types of topic covered in the literature includes:

- ▶ Increased opportunity for manual flying, including in unusual attitudes;
- ▶ Specific training to support 'upset' recovery, including managing 'startle' through more realistic training environments regarding stress;
- ▶ Increased focus on declarative knowledge on automated systems, including underlying logic to help development of mental models, different modes and their transitions;
- ▶ Integration of technical and non-technical skills related to flight handling;
- ▶ Development of monitoring skills;
- ▶ Training on cues to recognise 'upsets' and lapses in situation awareness;
- ▶ Development of meta-cognitive skills to support self-evaluation and review;
- ▶ Prioritisation skills and strategies for workload management, including task shedding.

However, it was noted that much of this literature was without practical guidance on how to deliver the developments in the course of real-world training programmes. Indeed, it was noted in the review that to achieve implementation of the state-of-the-art in operational training, it is crucial that there are organisational pathways that bridge the gap between research, the development of training programmes and the day-to-day delivery of pilot training.

Additionally, the literature review revealed gaps in knowledge and available information, including:

- ▶ Clearly defined, detailed competency frameworks for pilot Knowledge, Skills and Attitudes (or sometimes Abilities; KSA);
- ▶ Methods to develop airline specific KSAs;

- ▶ Approaches for systematic needs-based training analysis;
- ▶ Approaches to optimise retention of manual flying skills, including in unusual attitudes;
- ▶ Guidance on integration of technical and non-technical training from the early stage;
- ▶ Guidance on the use of low-cost training tools such as low-fidelity 'what-if' training and use of computer games.

It was recognised that some of these topics could have been addressed elsewhere or even resolved and hence not be discussed in the more recent literature. Or these topics could have been picked up directly by the aviation industry in development of training, and so information might not have been published. The purpose of the interviews is to survey this to understand what is going on in the 'real world'.

3. INTERVIEW METHODOLOGY

3.1 PARTICIPANTS

The participants for the interview were identified through discussions with CAA Stakeholders, supplementing our suggested participant list outlined in our proposal (Frazer-Nash consultancy, 2014). This provided a list of 38 possible contacts within various categories:

- ▶ Different types of airlines, i.e. large, low cost, private charter, international etc.;
- ▶ Helicopter Operators;
- ▶ Military Aviation;
- ▶ Training Establishments, both UK and non-UK;
- ▶ Pilot and trade associations;
- ▶ Manufacturers; and
- ▶ Regulators.

From these possible participant types, 30 organisations were approached from our initial contact list. Where direct points of contact had been identified through Frazer-Nash or the CAA, potential participants were sent email invitations to interview. For others, the project team used public contact details to try to identify relevant stakeholders through exploratory phone calls. Participants were also identified through discussion of this work at the International Flight Crew Training (IFCT) Conference held at the Royal Aeronautical Society from 23-24 September 2015.

These activities and the subsequent follow up communication resulted in interviews with representatives from 16 organisations. A number of other organisations were interested in participating but scheduling prevented the engagements. Recruitment of participants was most effective when facilitated by a direct introduction from the CAA or personal meeting. No direct refusals to take part were received, rather it was just not possible to make contact with appropriate persons for the areas not covered, e.g. regional and business operators.

Table 1 shows the distribution of participants across organisations. A total of nine interviews were held face-to-face, and seven were held over the telephone, including participants based elsewhere in Europe.

Table 1. Interview participants (by organisation type)

Organisation Category	Number of organisations interviewed
Large Airline	2
Charter Airline	1
Helicopter Operators (Offshore)	2
Military Aviation Training	2
Training Establishment (Ground School, Flying Training, Helicopter Manufacturer)	3
Professional and Industry Associations	3
Regulatory perspective (UK, US, EASA)	3

Of the above list, participants had multi-national experience: one organisation was part of a pan-European airline; the helicopter manufacturer provides training globally; and regulatory insights were provided from US, UK and European perspectives. The professional association was a pilot union and the two industry associations (covering fixed and rotary wing operations) both address UK and international interests. Some interviews were with individual participants, whilst others were conducted with a number of representatives from the organisation. The interviewees held posts such as: Chief Training Pilot; Head of Flight Operations; Head of Pilot Training; Head of Training Strategy; Flight Safety Officer. The total number of participants engaged in the interviews from within the organisations was over 25.

3.2 INTERVIEW SCHEDULE

From the breadth of findings from the literature review, a number of areas emerged for consideration in the Stakeholder Interviews. These were used as the basis from which to develop the interview questions. The aim of the questions developed were to explore how much of the state-of-the-art has transferred to initial and operator training, if any further advances exist that have not been reported in the public domain and to understand the barriers and enablers to changes in the pilot training system.

The overall approach to the interviews was to follow a semi-structured format that would allow similar areas to be discussed across the range of stakeholder types but also to allow flexibility and to prompt discussion. For example, with airlines, the question could be used to explore specific aspects of their training programme but with regulatory or industry bodies the discussion could be higher level. The interview schedule was divided into seven areas:

- ▶ **Overall Approach:** questions to explore the training philosophies / strategies being applied, use of technology and simulation and course evaluation;
- ▶ **Content:** questions about the content of training including how competence and competencies are identified, addressed and assessed, with specific questions about training for a number of key topics identified in the literature;
- ▶ **Instructors:** questions about the selection and training of instructors, the assessment of instructor activities and evaluation and the main challenges associated with the task;
- ▶ **Pilots/Careers:** questions about pilot selection, background and any changes in trends in career pathways and general makeup of the workforce;
- ▶ **Support:** questions about the guidance and support available to the aviation training industry to develop and implement improvements, including from regulators and other industry associations;
- ▶ **Change:** questions about the drivers for change in organisation, identification change requirements, any recent developments and anticipated future changes;
- ▶ **Challenges:** questions about the current risks in pilot training, ways to address this and likely challenges going forward. A final question asked about barriers and enablers to achieving change in the organisation.

A full interview schedule is available in Annex A - . A brief rationale of the different groups of question is given.

During conduct of the interviews, the question order was adjusted so the first question explored views on the current risks regarding pilot training (initially question 23, see Annex A -). This then lead into the other topics to a level of detail suitable for the participant. The change in

questioning order was made because discussion naturally started in this place following introduction of the project and it helped with the flow of subsequent questions.

3.3 ANALYSIS

The raw notes from each of the 16 interviews were recorded in Word. All notes were de-identified. The key points raised in response to each question, or part of the interview, were extracted for analysis alongside other organisations of that type and across all organisations. Given the sample sizes in each group and the varying level of detail in the information collected from different participants it was not possible to conduct any qualitative analyses.

In addition to the interview data, additional insights were provided for the analysis from notes taken during presentations and discussions with a range of national and international stakeholders attending the IFCT Conference. Information was extracted from 13 presentations, delivered by individuals from 11 organisations. The types of organisation were: five airlines: regional, international scheduled and low cost; a business jet operator; three ATOs: small, manufacturer and international; and an industry commentator. These were considered alongside the main interview results but always recognising their separate source.

3.4 PRESENTATION OF THE FINDINGS

The main results are presented in section 4 with discussion around the issues emerging from the interviews. A summary table of the main findings on current practice in pilot training is shown in section 4.10. The results from the last two questions on the schedule interview are presented in section 5, as they will be used to support the gap analysis and development of recommendations.

4. INTERVIEW FINDINGS

4.1 INITIAL OBSERVATIONS FROM THE DATA ANALYSIS

The interviews were broad in their discussions, in keeping with the purpose of the study, and a large volume of information was collected from participants. While there were differences across organisation types and participants, there were also a number of common themes and concerns. There was marked consistency in issues raised from within the group of airlines and between the helicopter operators; indeed, putting aside the different challenges of their operating environments, most of the main challenges faced by helicopter operators and airlines were similar. This perhaps reflects that both are commercial operations whose core business is passenger air transport. Training is a means to an end, on one side offering potential to achieve a more competitive edge, but on the other having to be balanced with resources in an increasingly changeable and global environment.

Military aviation increasingly shares many of the same challenges facing other operators in terms of resource constraints and numbers, although there are also obvious differences based on the nature of their role and the proportion of time spent in training. The military also has the advantage of a cultural expectation of stricter controls on selection and maintaining high standards of quality. The other significant difference for the military is the requirement to follow the Defence Systems Approach to Training (DSAT) and use Training Needs Analysis (TNA), whilst there is also a significant drive for increased use of simulation of varying levels of fidelity.

The most diverse set of data came from the ATOs. This is because the types of organisation involved in the interviews were all very different and as such their focus is on different issues. The regulatory perspectives clearly varied between the organisations considered. Each have different organisational make-ups, coverage and remits. Also, the type of role/experience of the individuals consulted with respect to the organisations was different. Likewise, the different professional and industry associates offered markedly different perspectives. They are retained together because they represent an external view on training. Interestingly, they are the group that seemed to generate the most responses to the question (24) about how to address risks in training. This is perhaps because the role of these organisations is to think about solutions for their members.

One area that emerges from the interviews but that was not explicitly included as a question in the interview schedule is that of standards. As this is a significant factor and cuts across a number of areas of training it is discussed further in section 4.7.

4.2 OVERALL TRAINING APPROACH

4.2.1 Training philosophy

4.2.1.1 Competence-based approaches and EBT

There is a strong desire to be able to train across the training pipeline to reflect real issues relating to current operations and aircraft. All but one organisation explicitly stated that pilot training should be moving toward some type of needs-based, output focussed training. Generally, this was described as being EBT, but there is recognition that other approaches of competence-based training could be used in licencing training. Within the UK, under EASA regulation, airlines with aircraft carrying more than 50 passengers, with full flight simulators (FFS) and with the mechanisms in place to collect (and process) required safety data are able to implement the Alternative Training and Qualification Programme (ATQP) for recurrent training and operator proficiency checks. This offers a step towards EBT but still requires compliance

with traditional proficiency checks in a FFS. This reduces the overall amount of time available for training around evidence-based topics.

Helicopter operators and smaller airlines are not permitted to follow ATQP and their training is still regulated by traditional task-based proficiency checks. Flying hours are also still used by the external customers for some operators, e.g. oil companies, for judging suitability of pilots for operations and promotion. There is a move by helicopter operators to bring in the spirit of ATQP/EBT as far as possible, e.g. using Line-Oriented Evaluation (LOE) and Line-Oriented Flight Training (LOFT), including scenarios around known risks; but the main regulatory checks must still be completed, so simulator time is limited. As a result, there is considerable frustration across the community that progress towards fully flexible risk-based, competence training is being hampered by out of date regulations. There is an EASA Rule Making Task (RMT), RMT.0599, underway to explore EBT and competence-based training but it is not due until 2018 at the earliest. Helicopter operations are now being considered, but it is not clear how widely the rules will apply beyond this or if provision will be made to support all operators in adopting performance based training of some kind.

While there was very clear support for the EBT concept, a couple of more cautionary comments were also made. One participant noted that, while ATQP allows for three different and relevant scenarios in the currency check, each pilot only experiences one of these. This means there are two other scenarios each addressing relevant risks that they might not have had the opportunity to experience. However, theoretically as a competence-based approach, the same competences should be addressed in the different scenarios, just under different circumstances. The other observation made is that, because of using this risk-based approach to focus training, it relies on pilots having really good foundation training across all competences because not everything may be addressed in each training event and, hence, the time between training for some skills could actually increase.

The military has always adopted a more performance-based approach to training and has already started undergoing the shift to competence-based training. One of the underlying tenets to military training is 'train as you fight' and embedded in this is the need to design training to meet the needs of real operations. Furthermore, all military training (not just aviation) is now being managed through DSAT, which requires all organisations to follow a systematic and needs based approach to all training related activities. Organisations are still becoming fully compliant with this but it already provides a clear framework for action.

4.2.1.2 Ground school and early flying training

While operator training seems to be driving forward in its approaches, there is a clear view that ground school training is significantly behind. One major concern about the ground school training area is the lack of any requirement for qualification or experience for ground school instructors. Question banks are widely used as a source of material, suggesting a clear culture of training to pass the test. One organisation interviewed is trying to bring in a competence-based training approach and use TNA and Instructional Systems Design (ISD), to ground school training, as well as focussing on learning and adapting courses to different styles and student backgrounds. How well this type of approach would suit ground school instructors was unclear.

The other area of training that seems to receive little attention is early flying training, and some elements of training delivered through a fragmented approach. The key area of concern here seems to be the high level of training delivery by hours-building pilots, who by definition do not have any depth of experience. One participant observed also that it is the early part of training where pilots gain their all-important manual flying skills and yet it is also somewhat undervalued

as trainees are keen to get into more advanced aircraft. Another concern is that where hours building is taking place, it needs to be properly structured to support consolidation of learning and skills development. The military uses extensive practise and debriefing to achieve high, consistent standards of performance. Another anomaly identified with licencing training is in the type of aircraft being used to obtain checks. To achieve a multi-engine instrument rating, training schools use small multi-engine piston aircraft but these are unlikely ever to be flown in again by students, and have limitations on the conditions under which they can be flown. Given the high costs associated with pilot training, perhaps simulation could be used more for some activities, and could be more representative of the end point pilots are trying to achieve.

4.2.2 Use of simulators and training technologies

A significant benefit in aviation training is the availability of sophisticated high fidelity simulators. Although not all aircraft and every training organisations/airline have them, FFS are used extensively across pilot training for fixed wing and helicopter operations, military and civil. Operators would like to be able to use their simulators more flexibly, which is something they would gain with EBT. From a pilot perspective time in simulators should be less about checking and more about training, i.e. have time that has no punitive risk arising from any actions observed (known as non-jeopardy training), which might improve uptake of sessions for practise outside of the formal checks. Perhaps important regarding use of simulators is that current trends in training are advocating use of lower-cost training devices. Not everything needs to be trained in a device with the use of full motion and visual systems represented. The military use a range of simulator types from part-task and procedures trainers to FFS, and even networked systems. The value of this, and of using simulators themselves, is that time at the next stage, in a more expensive device or aircraft, is not wasted on training that could be conducted with less (physical) fidelity or sophistication. EBT and recent Airbus training (discussed at the IFCT conference) advocate this approach. The use of tablet computers for this purpose does appear to be growing, primarily for ground school type training but also for learning button layout and some procedures. One step that has not yet been taken, but could have value, is use of low-cost simulation and games-based training. These are used in various areas of the military but it was observed in the interviews that civil operators and training schools do not have the resources to spend on expensive training development, or would certainly struggle to make a business case for it.

4.2.3 Evaluation

Organisations running ATQP are required to include evaluation of their training because it forms part of the continuous development of the evidence-base for the training. The ATQP process used includes reviewing training reports and feedback and using data from the organisation's safety management system including flight data. The route for training evaluation for ATOs is not clear. The majority of interviewees did not provide information on this process. One participant described collecting feedback from their airlines they train for, but beyond this no further information was obtained. A couple of responses indirectly suggest that because the checks are fixed externally, if pilots pass these checks then the training has met its purpose. The challenge of encouraging ATO commitment to long term quality was noted.

4.3 TRAINING CONTENT

4.3.1 Identification of syllabus requirements

The design of the interview schedule, driven by the literature, suggested that a large proportion of the discussion would be around different aspects of training content. In the actual interviews discussion around content was only a smaller part of the whole. This is perhaps because the five civil operators were all building their training around an ATQP/EBT approach, and viewed

decisions about the content of training as being implicit in this. Two organisations specially mentioned about the use of a TNA approach to identify requirements and develop content. Others could not be drawn on more detail about this. They did, however, mention focusing simulator scenarios and checks around identified risks, using 'first checks' as an individual's needs assessment, but it was less clear how other content material was developed. One of the operators described difficulty in matching new EBT style content with their ground school syllabi, suggesting not everything is fully joined up. Military aviation training uses a formal TNA approach to identifying training needs, producing objectives, defining different media and developing content etc., which is all increasingly focussed on developing competencies and assessing competence.

A ground school participant also described introducing a TNA type approach identifying competence requirements, and later highlighted trying to link ground school training for early pilot training to the requirements for later line operations. A couple of participants commented that ground school training is out-of-date with another observing that early training (on non-integrated and MPL courses) has also not changed in multiples of years, which was of concern considering it provides the foundation for all future pilots.

From the interviews, it seemed that some organisations were interpreting the term 'competences' as being equivalent to non-technical skills, and not as including the technical KSAs as well. The EBT material perhaps encourages this because its core competences are predominantly non-technical, with just two competences covering all of flight handling (both manual and with automation). Furthermore, it does not provide information on the knowledge or attitudes aspects of these (see IATA, 2013).

A final point as regards the content of training was made by a couple of participants and can be implied from the responses to other questions. Whilst the demand on pilots has increased over the years, e.g. the need for skills in automation management, manual flying and increasingly for commercial awareness, the footprint of pilot training has not changed with this. If anything, it has reduced. While realistically the amount of training is unlikely to grow to match the increasing list of KSAs to be addressed, the point highlights the importance of finding smarter ways of training pilots, and the need to extend this knowledge across the whole industry.

4.3.2 Training for specific topics

The literature review suggested a broad range of training topics that were relevant for modern aviation. This list was shared with participants to explore if any specific approaches were being used to address them. The general response from operators was that most things on the list would be included in training as a matter of course. For example, all organisations reported integrating non-technical skills/Crew Resource Management (CRM) training with technical training across all parts of training. A few areas generated further comments, details of these are provided below, but overall there did not appear to be much concern amongst the participants about not knowing what or how to teach the key skills.

Military pilot training takes a particular focus on cognitive skills to address previous concerns about pilots not dealing well with the demands of flying. Decision making is highlighted as central to military flying from the start of training. The importance of cognitive skills was also highlighted by the professional and industry associations, with one asking if there were better ways to train decision making. One organisation specifically mentioned providing resilience training to support pilots with dealing with the unexpected. Resilience is also identified as one of the core components of EBT.

The two widely recognised challenges associated with training for (and flying) modern aircraft irrespective of type of operations are automation management and manual handling/flying. All

organisations talked about increasing training time (or trying to) around these topics. For automation management this included understanding the automation philosophy, modes management and using different levels of automation. Simulation is considered essential for training automation because of the need to see/practise how things work in the real world. However, even with this there was the suggestion that pilots may still have difficulty understanding how their systems really work. Airbus is reportedly trying to overcome this by allowing pilots to 'free play' with the automation to improve their understanding of the systems. This involves allowing them to explore the effects of different actions, to test understanding of their knowledge, explore how different errors could occur and visualise the consequences. What was stated clearly is that as automation and flight operations become more complex, the need for deep knowledge of automation and its operations will increase. The helicopter trainers highlighted a challenge in balancing time in a limited training window for automation and manual handling skills training. While manual flying training is mentioned as important, including pilots wanting more time for practice, details of how training takes place were not covered.

A recent addition to the training regulations is the requirement for Upset Prevention and Recovery Training (UPRT). However, operators reported that they did not find the new rules helpful because of limitations in current simulator capabilities and having to train pilots who fly in both seats twice, which was felt to be unnecessary. They would also have preferred more of a focus on prevention. In terms of prevention, startle factor was specifically mentioned, with the operators including it in training with a focus on understanding the pre-cursors, pre-planning and as part of resilience training. The military engage in more training for unusual attitudes and upsets as a matter of course. Their training includes not only physical handling but also inputting data, situation awareness, recognition of spatial cues for unusual attitudes.

Although most of the discussion around training content related to operators, one ATO described how it was broadening its ground school activities to make them more focussed on industry requirements, and is considering how to prepare students of the changing pilot role: technical handler, safety manager, commercial manager, etc. Key skills that should be considered from the start of training include: resilience, stress and threat and error management. A strong driver in taking this approach was to move away from traditional, technically focussed question bank material.

4.4 INSTRUCTORS

4.4.1 Increasing skill requirements

As the approaches to training change, with the introduction of EBT concepts and the increasing complexity of the automation and operational environments, participants recognised the need for instructors/trainers to have broader, more advanced skills to cope with this. One airline noted that having very good instructors for EBT is essential because they now have to train and conduct competency and competence assessments. They may also have to give feedback around performance management issues, when the execution of an action was less clear cut. Another organisation described having interventions skills training for its Training Captain pilots so they could supervise right seat line pilots effectively and without risking the safety of passengers. The lack of regulation around Line Training Captains was also highlighted as surprising.

With the increasing requirements for instructors and as the demand for more pilots continues to rise, so does the need for good quality instructors. Unfortunately, with a shrinking pool of pilots, finding high calibre candidates is difficult. In some types of operation, instructing is becoming less popular due to anti-social hours, little opportunity for training (rather than just checking students) and reduced time for own line-flying. In the helicopter environment, instructor

qualification used to be conducted by a CAA examiner but it can now be conducted in other ATOs. The view was expressed by one organisation that that standards may fall as a consequence.

4.4.2 Ground school and early flying instructors

As well as the need for flight trainers in airlines, there is also need for instructors at ground school and non-integrated training courses. There are no formal qualifications for ground school instructors, and early instructors with ATOs tend to have low experience because they are hours building. Quality standards are a real concern with instructors for small aircraft. With salaries being quite low, this confounds the problem further. One organisation described low experience trainers as being at the limit of their own experience envelope (primarily due to using the training time to build hours), what this does for learning of the trainee is not clear.

4.5 PILOTS/ CAREERS

4.5.1 Reducing supply

A broad range of issues were described around pilot selection, promotion to command and changes in trends across career pathways. The main concern is around the reducing number of pilots available. Pilot training unless sponsored by an operator is very expensive. It is widely acknowledged that having access to the funds now plays a role on who goes into training, (less is said about who now does not). There is some concern that chequebook power is driving selection, which could have a significant impact on pilot quality, as is being reported elsewhere in the results. Theoretically, with a fixed end check this should not be an issue but again, other comments suggest otherwise. The present reality is that there are not going to be enough pilots globally to meet demand, so standards will have to drop somewhere. All this at the same time when demands on pilots' capabilities – more complex aircraft and more complex operations - are increasing. More tailored, learner centric training might help address this but that also requires the availability of good instructors, who have to be developed from the pilot community.

4.5.2 Military pilot selection and management

One of the most notable differences between the military environment and the civilian one is in terms of selection. In the military, pilot applicants are subject to a rigorous selection process, and trainees who fail to make the grade in training are de-selected. The military has clear performance standards and selection approaches to support this. The large commercial airlines have more control especially when using the new integrated Multi-crew Pilot Licence (MPL) training programmes, which are receiving good reports from operators who have used them for several years. In MPL, selection is based around the operators' needs and values. This need for a good organisational fit was mentioned by a number of participants. It is something that the professional association is concerned may be missing for trainees following a fractionated approach to training.

4.5.3 Flexible working patterns

One final area to note is the issues around more flexible working patterns, which affects all walks of life, and is becoming more common now in aviation. Part-time working is on the increase, and as one participant observed, older pilots may like to reduce their hours to avoid heavy rostering schedules. However, one airline noted that part time workers may experience more difficulty with maintaining their knowledge and skill levels, indicating that pilots with reduced flying hours were more likely to be in the lower percentile group for performance. Contract work is also in the increase, and this can have implications for safety for a number of reasons; e.g. potential concern over reporting safety issues at contract renewal time. From a

training perceptive, pilots working in more flexible ways will also need more flexible approaches to their training.

4.6 SUPPORT

4.6.1 Regulatory support

Responses to this question focussed mainly around support associated with the CAA. There were two main messages in the responses from the operators. The first: that at an individual level the CAA is very supportive and people have good relationships. The second: that organisationally, since the introduction of EASA, the CAA has been effected by changes that are perceived within the aviation training community as having a negative impact. For example, interviewees from across all organisation types reported seeing: high levels of turnover amongst CAA staff, high workload for inspectors, fewer numbers of staff, a reduction in some activities previously undertaken by the regulator, and a sense that organisational expertise has also been lost. Some participants observed that the CAA had previously worked to a 'gold standard' in regulation and this standard had now been reduced. Most participants acknowledged the CAA now has a difficult role to undertake. However, the industry still looks to the CAA for relevant guidance material, funding to support training development and would like to see a greater ability to influence the European regulator.

Some of these changes, e.g. reduction in staff and a more hands-off approach, could be due to a shift towards performance-based oversight but, as one interviewer commented, some areas of industry will need additional guidance and resources to support them with responding to the changes. The new approach to regulation itself will mean further changes at the CAA and the way it operates: different ways of working, different inspector training, different tools and guidance. One suggestion was offered to provide additional support to the community as things change was to initiate the role of a development ATO to encourage more sharing of expertise in training.

The FAA is currently working with US industry on a number of areas of interest through its Air Carrier Training Aviation Rule Making Committee. These include work on new approaches for training in Part 142 Training Centres who provide contract training, particularly to regional carriers, but cannot follow the competence-based ATQP approach because they do not have the necessary data from operations. Another working group is exploring cross-functional CRM, which would include other groups whose actions can directly affect flight safety but who are not on the aircraft. This is interesting because it recognises the broader factors impacting on safety that should be considered in training. It links with previous comments about cross-training with air traffic controllers. The two other working groups current under this committee are investigating alternative routes to achieving an air transport pilot licence and training for flight path management (use of automation, etc.).

4.6.2 Support from other organisations

In terms of other sources of support, a number of organisations reported working with academia to investigate pilot performance issues and develop/support training. Examples were mentioned around safety data analysis, resilience, mentally flying the aircraft and safety culture. However, overall the funding available to support training development research is thought to be limited. There was a sense that research into training development was someone else's' responsibility, possibly the CAA who have traditionally provided comprehensive guidance material but were felt to do less now.

Where industry associations exist to provide support these were seen as providing benefit but as they become more global, so the requirements of different stakeholders will vary. There did,

however, seem general interest in increasing the amount of communication and support across the aviation community, where commercial interests permit.

4.7 STANDARDS

4.7.1 Different proficiency requirements

The issues of standards has already been mentioned under a number of the question topics already discussed, and these all link in with this additional section. The overall concern in the training community around standards seems to be best illustrated by a question posed to the audience at the IFCT Conference. This asked: “how it is possible for the training industry to produce licence pilots where 50% are not good enough to get a job with an airline, but all still have a licence?” The simplest answer is explained by the fact that European regulation places a different standard of safety on individuals (through licencing) than it does on operators. This means that the operational training requirements are stronger than the licencing ones, and as a result an individual who can pass their licencing check may not achieve the necessary standard to pass the check used by the airlines.

4.7.2 Standards vs. supply

One route for pilots who do not find airline jobs is to go into instructing, but this means the standards of training could be lowered. Another is to undertake further training at a different ATO or to find an operator with less strict operator standards. This is where variation in standards across Europe becomes an issue. Several participants observed that standards vary considerably across organisations, with some even suggesting more checks should be done across organisations in their area of operation. Standards are also known to vary considerably across Europe. These variations could be due to different interpretations of the regulations, differing levels of development across organisations and member states or just the need to address commercial pressures and the demand for pilots. One ATO highlighted seeing increasing numbers of students with deficiencies but acknowledged that if all such pilots were de-selected there would not be enough pilots to meet the demand.

4.7.3 Management of standards

There is clearly a significant challenge for training in how to manage the issue of standards. The larger airlines that engage in the ATQP have more robust safety management systems and performance management systems to maintain standards. The main areas of concern expressed by participants related to training at the earlier stages of the pipeline and also to smaller operators. These are also organisations which may not have such robust internal processes for managing risks in training delivery, and they may also have more difficulty finding (or retaining) high calibre staff. The reduced regulatory resources available to support organisations was also identified as a concern. Several interviewees observed that one-size fits all regulation is not appropriate and, where standards are a concern, different approaches might be needed.

4.8 CHANGE

4.8.1 Risk-based drivers of change

Only three organisation types had responses to questions in this area about drivers for change, identification of change requirements and latest/next developments.

Within the offshore helicopter environment, safety is the biggest driver for change but it has to be carefully balanced with cost because of the highly competitive commercial environment. At present, the operators see the current training regulations as preventing them properly

addressing the real risks faced, and as such they are trying to drive change by exploiting the benefits of ATQP/EBT as far as possible.

One organisation noted that a company incident had actually been beneficial in justifying more focus on training. Making a case for training was identified as a challenge. Comment from one of the industry associations supported this, explaining that until training can be discussed in terms of performance and outputs, making business cases for training will continue to be difficult.

4.8.2 Increased globalisation

One ATO who provide helicopter training internationally, highlighted the challenge associated with driving change around safety. They reported that in trying to bring training more in line with competence-based approaches, they had started including scenarios with unexpected failures. But they found that as the level of difficulty in the training went up, so did the level of trainee failure, which the operators (their customers) do not like. This same organisation also noted that it cannot force the 'right' (EASA/UK) culture on its (international) customers, but recognises that it still carries a risk of reputational damage if an incident occurs where they had been responsible for delivering the training.

4.8.3 External factors

The changes in air traffic management (ATM), which will continue to progress, were identified as having a significant impact on pilot training requirements. Air traffic requirements can change the way pilots have to operate, which changes the way the automation is being used. In some instances the operations required to comply with ATC instructions increase the complexity of the pilot's role, e.g. by increasing the number of non-precision approaches and keeping aircraft higher for longer. It used to be the case that ATC personnel had the opportunity to engage in some training with pilots but this is seldom the case now. One organisation suggested jump-seat observations would be useful for air traffic controllers so they can see first-hand the impact of their request, e.g. the high workload generated by late runway changes.

4.9 PERCEIVED RISKS AND MITIGATIONS

Participants were asked what they considered the current biggest risks to pilot training and ways of addressing these risks. The key risk and mitigations reported are shown in Table 2 (not all sections of the table have been completed because these are items volunteered by participants). The topics identified varied between organisations but a number of groupings emerged. The term 'governance' was used to describe topics relating to standards and regulation because while traditionally regulators have set the basic standards, delivery and maintenance of the appropriate level of quality is about more than regulatory action. The suggested mitigations certainly suggest more ownership in the broader community going forward.

Table 2. Participants' perceptions of risks to pilot training

Theme	Risks	Mitigations
People-related	<ul style="list-style-type: none"> ▶ Reducing supply and quality of pilots entering the industry ▶ Lowering experience and quality and of training instructors 	None provided

Theme	Risks	Mitigations
	<ul style="list-style-type: none"> ▶ Lowering levels of experience across the community, in context of increasing demands for growth 	
Content	<ul style="list-style-type: none"> ▶ Current approaches to pilot training not addressing the real risk of modern operations 	<ul style="list-style-type: none"> ▶ Modernise the whole way pilot training is conducted ▶ Greater use of simulation
Governance	<ul style="list-style-type: none"> ▶ Out of date and inconsistent regulation ▶ Variation in interpretation of regulation across Europe ▶ A tick-box approach to training standards Different in standards between nations and across organisation types ▶ Globally, emerging nations have the most growth in aviation but the lowest standards 	<ul style="list-style-type: none"> ▶ Having clear standards and strong performance management processes ▶ Accelerating introduction of EBT, with the process being driven by the operators; ▶ Make continuous improvement everyone's responsibility ▶ Employ benchmarking and league tables for ATOs ▶ Have greater integration between airlines and ATOs
Economic	<ul style="list-style-type: none"> ▶ Costs driving down time for training ▶ Vulnerability to external market forces ▶ Measuring training in hours and modules completed not task performance and risks management 	None provided
Operations and environment	<ul style="list-style-type: none"> ▶ Use of complex automation in increasingly complex environments ▶ High risk nature of some operations (especially for the military) 	None provided

4.10 SUMMARY

A summary of the key findings from the interviews from across organisations are presented in Table 3.

Table 3. Summary of current practise in UK pilot training

Theme	Practise Issues and Activities
<p>Overall approach to training</p>	<ul style="list-style-type: none"> <li data-bbox="405 316 1991 592">▶ There is general dissatisfaction with prescriptive proficiency requirements that encourage a tick-box approach to training, use of hours-based assessment criteria and focus on scenarios that are not representative of current operational challenges thereby reducing time for training in real risk areas. As such, there is strong support for and increasing use of competence- and risk-based approaches to training in airlines, and in helicopter operators. At present, the extent of this is limited by EASA regulation. Airlines with requisite safety management systems and simulators can follow ATQP but this does not apply to helicopter operators, although organisations interviewed reported implementing evidence-based training concepts as far as possible. What emerged from the discussion around the overall approach to training is that operators need the regulation to reflect their requirements because it is difficult (financially) to justify providing additional training that goes beyond this. <li data-bbox="405 608 1991 778">▶ Ground school and early flying training are generally less developed around modern training and learning approaches than those for operators. However, some efforts are starting to be made to introduce the competence-based approaches to ground school to create a consistent approach across training. Such an approach is clearly easier for schools that provide integrated courses rather than with modular training, and managing integration between training and hours-building provided by different organisations or counties seems to be a challenge. <li data-bbox="405 794 1991 965">▶ Within military flying training, all organisations have been introducing a systems approach to training to structure development, delivery and evaluation. There is no formal evidence as yet on the effectiveness of DSAT but it provides a route to ensure robust quality management of both processes and content and sets a broader governance framework around the whole training system. This type of approach was recognised by a couple of participants in the civil community but no indication was identified of an equivalent whole system approach being adopted. <li data-bbox="405 981 1991 1262">▶ Participants reported extensive use of FFS for operator training. Organisations seem interested in more use of FFS but are restricted by time available in the training footprint and the requirements set in the regulations regarding use of different devices; also not all organisations and aircraft types have simulators. Resource pressures appears to limit the time available for simulator use, but there may also still be reluctance to maximise use of time allocated or to seek out additional sessions because of the risk of negative assessment during training. There appears to be less use of lower-fidelity training devices, with the exception of the military and, reportedly, the new Airbus approach in EBT, although some organisations are starting to use tablet computers in training. Interestingly, while there was wide recognition that new low cost training technologies could provide value, there was no sense that the aviation industry would have the resources to invest in its development.
<p>Content</p>	<ul style="list-style-type: none"> <li data-bbox="405 1289 1991 1385">▶ The need for integration of both technical and non-technical skills was recognised across the participants. Operators report development of training content as being based on some form of TNA to identify competence requirements and local risks, or drawing on the competencies provided in EBT guidance, or from a combination of these and traditional proficiencies defined in the

Theme	Practise Issues and Activities
	<p>regulations. It was not possible in the study to investigate the TNA methods being used to establish how effective the processes are likely to be. More in depth investigation in to identification of specific KSA would be interesting because several participants seemed to link the term competences with non-technical skills only. Cognitive skills are recognised as being particularly important for modern pilots important for this but organisations report that specific training techniques are still needed for some areas, e.g. decision making. Despite the increase in the numbers of KSAs needed by pilots, the training footprint has not increased in response to this need to train more.</p> <ul style="list-style-type: none"> ▶ Operators report explicitly addressing automation management in training, covering issues around automation philosophy, mode management and transitions, usually in the simulator. (Although, this raises an additional question to be answered as to how effectively underpinning knowledge of the automation can be developed in the simulator given the time limits on sessions.) Certainly, some participants report pilots still struggling with understanding the increasing complexity of automation and how to use for different operations; some operations and ATC requests may also add to pilots' difficulties because of the way the systems are designed. There is recognition in the <i>ab initio</i> training community of the need to start training knowledge of automation in earlier stages of training in recognition of the future role for which pilots are being trained. However, the extent of this approach is unclear because the sample size for training schools. ▶ Manual flying skills are still regarded as an essential component of pilot competence despite the widespread use of automation in routine operations. Opportunities for practise are provided in the simulator or as a necessary part of line operations. However, this practise is often limited; some operators support more manual flying on the line than other operators, the exception is in the military where high levels of manual flying are still achieved. Despite clear concern about skill fade and, importantly, loss of confidence, no specific approaches to address these issues were reported. ▶ Airlines reported that recently introduced UPRT as being difficult to implement because current simulators are not able realistically to replicate the scenarios and the training was thought to focus too much on management and not enough on prevention of problems through pre-planning, early identification of cues and resilience. The training apparently also requires pilot who can fly from both left- and right-hand seats having to be fully trained from both positions, i.e. to attend the training twice. This was felt to be unnecessary given the skills required are effectively the same from either seat.
<p>Pilot-related</p>	<ul style="list-style-type: none"> ▶ There is widespread recognition that the overall demand for pilots is increasing but the supply seems to be reducing. There is growing concern that as demand overtakes supply, pilot quality will start to reduce. This is already being detected in initial ground school. Linked with this, is the perception that different standards across ATOs may mean that licences can be obtained in other countries at a lower standard than in the UK and, because of the way EASA regulations work, these can be transferred to the UK with no requirement for further licencing checks. ▶ One factors behind this is that pilot training is very expensive. While major operators (of a range of types) are now investing again in cadet programmes, for which there are robust selection approaches and the best candidates can be recruited, large numbers of

Theme	Practise Issues and Activities
	<p>would-be ATPL pilots are entirely self-funded. This is leading to a perception of possible ‘cheque-book selection’ where entry to courses is based on ability to pay and not on requisite aptitudes and characteristics. The fact that courses can be accessed across the EASA community perhaps adds strength to the perception that this is a risk to standards.</p> <ul style="list-style-type: none"> ▶ Military organisations are also facing the challenge of reduced supply. However, their strict controls over selection and strong performance management throughout pilots’ careers resolve most of the problems regarding quality standards. None-the-less, the general reduction in flying hours seen in recent years is recognised as affecting the overall levels of experience within the system, which then in turn can affect retention. ▶ In line with the wider working population, increasing numbers of pilots have more flexible work patterns; this can include part-time and contract working. There is concern that flexible working can create challenges for maintaining competence levels and that managing this will require more flexible approaches to training to be adopted. This issue was not discussed in great detail in the interviews but as flexible working is on the increase generally it might benefit from specific investigation.
Instructor-related	<ul style="list-style-type: none"> ▶ The need for high quality instructors was recognised across the interviews. Indeed, the demands of EBT and the growing complexity of aircraft were thought to increase the competence requirements for instructors. A number of operators reported enhancing their instructor programmes to address this, including now training for: competence assessment, performance management and intervention skills. However, it was noted from during the interviews that there are no formal (regulatory) requirements for training and qualifications of Line Training Captains and Ground School Instructors. But both of these groups clearly have significant influence on the learning and development of trainees and newly qualified/appointed pilots. There was also felt to be less regulatory control around examination for instructor qualifications, e.g. in helicopter training. ▶ As there is increased demand for pilots, so there is increased demand for instructors in operators and ATOs but this is offset with the need to maintain standards and, in some areas, attract the numbers. In the military becoming an instructor used to be considered career-limiting but this is less of a concern now, although the overall lower level of experience amongst instructors was noted. In ATOs the salaries are not high, especially given the costs associated with training to become a pilot, which can be a problem for recruitment of instructors. Indeed it was suggested that for ATOs, increased salaries could increase both quality and numbers of ground school and flying instructors. ▶ Some concern was also expressed low level of experience and sometimes poor quality standard of instructors for early flying training and small aircraft. This may be linked with the fact that instructors at early stages can be pilots ‘hours building’, e.g. frozen ATPL pilots, before they can move on with their own careers. This means they are instructing at the edge of their own experience envelopes, which may limit their ability to provide appropriate training. This has potential to link in with other concerns about the parity of standards across flying schools.

Theme	Practise Issues and Activities
<p>Support</p>	<ul style="list-style-type: none"> ▶ The UK regulator role has changed in since the move to EASA, with the effects of this being viewed negatively in the aviation training industry. The changes seen include: high turnover and overall reduced numbers, which then creates high workload amongst CAA staff leading to reduced capacity and capability to provide support and guidance to operators and training organisations. Furthermore, as the CAA's role shift to performance-based regulation, there is also some concern that organisations with less resources, may struggle to achieve the required levels of performance and governance without stronger support and control. ▶ The move to EASA is seen by the training community as having slowed down the pace of change in regulation. There is thought to be increased bureaucracy and less opportunity for UK industry engagement. Of real concern to participants, there is a strong perception that the move to EASA has increased the variability in training standards, which makes it harder for UK operators to quality control pilots. ▶ There was no sense from the interviews that alternative sources of guidance and support are emerging to fill the shortfall from changes at the CAA. Within the offshore helicopter community a cross-industry forum has been established for addressing safety problems. This has scope to consider training but it is helicopter specific. A number of airlines reported engagement with research and analysis organisations to support development and monitoring of training programmes, e.g. EBT, but this seemed to be for specific purposes rather than a route to provide general support and develop across the whole training system, e.g. as per remarks about non availability of resources to develop low cost simulation.
<p>Change</p>	<ul style="list-style-type: none"> ▶ Not all interviewees responded to questions on change and its drivers. For those who did, change factors fell into three areas: internal, external and global: <ul style="list-style-type: none"> ▶ Safety was seen as an internal driver but it was felt that justifying the need for change in training was difficulties because training is traditionally described in an hours-based language. If it were focussed on improved task performance and reduced risk it would be easier to demonstrate cost-benefit of investments; ▶ External drivers for change still come through changes in ATM and local ATC directions because these have a significant impact on the way pilots have to use their automation, e.g. often increasing workload and complexity, and this has to be considered in training; ▶ Growing globalisation is increasing the number of pilots being trained abroad and the number of pilots coming from other countries and cultures. This potentially increases UK exposure to pilots and instructors trained to different (potentially lower) standards and more competition in the industry, which can drive down time and resources for training (when actually it should be increasing).

5. NEXT STEPS - GAP ANALYSIS

5.1 OBJECTIVE

The next stage of the project is to conduct a gap analysis to compare the findings of the interviews and the literature review to identify any shortfalls and from these to conduct a multi-disciplinary risk assessment activity to identify any residual risk in pilot training. Recommendations will be developed to address the residual risks identified. The risk assessment process will support prioritisation of the findings in terms of safety benefit and likelihood of effecting change.

5.2 PROPOSED ACTIVITIES

The first step will be to conduct a gap analysis by comparing current practice in UK aviation training (as identified in Section 4) with the state-of-the art on pilot training from the Literature Review. This will be a desktop exercise and, given the outputs from both activities, it is not anticipated that there will be a complete mapping, not least because there are limitations in both the literature and information obtained on current practice. As such, the gap analysis will identify gaps and any other issues, including good practices, such that they can all be included in the risk assessment and subsequent prioritisation. The output of this activity will be a set of hazards to be fed into the risk assessment.

The second activity is to risk assess these hazards in order to prioritise them and thereby enable development of more focussed recommendations. The specific nature of the risk assessment will be determined based on the level of granularity of the residual risks. The broad plan is to quantify the real risk associated with the 'gaps' based on published safety data, e.g. from incident reports. For example, amongst which types of operation, aircraft, and organisations have training related events been identified? However, it is recognised the data available may only be high level, and as such it might be difficult to prioritise areas of concern this way. In that event, a risk workshop may still be appropriate but with the goal of prioritising the risks based on existing information and participant experience rather than using safety data and using the workshop to validate the findings.

5.3 FURTHER CONSIDERATIONS FOR RISK ASSESSMENT

In addition to assessing the relative risks of any gaps in current pilot training, any recommendations should be future-proofed against further changes in aviation in the future. To support this, in the interviews, participants were asked to suggest what they thought would be the greatest challenges for pilot training going forward. These are listed in Table 4.

Table 4. Challenges for pilot training going forward

Theme	Challenge
People-related	<ul style="list-style-type: none"> ▶ Increased levels of competency required for modern aircraft ▶ Instructor quality ▶ Reducing supply of pilots ▶ Level of experience in reduced pool ▶ The time it takes to generate a trained pilot ▶ Increased training with international students
Economic	<ul style="list-style-type: none"> ▶ Increased selection by bank account ▶ Time available for training because of demands on the line

Theme	Challenge
Governance	<ul style="list-style-type: none"> ▶ Regulatory authority funding ▶ Different interpretation in regulation across EASA ▶ Movement around EASA states without needing to change licences ▶ More cultural differences; different accountabilities ▶ Training standards
Operations and environment	<ul style="list-style-type: none"> ▶ Increasingly busy airspace ▶ Complexity in helicopter operations, e.g. from ATC, O&G companies ▶ Air space design and new ways of ATM ▶ Drag management
Technology	<ul style="list-style-type: none"> ▶ Increased use of PC-based, games-based training ▶ Increasing levels of technology: e.g. use of autoflight systems, use of electronic flight bags ▶ Aircraft design for the X-box generation ▶ Single pilot operations ▶ Unmanned systems

5.4 DEVELOPMENT OF RECOMMENDATION

Following the gap analysis risk assessment, recommendations will be proposed for potential training interventions, changes in policy or procedures (for training, air operators and regulation) or for further research, all as appropriate to the results. Where possible, a mix of short term ‘quick wins’ and other longer term initiatives will be identified.

In the final interview question, participants were asked about the barriers and enablers to change around pilot training; these are shown in Table 5. The goal is to consider these issues when producing recommendations at the end of the project so that the interventions or influencing activities proposed can be designed to maximising the use of the enablers in order to overcome barriers where possible.

Table 5. Barriers and enablers to achieving change in pilot training

Barriers	Enablers
<ul style="list-style-type: none"> ▶ Cost and finances ▶ Resources – with operators and regulators ▶ Time take for change – in regulation and in implementing changes ▶ Variations in standards across Europe ▶ Difficulty implementing impractical changes ▶ Risk-based approaches do not apply to all carriers ▶ General resistance ▶ Ability and expertise to support the changed systems 	<ul style="list-style-type: none"> ▶ Changing philosophy at regulators and ATOs ▶ A system approach (including DSAT) ▶ Use of simulation ▶ Using ‘carrots and sticks’ ▶ More supporting resources ▶ Opportunities for sharing and learning from each other

6. CONCLUSION

The 16 interviews conducted in this study identified a wide range of themes and issues that together provide a description of current practises and directions in pilot training in the UK. While there were a number of concerns raised – both real and perceived issues – there was no feedback from study participants that pilot training was subject to any substantial safety risks at the time of the interviews. But it was clear that the overall training system is becoming under increasing strain from a combination of factors, including: demand and supply of pilots and instructors, increasing aircraft and operational complexity, the shift to regulation from EASA and an associated reduction in expert support available from the CAA, and economic pressures in both civilian and military environments. As pointed out, while the scope of training has increased over previous decades, the training footprint has not. So, if it is not feasible to increase training to address the challenges of modern aviation, then the training that is provided has to be absolutely optimal.

A full summary of the main findings emerging from the interviews are provided as a table. The key highlights from this are, in order presented in section 4:

- ▶ Strong desire to move away from traditional technical proficiencies and time-base measurement of training to competence- and risk-based content and assessment for all operator types and across a pilot's career. Some organisations already report following TNA approaches to inform this training content but the exact details of these processes were not identified;
- ▶ Military flight training organisations adopt a systems approach to training that provides clear processes for identifying requirements and structuring development, delivery and evaluation all within a broader quality assurance and governance framework;
- ▶ The advantages of simulation are widely recognised and exploited but, with minimal training footprints, time for training and practice are limited. Lower-fidelity devices could be utilised however resources to invest in alternative technologies are limited; also there would need to be more flexibility in the regulation around use of flight training devices;
- ▶ There seems to be a common understanding as to the general content required for training; for example, integration of technical and non-technical skills was highlighted. Detail on techniques for training particular competencies were not covered but the need for more specific approaches to train elements of cognitive skills, e.g. decision making was identified. It also appears that knowledge for understanding and using automation is still a challenge for pilots, although this is a strong focus in simulator training and increasingly considered in early training. Specific approaches for maintaining manual flying skills – other than regular practice – were not identified although again this is recognised as important;
- ▶ A significant challenge and concern is the increasing demand for pilots and the reducing supply, and how to manage this without reducing quality and safety standards. There is a perception that standards vary across training establishments with the EASA region and that there is no longer any central control for this from the CAA or ability to check up on training history. Military organisations face similar challenges with numbers but they have very strong selection and performance management mechanisms to manage standards, which other organisations may not be able to sustain;
- ▶ As with other professional areas, there is a growth in flexible working. This may have an impact on pilot training that needs to be considered;

- ▶ As with the increasing demand for pilots so there is an increasing demand for training instructors and a challenge in some areas with attracting people to the role. Improved salaries and reward was thought would be helpful. The need for instructors to have broader capabilities to address the greater demands of competence-based training (less prescriptive) and the growing complexities of the pilot role and aircraft operations was highlighted. The need for this is further reinforced given the reducing level of overall flying experience in the aviation community. Two anomalies were identified as regards training and qualification of instructors. It appears there is no formal regulatory requirement for either of these for Ground School Instructors and Line Training Captains, which given the importance of these roles is surprising;
- ▶ Following the move to EASA, the role of the CAA has changed, as has its capacity. As a result operators and training organisations report experience of reduced staff numbers, high turnover and, importantly, access to less expertise and guidance. EASA itself is viewed as reducing the pace of change in regulation and there is concern it has increased variability in standards. There was no sense that the levels of expert support and guidance previously provided by the CAA are now being provided by EASA or elsewhere, which may be particularly challenging for smaller or less developed organisations;
- ▶ Change is an ongoing challenge for aviation training. The need to be able to adapt training to address operational risks is critical not least because changes in ATM, continuing developments in aircraft automation and growing globalisation all influence the pilot's role and, therefore, the competences needed to support that safely and effectively.

Interestingly, most of the focus of discussion in the interviews was on the challenges facing organisations in delivering training than the training content itself. This is different to the findings from the literature review when the focus was more on the detailed content and training for specific skills rather than on the broader training system. Clearly, it is important to note that the interviews were necessarily time limited and it was not possible to explore any particular question or topic in much depth, nor was it within the scope of the study to review training syllabi or course material, etc.

The participants in the study were open and supportive of the project, and all indicated interest in continuous development in training to improve safety. However, there are some areas of the aviation community that were not represented in the study and so further information may be required to assess the extent of any residual risks in the next task. This could be achieved by involving an input in the risk assessment activity or collecting additional information in more focussed interviews with the relevant organisation types.

These items will be taken forward for comparison with the findings from the literature review in the Gap Analysis to identify and prioritise the residual risks that need to be addressed.

7. REFERENCES

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5. International Air Transport Association (IATA). (2013). Evidence-Based Training Implementation Guide, Appendix A: Competencies and Behavioural Indicators, pp65-66. Accessed at: <https://www.iata.org/whatwedo/ops-infra/itqi/Documents/ebt-implementation-guide.pdf>

ANNEX A - STAKEHOLDER INTERVIEW SCHEDULE

A.1 STAKEHOLDER INTERVIEW SCHEDULE

Frazer-Nash is conducting a project for the CAA to review the current state of pilot training, particularly with respect addressing concerns regarding training arising in some recent accident reports. A critical part of this project is to explore current training practises adopted in training for UK pilots. As such we are interviewing a range of stakeholders from airlines, training organisation, manufacturers, industry association and regulators. A key interest for the study is to understand how stakeholders are thinking about and addressing future changes in aviation that will affect, or be affected by, training.

It is important for the study that we understand the breadth of factors that influence development and implementation of training across the industry. Questions have been developed to prompt discussion and provide a semi-structured framework for the interviews but will be varied as appropriate for the different participants.

The interviews should last approximately one hour. If acceptable, we will record the discussion as well as talking notes to ensure nothing is missed or misunderstood later. The outputs of the interviews will be de-identified so that participants are not identifiable in the report.

If you have any questions please contact: Dr Georgina Fletcher on 0117 922 6242 or g.fletcher@fnc.co.uk.

Thank you for your support in the project.

Participant information

Organisation type:

Interviewee/s role/s:

Interviewee/s background and experience:

Overall Approach

1. What overall approach/philosophies are adopted for training?
2. What types of technology, simulation and training media are used?
3. How are training courses evaluated?

Content

4. How are relevant Knowledge, Skills and Attitudes (KSAs) or syllabus requirements:
 - a) Identified?
 - b) Addressed in training?
 - c) What is the balance between areas?
5. Are specific training methods, techniques or technologies adopted for different competences and/or elements of competency (e.g. K, S or A)?

For example, consider specific training techniques or content for:

- a) Manual flying?

- b) Upset recovery?
 - c) Startle?
 - d) Non-normal emergency response?
 - e) Automation understanding?
 - f) Mode management?
 - g) Monitoring?
 - h) Decision making?
 - i) Workload and prioritisation?
 - j) Stress management?
 - k) Communications and cockpit-gradient?
 - l) Culture differences?
 - m) Leadership/command skills?
6. How are assessments tailored to address specific elements of training?
7. How is training integrated across the competency areas and career pathway?

Instructors

8. How are Instructors and Instructor/Evaluators selected?
9. What does Instructor and Instructor/Evaluator training involve?
10. How is assessment/certification of Instructors and Instructor/Evaluators conducted and maintained?
11. What are the main challenges associated with the Instructor role/task in the current aviation environment?
E.g. developments in aircraft, increasing numbers of pilots being needed?

Career

12. How are pilots selected to your organisation?
13. Are there any variations in selection criteria or processes for different aircraft types or roles?
14. What trends do you see in the background for people joining your organisation?
15. What trends have you seen in general pilot career pathways in your organisation in recent years? E.g. reduced time to captancy? Changes to instructor training rules?

Support

16. How do regulatory agencies support (or not) implementing training improvements?
17. Are there other sources of support available? E.g. pilot unions, industry trade associations?

18. What would help your organisation to improve training to ensure flight safety within the modern operational and economic climate?

Change

19. What are the main drivers for change in training – strategy and/or delivery – within your organisation?

20. How does your organisation identify requirements for changes to its training system? E.g. regulatory requirement, specific incident, continuous improvement, research findings?

21. What are the most recent training developments that have been implemented in your organisation?

Consider:

- a) What led to these developments?
- b) Where did you source the information/resources for these?
- c) How have they been evaluated?

22. What are anticipated developments do you see coming in how you deliver/source training in the next 5-10 years?

Challenges

23. What are the current biggest risks regarding pilot training with respect to safety?

24. What would be the best ways to address these risks?

25. What are the greatest challenges for pilot training going forward? E.g. increasingly advanced aircraft, volume of air traffic, supply of pilots.

26. What are the main a) barriers/challenges and b) enablers to achieving changes in pilot training in your organisation? Also, across the industry?

Other

Any other comments or questions?



Frazer-Nash Consultancy Ltd
The Cube
1 Lower Lamb Street
Bristol
BS1 5UD

T +44 (0)117 9226242
F +44 (0)117 3169686

www.fnc.co.uk

Offices at:
Bristol, Burton-on-Trent, Dorchester,
Dorking, Glasgow, Plymouth, Warrington
and Adelaide