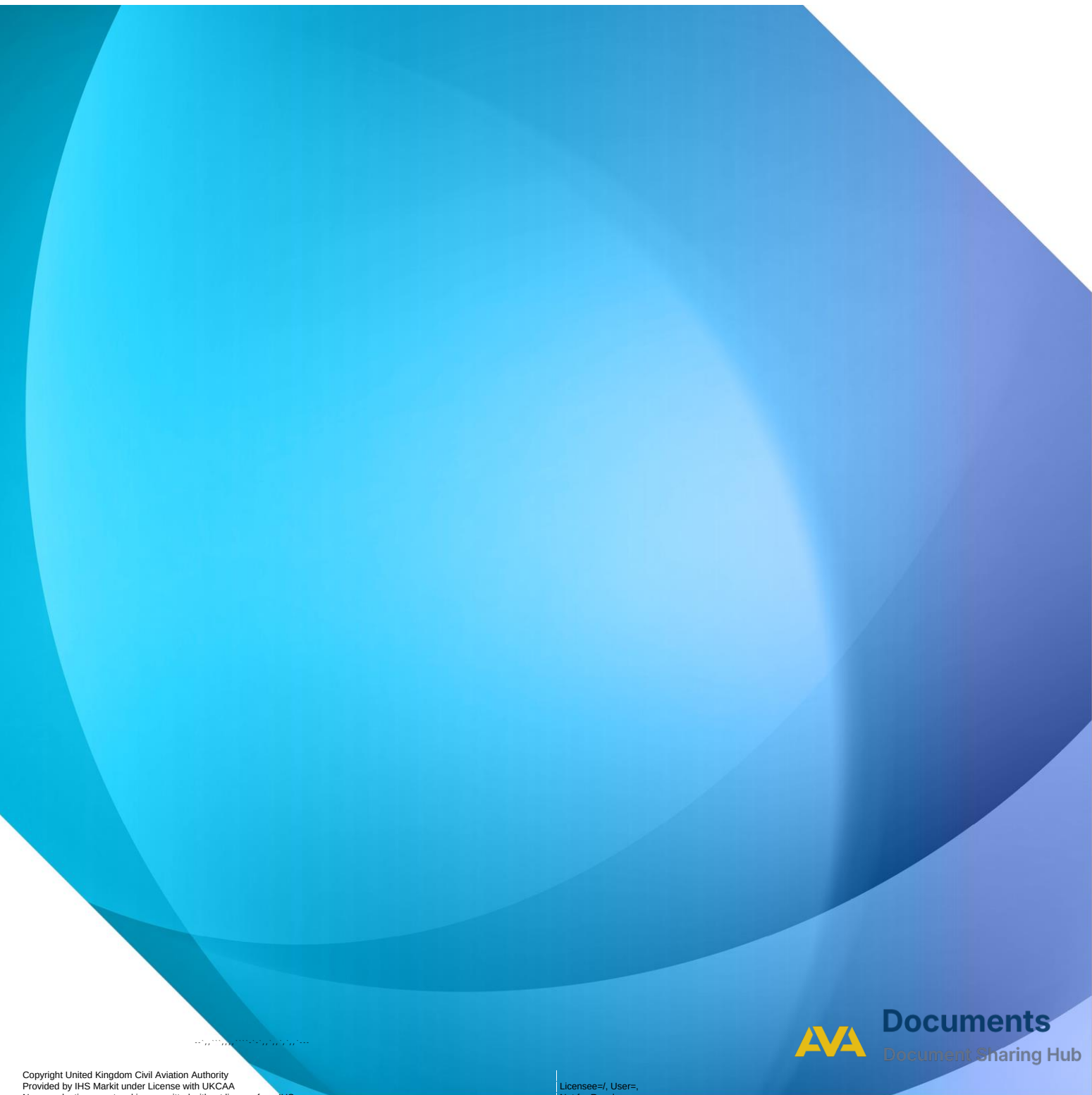


Pilot training review – final report: recommendations and conclusions

CAP 1581



Published by the Civil Aviation Authority, 2017

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

You can copy and use this text but please ensure you always use the most up to date version and use it in context so as not to be misleading, and credit the CAA.

The latest version of this document is available in electronic format at: www.caa.co.uk

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 sub-reports, 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.

Sub-reports

- [CAP 1581a – Gap Analysis](#)
- [CAP 1581b – Literature Review](#)
- [CAP 1581c – Interview Study](#)

11/11/2017 11:11:11



Pilot Training Review

Final Report: Recommendations and Conclusions

FNC 46243/46562R Issue 1
Prepared for Civil Aviation Authority (CAA)

SYSTEMS AND ENGINEERING TECHNOLOGY

DOCUMENT INFORMATION

Project : Pilot Training Review
Report Title : Final Report: Recommendations and Conclusions
Client : Civil Aviation Authority (CAA)
Client Ref. : 2217
Report No. : FNC 46243/46562R
Issue No. : 1
Date : 18-Sep-2017
Compiled By : Georgina Fletcher
Verified By : Gordon Bisset
Approved By : Gordon Bisset
Signed : *On Original*

DISTRIBUTION

Copy	Recipient	Organisation
1	Graham Greene	CAA
2	File	Frazer-Nash Consultancy

Copy No.: _____

Originating Office: FRAZER-NASH CONSULTANCY LIMITED
The Cube, 1 Lower Lamb Street, Bristol, BS1 5UD
T: +44 (0)117 9226242 F: +44 (0)117 9468924 W: www.fnc.co.uk

SUMMARY

This report provides a summary of the key findings, conclusions and recommendations from a human factors review of commercial pilot training in the UK conducted for the Civil Aviation Authority (CAA) under research Contract 2217. The high level project aim was to:

- ▶ Review recent training studies, activities and potential improvements to identify where CAA should be providing resource and developing policy to improve safety outcomes for UK citizens.

The need for the work arose from the growing scrutiny on the effectiveness of pilot training following a number of high profile air accidents (internationally) and evidence from the CAA's own reports on offshore-helicopter operations [1] and the Significant Seven [2]. The CAA had a particular interest in identifying practical approaches to improving training to provide good safety outcomes and wanted consideration of a full spectrum of issues including pilot selection and through-career support for both commercial and military fixed-wing and helicopters operations. The CAA highlighted that it was important not just to focus on recommendations around increasing complexity or duration of training as these would not be feasible to implement.

The project included three main tasks, plus recommendations development and final reporting:

1. Addressing Task 1 of the research specification, a literature review was completed 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;
2. An interview study to establish the state of current practice and issues for pilot training in the UK from the perspective of operators, training schools, industry and professional associations and regulators for civil, military, fixed-wing and helicopter environments, this addressed Task 2;
3. Task 3 assessed residual risks that remain to be explored, this was achieved through conducting a gap analysis to compare the findings of interviews with stakeholders from the aviation training community and a review of the human factors and training research literature to identify gaps and other issues in pilot training, and from this a BowTie type analysis to identify and prioritise the risks for UK pilot training;
4. Task 4 includes the final delivery of this report with its recommendations and conclusions based on the previous activities.

This Final Report and three interim reports from these underpinning tasks provide full details of all the issues, analyses and results.

The key findings of the project are summarised as:

- ▶ Pilot training in the UK is under increasing pressure from external influences, so, in order to maintain high levels of quality and safety, it needs continuing development and ongoing support from regulators and within the industry;
- ▶ Threats to pilot training exist across the whole Training System including: Content and Delivery, Training Tools and Devices, Pilots, Instructors, and Governance and Regulation, and, so, must be managed in an integrated manner across the whole system;
- ▶ A wide range of barriers are needed to mitigate the risks posed by threats to pilot training and from broader challenges in aviation. Some of these barriers are already in place, representing industry good practice in the UK, others need either more consistent application or to be introduced to address identified gaps.

Based on the findings from the project the following recommendations have been identified:

1. In the long-term, the CAA and pilot training community should, through implementation of regulation, supporting guidance and checks, ensure that barriers are in place to mitigate the identified (and developing) threats to pilot training. The barriers presented in this Report provide an initial set for consideration but these should be reviewed and refined locally through consultation with the pilot training community (threats and barriers are defined in the Gap Analysis report);
2. The CAA and pilot training community should agree a definition and framework for the Pilot Training System that encompasses all elements of pilot training and use this as the basis for driving on-going and future developments in UK pilot training;
3. The pilot training community should develop a collaborative, industry-led governance organisation with stakeholders from all areas of pilot training, including the CAA, to lead co-ordination, sharing and on-going development across the pilot training system going forward;
4. The pilot training community, CAA and relevant experts should work collaboratively to provide practical guidance, support material, good practice guidelines and information sharing activities around a range of topics, including: training needs analysis (TNA), training evaluation, latest techniques for cognitive skills rating and knowledge development of automation, and strategies for skill retention;
5. The pilot training community and the CAA should work collaboratively to develop a research strategy for addressing gaps in knowledge, tools and techniques and collectively invest in supporting robust, evidence-based research and development that can deliver practical outputs with clear implementation plans;
6. The pilot training community and the CAA should explore ways to enhance and strengthen the instructor role for all stages of training, giving consideration to training and qualification requirements, job design tools and support, career management and reward;
7. The pilot training community, supported by the training regulations, should ensure that comprehensive TNAs are conducted to inform the balanced design of training throughout the training pipeline. Attention should be given to ensuring that fundamental topics around automation management, use of manual flying and core cognitive skills, e.g. decision making, are strongly represented across training;
8. The pilot training community should focus on making pilot training 'smarter' so that greatest benefits can be gained from the training time currently available. This could include: ensuring that training time is spent on completely relevant and necessary content; using of specific training techniques and lower cost training tools; introducing challenging topics earlier in training; and the use of mentoring, coaching and peer support.

Successful pilot training is a critical component of safety in UK aviation. Current practices, although sufficient, may not optimise the role of pilot training as a barrier to safety events. Indeed, as the aviation environment becomes more complex, it is essential that pilots are optimally supported in developing and maintaining high standards across the full range of competences needed for flying highly automated aircraft in an increasingly busy air space and with strong commercial pressures. To achieve this, pilot training needs to be continually reviewed and refreshed in response to changing demands and challenges. The findings of this project have highlighted that, going forward, this will increasingly require a community wide systems approach to training that considers all elements of pilot training, including governance developed in consultation with industry, enhancing the instructor role, and improved guidance and support.

Fortunately, this need to maintain focus on pilot training appears well recognised by the UK aviation training community with larger organisations seeking to be proactive, as far as permitted by regulations, in implementing developments from on-going analysis and research into their training programmes. There are also sections of the industry that would almost certainly benefit from additional support and guidance around modernisation. Across the aviation industry, commercial pressures place considerable demands on training departments, and resources are inevitably scarce; justifying the need for change is difficult especially if there

have been no specific safety events to drive the change. Easy access to the latest research findings, training techniques and analysis methods in a format that can be readily implemented could facilitate change across all levels of organisations. It is highly unlikely that commercial organisations individually would (or could) support investment into such a broad range of enabling activities; therefore, more collaborative developments between organisations – across the pilot training industry and with the CAA – and improved information sharing would be of benefit to everyone.

Finally, while this project has focussed on pilot training in the UK, the issues explored apply much more broadly. The exact nature of the threats and effectiveness of the barriers will inevitably vary according to location, but the general challenges are shared by aviation globally. So, while not all the recommendations may be relevant everywhere, addressing them in the UK could lead to new tools, guidance, ways of thinking and improved sharing that provide benefit far more widely, improving safety through presenting more, and more effective, barriers to risks associated with pilot training.

CONTENTS

1. INTRODUCTION	7
1.1 BACKGROUND	7
1.2 DESIGN OF THE PROJECT	7
1.3 STRUCTURE OF THE REPORT	8
2. CURRENT ISSUES IN PILOT TRAINING	9
2.1 OVERVIEW	9
2.2 HIGH LEVEL CHALLENGES	9
2.3 THREAT PICTURE	9
2.4 BARRIERS AND MITIGATIONS	11
3. EMERGING DIRECTIONS AND RECOMMENDATIONS	17
3.1 OVERVIEW	17
3.2 DEVELOP THE PILOT TRAINING SYSTEM	17
3.3 BROADEN TRAINING SYSTEM GOVERNANCE	18
3.4 SUPPORT AND ENABLERS	20
3.5 ENHANCE INSTRUCTORS	21
3.6 ENSURE THE RIGHT CONTENT	22
3.7 SMARTER TRAINING	23
4. CONCLUSIONS	25
5. REFERENCES	27
ANNEX A - UNDERPINNING INVESTIGATIONS	28
A.1 SUMMARY OF LITERATURE REVIEW	29
A.2 SUMMARY OF INTERVIEW STUDY	31
A.3 SUMMARY OF GAP ANALYSIS AND RISK ASSESSMENT	34

1. INTRODUCTION

1.1 BACKGROUND

This Final Report provides a summary of the key findings, conclusions and recommendations from a human factors review of commercial pilot training in the UK conducted for the Civil Aviation Authority (CAA) under research Contract 2217.

The project started in January 2015 with the aim to:

- ▶ Review recent training studies, activities and potential improvements to identify where CAA should be providing resource and developing policy to improve safety outcomes for UK citizens.

The need for the work arose from the growing scrutiny on the effectiveness of pilot training following a number of high profile air accidents (internationally) and evidence from the CAA's own reports on offshore-helicopter operations [1] and the Significant Seven [2]. The CAA had a particular interest in identifying practical approaches to improving training to provide good safety outcomes and wanted consideration of a full spectrum of issues including pilot selection and through-career support for both commercial and military fixed-wing and helicopters operations. The CAA highlighted that it was important not just to focus on recommendations around increasing complexity or duration of training as these would be unfeasible to implement.

1.2 DESIGN OF THE PROJECT

The project was conducted according to the flow diagram shown in Figure 1.

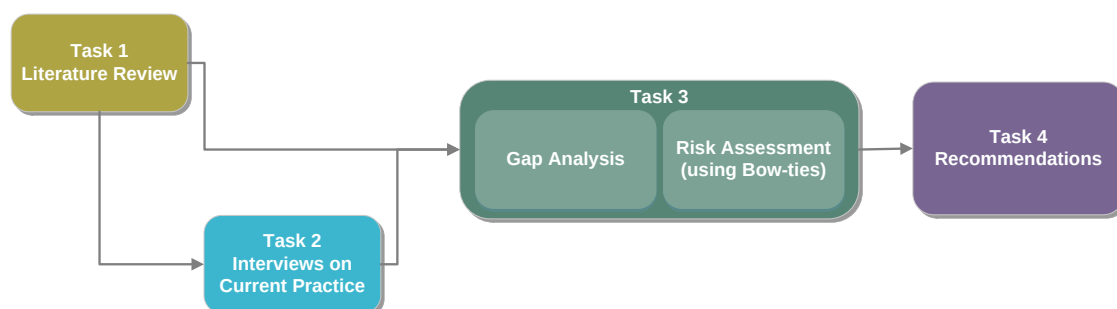


Figure 1. Tasks in the pilot training review project

The two main data collection activities were: a review of pilot training research literature and an interview survey of 16 stakeholder organisations, including operators, training schools, industry associations and regulators. Short summaries of these two underpinning investigations are provided in annexes A.1 and A.2, with full descriptions of the activities available in references [3] and [4], but very briefly it is worth noting the following key observations:

- ▶ The research literature tended to focus on topics around the content to be trained, e.g. for competencies around recognised problem areas, but the emphasis seemed to be more on 'what to train?' rather than new ways for 'how to train it?', or at least not to the extent of developing clearly exploitable tools for operators. Nor were there many evaluation studies reporting on the effectiveness of techniques currently being implemented. The majority of research was for fixed-wing pilots, and across the board very little around instructor activities, early career training or broader training system considerations;
- ▶ The issues emerging from the interviews were higher level than those being described in the literature, more around organisational challenges for delivering training, than details

of the specific content. A major point across all interviews was being able to deliver competence-based training in line with operational needs rather than being tied to training for prescribed technical failures, which were no longer felt to be representative. There was recognition that some skill areas, e.g. around decision making, automation, and manual flying skills, are still a challenge but there did not appear to be sufficient flexibility in the training footprint to allow for use of novel ways to address this. This appeared to be related to both regulatory and resource (i.e. financial) constraints. Ground school and early career training were considered less well developed than operational training.

The results from the literature review and interviews were then compared in a gap analysis to classify and prioritise threats to pilot training resulting from inadequate, variable or missing tools, processes, knowledge, guidance and support, etc. and to identify the barriers needed in the training system to address these. Given the broad range of issues to be considered, BowTie analysis was adapted to support the risk assessment and present the project findings. The key findings from this task are presented in section 2.

This Report relates to Task 4 and is the final output from the project. Its main focus is on the threats and mitigations identified (as taken from the gap analysis and risk assessment report, see reference [5]) and what this means in terms of next steps for the CAA and the pilot training communities. While the Report is written as a deliverable to the CAA, the conclusions and recommendations should be of interest to organisations across the pilot training community.

1.3 STRUCTURE OF THE REPORT

The remaining sections of the Report provide:

- ▶ A summary of current issues in pilot training in the UK;
- ▶ Emerging directions and recommendations;
- ▶ Final conclusions.

The Annex provides short summaries of the work conducted in previous phases of the project.

2. CURRENT ISSUES IN PILOT TRAINING

2.1 OVERVIEW

A central goal of this project was to identify the risks to aviation safety emerging from pilot training. While no evidence was found in the project to suggest significant problems with training for professional pilots in the UK, it is apparent that the overall training system is increasingly under strain from the demands being placed on it. However, it is important to say that the pilot training stakeholders who engaged in this project were very positive about the aims of the project and the opportunity it provided to consider how best to maintain the UK's traditionally excellent standards around pilot training going forward.

2.2 HIGH LEVEL CHALLENGES

At the highest level, there are a series of widely recognised external factors that increase the challenge faced by the whole pilot training community and will continue to do so going forward. Such challenges include:

- ▶ Increasing complexity of aircraft automation, growth in air traffic, and changes in the way this is managed;
- ▶ Commercial pressures affecting training departments and the time available for training;
- ▶ An increasing demand for pilots, resulting in initial selection criteria having to be broadened to meet capacity;
- ▶ The overall depth of experience amongst pilots and pilot training professionals is declining due to retirement of older generations, who inevitably had much deeper levels of manual flying skill and breadth of flying practice;
- ▶ Common licences are held across EASA nations but there is variation in standards (or the perception thereof) across countries and no formal mechanism in the UK for managing transfers.

These types of challenges are being faced across Europe and the world as the overall demand on aviation increases. As such, training, which is an essential cornerstone in aviation safety, must continue to progress in response.

Key Finding 1: Pilot training in the UK is under increasing pressure from external influences so in order to maintain high levels of quality and safety it needs continuing ongoing support.

2.3 THREAT PICTURE

A more detailed risk picture has been developed that describes the specific threats facing pilot training and that need to be managed to ensure sustainability and safety going forward. The analysis behind these threats is described in reference [5].

The top threats identified for pilot training combined across all types of training and operators grouped by theme are:

- ▶ Content and Delivery:
 - ▶ Training content not reflecting operational requirements;
 - ▶ Poor implementation of research findings;