Safety Regulation Group

Civil Aviation Authority

safety plan

2006/7 - 2010/11

ISBN 0 11790 568 2

Edition 1, March 2006

Enquiries regarding the content of this publication should be addressed to:
Safety Investigation and Data Department, Safety Regulation Group, Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex, RH6 0YR.

The latest version of this document and all applicable amendments are available in electronic format at www.caa.co.uk/publications, where you may also register for e-mail notification of amendments.

Designed by the CAA's Corporate Communications Department
Printed by TSO (The Stationery Office) on behalf of the UK Civil Aviation Authority.

Printed copy available from:

TSO, PO Box 29, Norwich NR3 1GN
Telephone orders/General enquiries: 0870 600 5522
Fax orders: 0870 600 5533

www.tso.co.uk/bookshop
E-mail: book.orders@tso.co.uk
Textphone: 0870 240 3701

Foreword

There has been a radical change to SRG's Safety Plan this year. Previously the plan has been based on a 'bottom up' model, using the considerable expertise in the organisation to identify potential risks. This element continues to make a vital contribution, but this year a new 'top down' process has been used, starting with the major risks as evidenced in the data, using Mandatory Occurrence Reports and other sources, and then determining what action SRG can take to help mitigate those risks. The combination of the two processes has resulted in the set of actions contained in this plan, and also serves to demonstrate SRG's commitment to continually developing our processes to help improve safety.

The plan reports on the UK aviation industry's safety performance and highlights the safety improvements upon which SRG intends to focus in the forthcoming years. These are arranged in the plan by industry sector, helping to identify the risks and actions relevant to each part of the industry.

The regulatory framework in which SRG operates is changing dramatically; the creation of the European Aviation Safety Agency and the Single European Sky are two significant examples. As this environment changes, SRG will remain focussed on safety and safety improvement, and the Safety Plan is the culmination of this effort.

Safety improvements cannot be delivered without our continuing engagement with all sectors of the UK aviation industry. The design and publication of this plan as a public document, for the first time, is part of SRG's determination to build on that relationship, and to enable greater involvement from industry in the development of the Safety Plan and to share the results of that partnership.

If you have comments on the Safety Plan, you can send your comments to us at the following e-mail address: safetyplan06@srg.caa.co.uk

M J Bell
Group Director Safety Regulation

Contents

Contents

Introduction

The civil aviation industry and the environment in which it operates is continually changing, giving rise to new safety issues. The industry is always striving to improve its effectiveness and efficiency and, as a consequence, develop new technologies and new ways of working. SRG remains committed to keeping abreast of these developments and ensuring that the current high levels of safety are maintained.

The CAA SRG's goal, in partnership with industry, is to develop the UK world-class aviation safety environment by driving continuous improvement in aviation safety. SRG continues to support national and international initiatives to improve civil aviation safety.

SRG also continually reviews how the civil aviation community is regulated and seeks to improve regulation and the associated regulatory processes, both to the benefit of industry and SRG's own effectiveness.

The purpose of the Safety Plan is to assist SRG in meeting its safety objectives. It also allows SRG to manage its approach to the changing regulatory environment and the ongoing improvements to regulations and regulatory processes. The plan identifies issues to be addressed over the next five years and defines the actions that will be taken. Progress and outcomes of actions taken in 2005 are also referred to, to provide continuity.

This aim of providing an overall picture of both of how SRG manages its safety initiatives and of Industry's safety performance is supported by the Plan's structure. The first section, Aviation Safety Statistics, provides data related to fatal and non-fatal aircraft accidents, and serious incidents, within different sectors of the UK civil aviation community. This provides an indication of safety performance. The next section gives further details of the processes used to develop the plan. The following sections show, for each sector of the industry, the principal risk areas identified and a description of the tasks and actions the CAA intends to undertake. These actions include any specific research SRG proposes.

Although the Safety plan is published annually, it is a living document, subject to change as new information becomes available or action plans are revised. A web based version of this document can be found at www.caa.co.uk/safetyplan.

Aviation Safety Statistics

1. Introduction

There are approximately 2 million flights per year in UK regulated airspace. SRG is responsible for safety oversight of civil aviation in the UK, which includes licensing, approving and monitoring:

- 16,600 aircraft on the UK register
- 200 aeroplane and helicopter AOC operators and nearly 80 balloon AOC operators
- 145 airports
- 170 air traffic service providers (including 80 air traffic control units)
- 600 aircraft maintenance organisations
- 51,000 professional and private pilots
- 200 production organisations
- 12,000 aircraft maintenance engineers
- 2,400 air traffic controllers.

The CAA also carries out oversight of around 75 design organisations on behalf of EASA.

Air travel is already the safest form of transport, and is continuing to improve. The worldwide rate of fatal accidents for public transport operations is now only 0.2 per million flying hours and the UK is among the world leaders in terms of its national safety record.

Figure 1 below shows the general fall, worldwide, in fatalities for Western Built Jets with a maximum take-off weight of greater than 5,700kg, being used on airline operations, excluding business jets. Third party fatalities, such as fatalities on the ground, are not included, simply to ensure consistency in the dataset since this information is not always available. The data is shown over a 21 year period (1985 to 2005) using a three year moving average to smooth out the annual variation. Thus the data entry for 1987 is actually the average rate of the years 1985 to 1987, and so on.

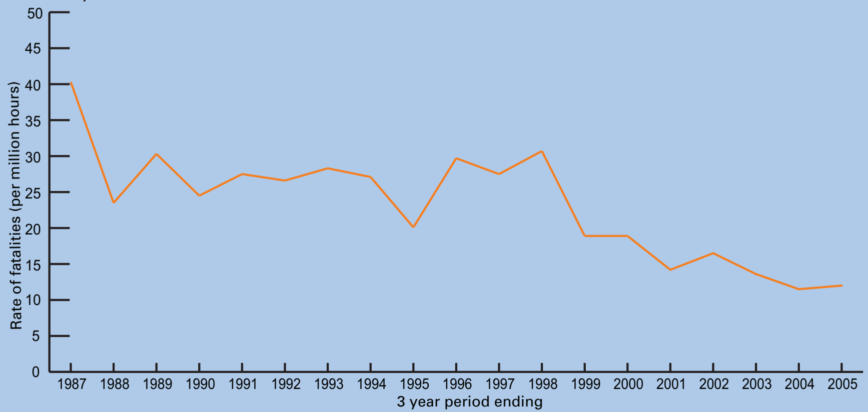


Figure 1. Rate of Fatalities - World-wide Large Western Built Jets (3 year moving average)

Further detailed information is available in CAA publications CAP681 Global Fatal Accident Review and CAP735 Aviation Safety Review.

In the context of this falling worldwide rate of fatalities, the following sections present statistics that provide an appreciation of the rate of accidents and fatalities specifically for the UK.

For comparison purposes, the majority of the charts shown use the same time period (1996-2005). However, note that the quality and availability of data differs for each industry sector, so care should be taken when making direct comparisons between them. The most comprehensive data is available for large public transport aircraft. All rates have been shown as three year moving average, which helps to highlight any trends.

Accident and Serious Incident data have been shown in tables for ease of reference. Again third party fatalities have been excluded from the data.

The data is divided into the following Industry sectors:

- UK Large Public Transport Aeroplanes (UK registered, >5,700kg MTOW)
- UK Large Public Transport Helicopters (UK registered, >2,730kg MTOW)
- UK General Aviation (UK registered aircraft <5,700kg such as aeroplanes, helicopters and 'other' aircraft, such as gliders, microlights, gyroplanes, airships and balloons.)

Most accident statistics refer to fatal accidents; these are events where there is a fatality during, or in a limited period following, an aircraft accident. Non-fatal accidents and serious incidents are often omitted from safety statistics but the CAA believes they have an important role in alerting industry to events that could be the precursor to an accident. Where appropriate, the data in the rest of this section includes fatal accidents, non-fatal accidents and serious incidents.

2. UK Large Public Transport Aeroplanes

This section refers to UK registered or operated aeroplanes with a maximum take-off weight of greater than 5,700kg on public transport operations.

When considering the fatal accidents in a single country, such as the UK, the number of accidents is small, and so a single accident is much more apparent in the statistics than would be the case when presenting data for the world as a whole. In the UK, the catastrophic loss of life in two particularly severe accidents in the 1980s dominates the UK accident record. There have been subsequent fatal accidents in the UK, but the loss of life has been much lower; in fact, since 1990, the UK's rate of fatalities in public transport accidents has remained very low (figure 2).

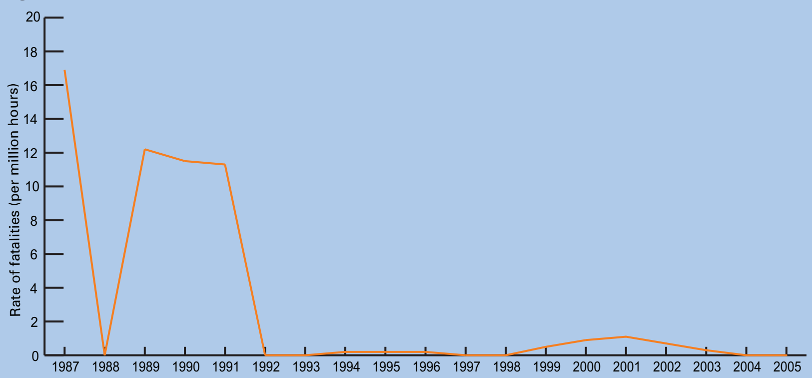


Figure 2. Rate of Fatalities - UK Registered/Operated Large Public Transport Aeroplanes (3 year moving average)

The fatal accidents to UK registered or operated aircraft included in Figure 2 are:

- On 22/08/1985 a Boeing 737 suffered an uncontained engine failure and fire on take-off from Manchester - 55 fatalities
- On 08/01/1989 a Boeing 737 crashed on approach to East Midlands after suffering engine problems - 47 fatalities

- On 25/02/1994 a Viscount crashed following problems with engine and airframe icing near Uttoxeter - 1 fatality
- On 12/01/1999 a Fokker F27 crashed into a house in Guernsey - 2 fatalities
- On 14/09/1999 a Boeing 757 departed runway at Geirona, Spain following heavy landing in severe rainstorm and fuselage broke into three pieces - 1 fatality
- On 02/05/2000 a Learjet caught fire on landing at Lyon, France after suffering engine problems - 2 fatalities
- On 25/05/2000 a Shorts SD330 was struck by the wing of a MD80 that was taking off from Paris, France - 1 fatality
- On 27/02/2001 a Shorts SD360 ditched in the Firth of Forth, UK following a double engine flameout - 2 fatalities.

Figure 3 and Table 1 show the rates and total number, respectively, of fatal accidents, non-fatal accidents and serious incidents.

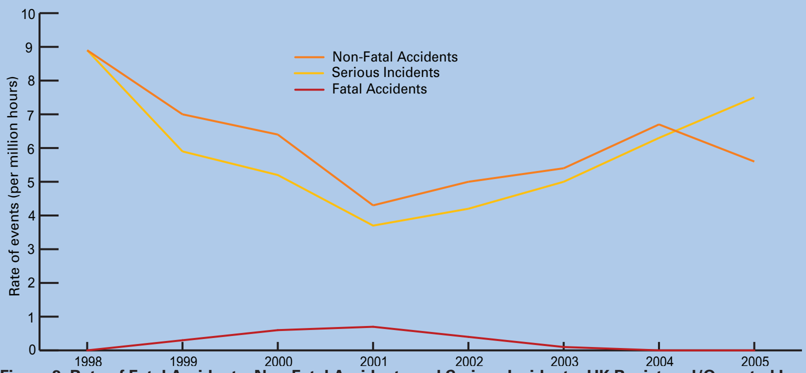


Figure 3. Rate of Fatal Accidents, Non-Fatal Accidents and Serious Incidents- UK Registered/Operated Large Public Transport Aeroplanes (3 year moving average)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fatal Accidents	0	0	0	2	2	1	0	0	0	0
Non-Fatal Accidents	19	14	20	11	13	7	17	16	17	11
Serious Incidents	22	14	17	7	12	8	11	18	18	23

Table 1. Number of Fatal Accidents, Non-Fatal Accidents and Serious Incidents- UK Registered/Operated Large Public Transport Aeroplanes

Within the data shown above, there is a wide range of aircraft. To provide a more detailed picture, these can be broken down into 'large' jets, 'business' jets and turboprops. Figure 4 and Table 2 show the rates and numbers of fatal accidents, non-fatal accidents and serious incidents for these three classes of aircraft.

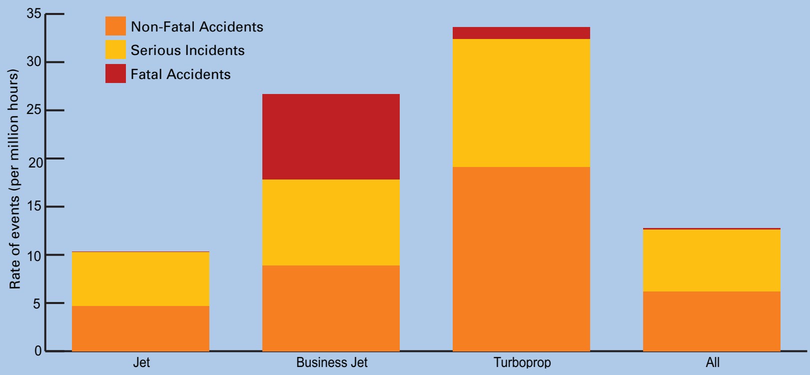


Figure 4. Rate of Fatal Accidents, Non-Fatal Accidents and Serious Incidents 1996-2005 by Class of Aircraft- UK Registered/Operated Large Public Transport Aeroplanes

Comparing the rates in Figure 4 with the numbers of events in Table 2, it can be seen that although the rate of events for business jets is quite high, it is actually based on a small number of events. One of the reasons for the resulting high rate of events is that business jets generate a relatively low amount of flight hours. Conversely, jets fly the majority of the hours generated by large public transport aeroplanes so, even though the number of events involving jets is high, the rate of events for jets is relatively low.

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
Large Jets	1	98	117
Business Jets	1	1	1
Turboprops	3	46	32
All Aircraft	5	145	150

Table 2. Total Number of Fatal Accidents, Non-Fatal Accidents and Serious Incidents 1996-2005, by Class of Aircraft

3. UK Large Public Transport Helicopters

This section deals with UK registered/ or operated helicopters with a maximum take-off weight of greater than 2,730kg on public transport operations. Figure 5 shows the rate of all public transport helicopter events.

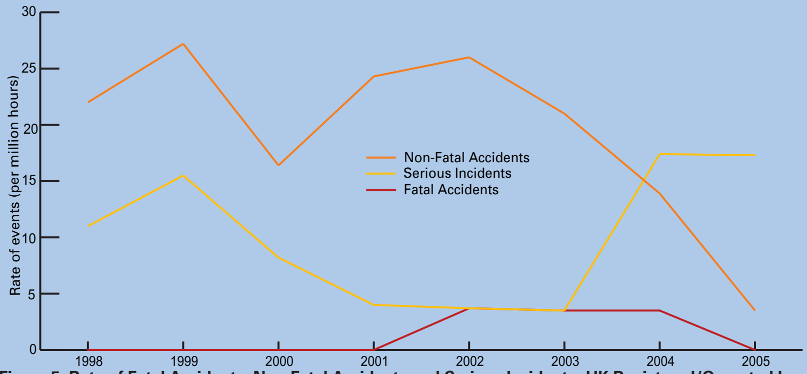


Figure 5. Rate of Fatal Accidents, Non-Fatal Accidents and Serious Incidents- UK Registered/Operated Large Public Transport Helicopters

	Fatal Accidents	Non-Fatal Accidents	Serious Incidents
Offshore	1	8	6
Emergency Services	0	6	2
Other	0	2	2
All Aircraft	1	16	10

Table 3. Total Number of Fatal Accidents, Non-Fatal Accidents and Serious Incidents 1996-2005, by Type of Operation - UK Registered/Operated Large Public Transport Helicopters

Table 3 divides large helicopters into three groups: Offshore (serving the gas and oil industry) which forms the majority of large helicopter operations, Emergency Services and 'Other'. There has been one fatal accident in the last 10 years: In July 2002, 11 people were killed when an S76 helicopter crashed into the sea and was destroyed following the failure of a main rotor blade.

4. UK General Aviation

The fatal accident rate for General Aviation has been produced using the hours flown by all UK registered aircraft below 5,700kg mtwa as it is not possible to separate out the hours flown on non-public transport activities. However, it is felt that it is reasonable to assume the majority of the hours flown by these aircraft will fall under the category of General Aviation.

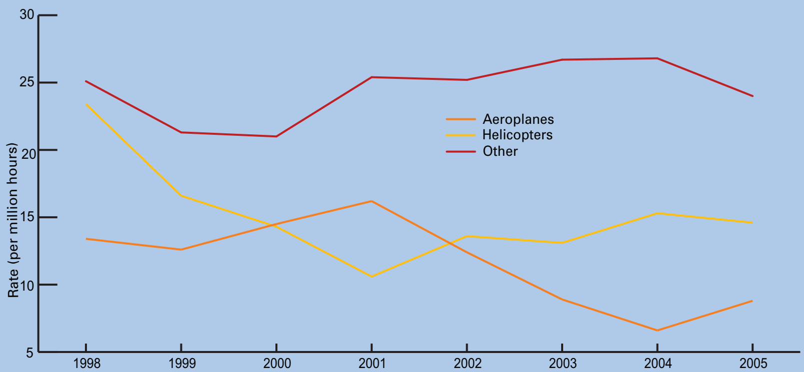


Figure 6. Fatal Accident Rate - UK Registered General Aviation Aircraft < 5700kg mtwa (3 year moving average)

The aircraft are divided into aeroplanes, helicopters and 'other' aircraft, such as gliders, microlights, gyroplanes, airships and balloons, on non-public transport activities. Figure 6 shows the fatal accident rate divided into these three general classes. Aircraft within the class referred to as 'other', in particular, may be engaged in recreational aviation activities and entering challenging situations with the full awareness of the occupant.

From Figure 6, it can be seen that the fatal accident rate for aeroplanes has been showing a general downward trend, whilst the rate for helicopters has been reasonably stable over recent years. The fatal accident rate for other general aviation aircraft remains considerably higher than for aeroplanes and helicopters.

5. Conclusion

The UK accident and fatality rates remain low, and are amongst the lowest in the world. However, there is no room for complacency and the CAA, in conjunction with industry, continues to strive for further improvements. The items included in this Safety Plan are designed to contribute to the ongoing improvement of UK flight safety.

Mandatory Occurrence Reporting (MOR) Scheme

Throughout this Plan, there are references to MORs and how the data is used by the CAA to identify and track potential safety issues, and also to develop possible safety improvements.

The CAA collects, records and analyses all reports received under the Mandatory Occurrence Reporting Scheme (MORS), as detailed in CAP382.

The objectives of the CAA Mandatory Occurrence Reporting (MOR) Scheme are as follows:

a) To ensure that the CAA is advised of hazardous or potentially hazardous incidents and defects (occurrences).
b) To ensure that knowledge of these occurrences is disseminated so that other persons and organisations may learn from them.
c) To enable an assessment to be made by those concerned (whether inside or outside the CAA) of the safety implications of each occurrence, both in itself and in relation to previous similar occurrences, so that they may take or initiate any necessary action.

The overall objective of the CAA in operating occurrence reporting is to use the reported information to improve the level of flight safety and not to attribute blame.

The CAA receives approximately 10,000 new reports every year, all of which are entered onto the database. The scheme has been running since 1976 and now contains over 150,000 records.

The MOR Scheme remains one of the most important safety data resources for the CAA and industry.

Working With The European Aviation Safety Agency (EASA)

European Union Regulation 1592/2002 came into force in 2002 and created the European Aviation Safety Agency (EASA) on 28 September 2003. On this date, EASA became responsible for the airworthiness of most of the civil aircraft registered in the European Union.

The CAA is committed to supporting the development of EASA as a world-class regulator. The CAA is an active member of the EASA Advisory Group of National Authorities (AGNA) and uses this forum to lobby EASA on rulemaking to improve flight safety; as part of this activity, the CAA is focussed on ensuring that the safety improvements which were being progressed under the Joint Aviation Authorities (JAA) are completed under EASA. CAA will continue to monitor the performance of EASA in this regard and will provide guidance and assistance wherever possible.

In developing the actions for this Safety Plan, a number of issues were highlighted that now fall under the remit of EASA. These will be reviewed and, where appropriate, passed to EASA via AGNA. In addition to the managed transfer of regulatory oversight major pieces of CAA work that have already been passed to EASA include:

Large Birdstrike Database: The CAA's large birdstrike database was created to collect information on strikes from birds over 4lb in weight. The database was fundamental to the improvement of the engine airworthiness requirements, to include a test with a 5.5lb bird, designed to address the threat of large flocking birds. This database will be extremely useful to EASA in reviewing airframe birdstrike requirements.

Human Centred Design: The CAA led the JAA effort to produce NPA 25-310 (Human Centred Design); a design methodology that takes into account, at the design stage, potential errors that could be made by the user, e.g. the pilot or maintenance engineer. Despite the fact that the work remains at the NPA stage, one large aeroplane manufacturer has voluntarily adopted parts of the methodology. The CAA has provided EASA with the background research required to take the rulemaking programme to fruition and will press for this issue to be given priority.

Large Public Transport Helicopter Emergency Flotation: CAA research into the improvement of helicopter ditching stability and the crashworthiness of helicopter emergency flotation systems has indicated the potentially significant safety benefits that could accrue from the location of additional flotation devices high on the helicopter fuselage in the vicinity of the main rotor gearbox and engines. Responsibility for design requirements has now passed to EASA, so, at the invitation of the CAA, EASA has become a member of the Helicopter Safety Research Management Committee (HSRMC) and has been formally notified of the CAA's previous work on emergency flotation. The CAA is in the process of collating all the remaining information on this topic, which will be provided to EASA for consideration.

Aircraft Icing: The CAA has been fully involved with the international effort to introduce new rules for Supercooled Large Droplet (SLD) icing, one of the NTSB's "Most Wanted" safety improvements, supplying professional expertise and sponsoring research necessary to properly define the certification requirements. The research has been presented to EASA during 2005.

In the context of this Safety Plan, the CAA will provide EASA with any information that results from implementing the actions in the plan which fall within the competencies of the Agency, and will work with the Agency to implement any resulting actions. However, the UK CAA is no longer independently pursuing research or rulemaking activities in those areas for which EASA is responsible.

The CAA Safety Risk Management Process

Strategic risk management is an important element of CAA work. CAA action areas will include:

- Further Development of the Safety Risk Framework
- Analysis to identify safety vulnerabilities and associated actions
- Prioritisation of actions
- Focussed use of CAA safety data
- Funding of Research

1. Introduction & Background

The tactical management of risk is the core of the CAA's day to day safety regulatory activities. This process takes many forms including:

- Risk identification during the oversight of organisations
- Assessing individual incidents and taking immediate action if appropriate

These processes have always been supplemented by more strategic reviews and analysis to identify where the CAA should be concentrating its resources to address safety issues. The CAA has continuously sought to improve these processes and in 2005 introduced a new approach to the identification and prioritisation of risk. The new approach is discussed below.

2.Further Development of the Safety Risk Framework

Risks that are statistically rare cannot be mitigated solely by addressing the cause of the most recent accident. What is required is continuous monitoring of safety related parameters and systematic analysis to ensure the robustness of the overall safety environment.

To ensure that the process for identifying risks is as rigorous as possible, it is important that a framework is used for registering and analysing potential safety risks. The CAA has always had such a framework for raising potential safety risks and planning for mitigating actions, and continues to be committed to continuously improving the process. In the latest development, the starting point has been the work of the CAA SRG Accident Analysis Group (AAG), which reviews annually fatal accidents to large public transport aeroplanes world-wide and assigns causes of the accident wherever possible. Figure 7 provides an overview of the consequences of accidents that occurred between 1995 and 2004, as determined by the AAG.

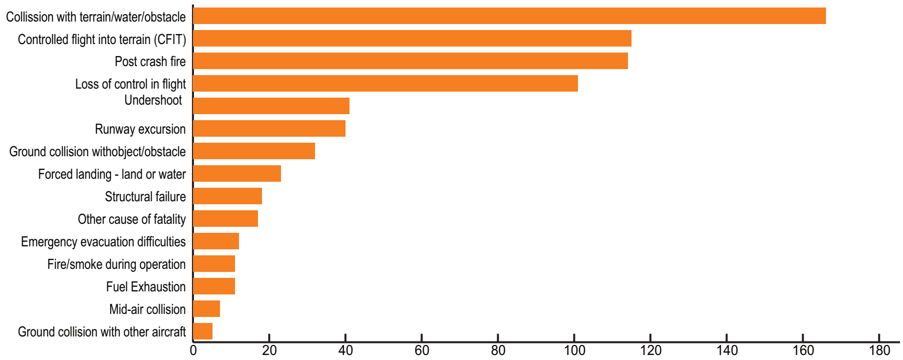


Figure 7: Number of Fatal Accidents allocated with Consequence

The categories shown in figure 7 are not mutually exclusive so that the same accident could be assigned to both 'CFIT' and 'Post Crash Fire', for example.

Accidents were not attributed to collision with terrain/water obstacle in addition to CFIT, but were attributed in all other cases where the aircraft struck the ground. Thus the former category should be interpreted with care as it contains many accidents that have also been included in other categories, for example loss of control that resulted in the aircraft colliding with terrain. Undershoot is also a relatively large category, but measures required to reduce the risks of Undershoot and CFIT are likely to be related.

This assessment provided an initial framework of:

- "Loss of Control" of the aircraft
- Controlled Flight into Terrain (including undershoot),
- Fire on the ground following an otherwise survivable accident, or, less commonly, fire in flight

Loss of control was further divided into its main causal groups: following technical failure; resulting from adverse weather (e.g. ice); or attributed to other non-technical factors such loading error.

It was also evident during the initial review that there are two issues which are generic in nature and which had an impact on all types of accident; pilot performance and organisational safety issues. There are also a number of issues which were not identified from the AAG's review, but are recognised risksin the UK and elsewhere. These include identified risks such as Level Busts and Runway Incursions.

The final Safety Risk Framework that the CAA used as the basis for its latest strategic approach to risk is reflected in the structure of this plan.

3. Analysis to identify safety vulnerabilities and associated actions

The process to identify safety vulnerabilities entailed multi-disciplinary teams considering each of the accident types in the Safety Risk Framework and working through any potential contribution from each major element of the aviation system: aircraft design, aircraft maintenance, air traffic control, airport design, flight operations, and monitoring information. To provide a structure for the analysis, the teams used a standardised series of prompt words applied to each area in turn, for example 'support documentation', 'training', 'differences', and ‘organisational factors'. This process has identified a number of issues of interest and where possible the risks were substantiated by reviewing the information available from the CAA's Mandatory Occurrence Reporting system.

Lists of possible safety issues were distilled by each team into a 'barrier' safety model. A barrier model is one which considers the 'safety barriers' that exist between safe operation and an eventual accident, and attempts to identify any 'holes' in the barriers that could allow a risk to pass unchecked. This model can be helpful in revealing the relative importance of potential vulnerabilities.

Each potential vulnerability was analysed and possible actions which the CAA could take were developed. The resulting list of vulnerabilities and actions were subjected to peer review and modified where appropriate.

4. Prioritisation of Actions

The actions resulting from the review were then prioritised by considering level of risk and likely effectiveness of actions that could be taken, several criteria were used to assess prioritisation, including:

- statistical safety risk: the most frequent causes apparent in accident analyses and MOR data, especially those leading to serious injury or fatality
- perceived safety risk: CAA specialists who become aware of an emerging situation or risk that is not apparent in historical data, for whatever reason
- degree of voluntary risk: the extent to which an activity is deliberately adventurous such as gyroplane flying, compared with passengers who fly for public transport purposes with an airline
- degree of international participation, for example, the subject of offshore helicopters has much greater prominence in the UK than internationally due to the significant UK oil and gas industry active in the North Sea area
- likely effectiveness and efficiency: an action likely to produce a step improvement in a moderate timescale for modest cost received preference to those that are costly, longer term or have an uncertain outcome.

The final prioritised list of actions form the basis of this safety plan.

5. Focussed use of CAA Safety Data

The CAA collects Mandatory Occurrence Reports (MORs) from industry as outlined in CAP 382. These are processed, recorded and where necessary actioned by the CAA. These reports remain invaluable. However, aviation events are complex and the database does not automatically highlight emerging trends that need to be addressed, although the CAA attempts to identify such trends where possible. Instead, the database is available for interrogation once the specific question of interest has been defined. The process described in the sections above identified the most important questions to be answered by the database. For example, having identified 'Aircraft Loading' as an issue of potential interest, an interrogation of the MOR database revealed the number of Loading Errors relating to UK operations justified attention.

In addition, the MOR database is oriented toward providing information on individual aircraft systems but has neither the structure nor, in some cases, the data to monitor how exposed the UK industry is to a risk such as Loss of Control or CFIT. For example, in the case of CFIT, it may be of interest to know how many times there have been navigation database errors, actual location deviations, excursions below Minimum Safe Altitude, or hard Terrain Avoidance Warning System (TAWS) alerts (and how many of these were risk bearing events). Not all of these 'precursor' events are required to be reported. Therefore, data which clearly identified the collective safety performance of UK industry in these 'precursor' measures would give the most important indications of the 'safety health' of the industry and help prioritise effort in safety resources.

The CAA will explore ways to improve data collection and processing in order to monitor the 'safety health' of UK civil aviation and feed this information back to the industry. This will help focus attention on the most important issues for safety and should provide a more extensive - and meaningful - pool of statistical data upon which to base decisions.

6. Funding

CAA funds invested in research are increasingly matched or augmented by contributions from elsewhere, including the European Commission, Health & Safety Executive, industry bodies (notably the UK Offshore Operators Association and Shell Aviation), professional bodies (such as the Guild of Air Pilots & Air Navigators), other national regulators (such as Norway, USA and Canada) and academic funding (such as the Engineering & Physical Sciences Research Council (EPSRC)).

Where external research is required to assist in a better understanding of a risk, or to help identify potential solutions, CAA is committed, whenever possible, to 'gearing' its own contribution to a project with additional funding from industry, other authorities and other interested organisations. This provides better value for money for all involved.

Summary of Actions

Issue	Actions	Dates
Monitoring Industry Performance	Explore ways to improve data collection and processing in order to monitor the 'safety health' of UK civil aviation and feed the information back to the industry.	July 07


A380

Large Public Transport Aeroplanes

Large public transport aeroplanes over 5,700kg, dominate aviation activity in the UK. In one year, the UK Airline and Air Taxi fleet fly more than 1 million flights, more than 2.5 million hours and carry over 115 million passengers in almost 1,000 aeroplanes.

This section covers work in the following areas:

- Supporting pilot performance
- Loss of control
- Controlled flight into terrain
- Aircraft fire

supporting pilot performance

Pilot performance is the single most prominent factor in flight safety. CAA action areas will include:

- **Improved Pilot Training**
- **Effective Communication**
- **Pilot Physical Capabilities**
- **Terms and Definitions Supporting RNAV/RNP Operations**

1. Introduction & Background

The role of the pilot is critical in ensuring a safe flight and pilots perform extremely well in discharging this duty, as demonstrated by the safety statistics. This is achieved through high standards of initial and recurrent training, effective working practices for the crew as a team, manageable pressures from the operating environment, usable documentation and human/machine interfaces, high standards of medical health, and regular rest periods to ensure that pilots are sufficiently alert.

However, where accidents do occur, analysis of worldwide statistics shows that crew error is the primary causal factor in 72% of fatal public transport accidents where a cause can be assigned (figure 8). This is comparable with other safety critical industries, but the CAA believes that every effort should be made to help pilots continually improve. As part of this effort, and to assist the CAA identify and address areas of concern, the CAA formed the Flight Operations Research Centre of Excellence (FORCE), at Cranfield University, in 2004. Staffed by an operational pilot, directed by the CAA, and with support from industry, FORCE has the remit to assist in improving operational safety.

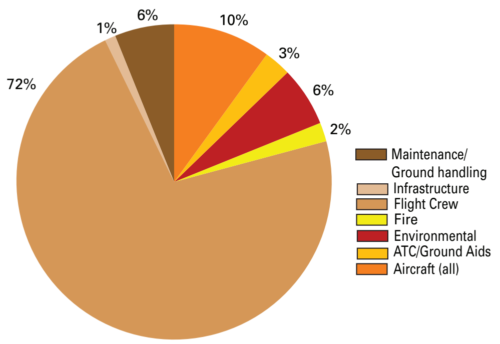


Figure 8: Primary Causal Factors of Fatal Accidents to Large Public Transport Aeroplanes World-wide

2. Improved Pilot Training

2.1 New Type Rating Syllabus

Pilot training is a well established and highly controlled system, based upon substantial experience. However, the current training regime is based upon conventional aircraft designs of the past and may not address the new dimension of pilot skills required for highly automated aircraft. The traditional training includes explanation of how the aircraft systems work. It may be, however, that the style of training needs to adapt to emphasise 'how to' use the system best in certain situations rather than being able to explain in detail how the technology works.

An experimental new Type Rating syllabus developed by the FORCE will be trialled with a major British operator early this year. Further trials on other aircraft types will follow. If successful, the new approach will significantly improve the pilots ability to control the aircraft flight path in challenging situations, increase confidence when coping with automation failures, and help the pilot stay 'in the loop' when monitoring and operating the aircraft throughout the flight envelope. It is the aim of the project to achieve this without increasing the cost or training time for the Type Rating. There may also be opportunities for further work to develop guidance to crews on how to deal with failures in automation.

2.2 Manual Handling Skills

Industry anecdotal feedback to the CAA has suggested that the manual flying skills of flight crew in highly automated aircraft are deteriorating. The CAA's initial investigation into this issue will be to define what is meant by manual handling skills; for example does it include the mental functions that the pilot would have to perform if the automatic systems were to fail?

Pilots are currently tested regularly on certain manual flying tasks thought to be the most difficult, but does practising this regularly guarantee that they could also perform the full range of other 'less difficult' tasks adequately? How should manual flying tasks be measured and assessed? And how many of these manual skills really affect safety in today's highly automated world, how often are they needed, and is the cost of sustaining them justified, or are there alternative solutions? **FORCE is exploring these questions so that the decisions eventually taken will be based upon scientific data and a full understanding of the facts**.

3. Effective Communication

3.1 Radio Telephone (RTF) Discipline

CAA surveys of RTF usage by both UK and foreign flight crew have indicated that they frequently fail to utilise the correct phraseology, or they omit essential elements in both initial transmissions and subsequent read backs. This increases workload for busy Air Traffic Controllers and can have an adverse effect on safety, such as causing level busts, and increased occupation of radio time to obtain clarification. A study carried out in November 2003 by ATC Operations at the London Terminal Control Centre (LTCC) resulted in 346 reported cases of incorrect read back in a period of only 10 days; 38% were UK operators. **A Working Group led by CAA Flight Operations will review the evidence of poor RTF usage by pilots operating within the UK and identify areas for action.**

3.2 'Sleeping' Receivers

A series of incidents has been reported where ATC was unable to contact an aircraft that had previously established two-way communication with the ground controller. In almost every case, satisfactory reception was only restored after a transmission from the affected aircraft. In these cases the aircrew have used the phrase, "receiver gone to sleep" or "suspected sleeping receiver" in their reports. The likelihood of a loss of separation and increased risk of collision arising from a prolonged loss of communication (PLOC) was highlighted by the UK Airprox Board in 1999 when two aircraft, on opposing tracks, were both "out of communication" for a period of 5 minutes. The Airprox report (150/99) mentioned that one of the operating companies had experienced several incidents when their aircraft radio was "neither receiving nor transmitting". The CAA is aware of more than 250 incidents of missed calls since 1999. CAA Air Traffic specialists led a team with representatives from NATS, EUROCONTROL, Thales and British Airways to investigate this issue and recommend actions to CAA to address 'sleeping receivers' causing prolonged loss of communication.

The investigation revealed that on a small but critical percentage of occasions, the aircraft communications transceiver failed to return from the transmitting to the receiving state. To mitigate this problem, one transceiver manufacturer has devised and published a non-mandatory service bulletin. The recent incorporation of this service bulletin into the ATC transceivers carried by a major UK airline has proved to be completely successful, but the CAA believes that this problem is very likely to be replicated in other transceivers. The CAA is now investigating whether high power ground transmitters at frequencies close to the civil and military aeronautical frequencies are likely to adversely affect the performance of an airborne receiver and if so, what measures are necessary to improve the immunity from strong signals and third order inter-modulation (IP3).

To progress this work **the CAA will lead a team to investigate 'sleeping receivers' causing prolonged loss of communication (PLOC) between pilots and ATC**.

4. Pilot Physical Capabilities

4.1 Flight Crew Fatigue

Although there is established guidance regarding Flight Time Limitations (FTL) (CAP 371), it cannot foresee every possible combination of flights an operator may wish to undertake. Operators may apply to the CAA, therefore, for acceptance of variations to their FTL scheme. **CAA research has developed the 'System for Aircrew Fatigue Evaluation' (SAFE) software model, to support SRG when assessing whether variations to FTL schemes could be safely permitted.** SAFE is being used successfully by SRG Flight Operations and the CAA will monitor the benefits of incorporating this model into industry rosters in co-operation with operators.

4.2 Medical Standards for the Automated Flight Deck

Pilots may be deemed medically unfit to fly because of a risk, often very small, that they will become incapacitated. For example a very experienced pilot with 15,000 hours might be grounded because of only a 1% per year risk of an incapacitating event. These medical standards were evolved in an era of relatively unsophisticated cockpit automation (1960-70s), and also have not been properly evaluated in the modern two crew environment. These stringent requirements remove experienced pilots for relatively minor medical reasons. **The CAA is conducting a medical study into the most appropriate medical requirement for fitness to fly, to ensure that the aeromedical standards reflect the modern cockpit environment.** This report will be provided to EASA for consideration.

4.3 Long Term Health

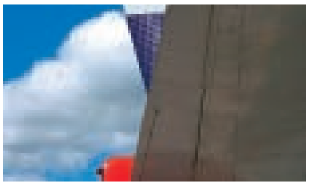
Questions have been raised concerning the health of pilots because of their unusual working environment. A research project is underway to assess the potential implications of long term exposure to the flying environment. One of the objectives of the research is to establish whether pilots are at higher or lower risk of certain types of medical condition that may increase or decrease their risk of incapacitation during a defined period compared to the general population. This helps to justify regulation by using an evidence based approach to quantify the risk. Department for Transport (DfT) has also established an Aviation Health Unit, based at the CAA, to address issues such as this. **The CAA will complete the ongoing research on Long Term Exposure to the Flying Environment.**

4.4 Colour Vision

Measurement of colour vision is part of the pilot selection process but the results are not treated consistently in different countries, even within Europe. Colour vision standards have not been updated to take account of the modern 'glass cockpit' flight deck, and adequate discrimination of Precision Approach Path Indicators. **The CAA is developing objective computerised colour vision tests based on current operational demands, which will be submitted to ICAO for their consideration as a world-wide standard to be recommended to contracting states.**

5. Terms and Definitions Supporting RNAV/RNP Operations

Required Navigation Performance (RNAV or RNP) technology is being developed for approaches in the UK and elsewhere. Definitions and terms have proliferated without any co-ordination, giving rise to a situation where confusion and ambiguity are likely to occur in flight. With support of the Guild of Air Pilots and Navigators (GAPAN) funding, FORCE have developed a web based tool for standardisation of definitions which is now accepted for use by many parties world-wide such as ICAO, ARAC and the Adverse Weather Operations Harmonisation Working Group (AWO HWG). **The CAA will continue to promote the use of standard terminology by presentation of the database tool to relevant parties and active facilitation of its use and will review the need for further action.**


Summary of Actions

Issue	Actions	Dates
Improved Pilot Training	Conduct research trial on improved training for highly automated aircraft.	March 07
	Conduct research into loss of manual flying skills.	July 07
Effective Communication	Conduct study of R/T discipline.	December 06
	Lead a team to investigate 'sleeping receivers' causing prolonged loss of communication (PLOC) between pilots and ATC.	August 06
Pilot Physical Capabilities	Monitor incorporation of the fatigue model "SAFE" in rosters.	March 07
	Complete a medical study into the most appropriate requirement for medical fitness to fly, to ensure that the aeromedical standards reflect the modern cockpit environment.	September 08
	Complete the research on Long Term Exposure to the Flying Environment.	December 06
	Develop objective computerised colour vision tests based on current operational demands	March 07
Terms and Definitions Supporting RNAV/RNP Operations	Promote the use of standard terminology by presentation of the database tool to relevant parties and active facilitation of its use and will review the need for further action.	January 07

Loss of control

Loss of Control is the only type of accident that is not reducing in world-wide statistics. It most commonly occurs for non-technical reasons such as the pilot's flight handling (especially in adverse weather), following a bird-strike or loading error that makes the aircraft difficult to control, aircraft icing, contaminated runways, or following a technical failure. CAA action areas will include:

- **Loading Error**
- **Flight Handling**
- **Aircraft Icing**
- **Contaminated Runways**
- **Technical Failure**

1. Introduction

Loss of control is one of the most prevalent fatal accident types to large public transport aeroplanes world-wide; between 1995 and 2004, there were 101 fatal accidents worldwide involving loss of control. From the information available, the CAA Accident Analysis Group was able to assign a primary causal factor to 85 of the accidents: of these, 21 had primary causes associated with technical issues (including maintenance) and 5 had primary causes associated with ice.

This leaves 59 fatal loss of control events arising from other primary casual factors. That is, in 10 years there were 59 fatal accidents to large public transport aeroplanes that were controllable, not contaminated by ice, and where the crew were believed to be aware of their location.

Analysis of these 59 accidents showed:

- Ground handling errors where the aircraft had been incorrectly loaded,
- Poor risk management by the crew in events leading to the accident
- Unsuccessful flight handling, such as
  - failure to recover properly from an extreme attitude or an upset (e.g. related to turbulence)
  - poorly executed go-arounds
  - inappropriate use of automation

Between 1995 and 2004, there have been 186 fatal accidents to airliner aircraft worldwide that feature weather as a causal or circumstantial factor (107 of these accidents involved approach and landing phases of flight). In 44 fatal accidents to airliners world-wide, weather was attributed as directly causal: 22 related to wind (wind-shear, upsets, turbulence and gusts) 14 were due to ice, and others featured rain, hail or lightning.

The analysis also showed that there is a need to better identify which occurrence reports might represent precursors of potential loss of control of the aircraft. While this is not straightforward it would be worthwhile if occurrences could be used to monitor the safety margin from a loss of control event in the UK fleet.

2. Loading Error

Excess or incorrectly placed load can reduce the aircraft's performance or handling qualities to such an extent that safe flight cannot be maintained.

Over the last ten years, there have been 20 fatal accidents world-wide involving large public transport aeroplanes where loading error was a causal factor, one of which was in the UK. The accident occurred when control of the aircraft, carrying three tonnes of newspapers, was lost during the final stages of an approach to Guernsey Airport. It was shown that the aircraft was outside the load and balance limitations. Also during this period there were 1,000 MORs of which 15 were serious incidents & high risk MORs. This equates to approximately 1 loading incident every 3 days. Figure 9 below shows the trend over a ten year period, increasing from 4 errors per 100,000 flights to 13 errors for the same exposure over a five year period. The reasons for this sharp increase are not known, but clearly merit attention. Whilst reporting can be affected by awareness campaigns and reporting levels generally, an increase of this magnitude is likely to reflect some genuine underlying risk in the industry. Since then, there has been a downward fluctuation but 2004 saw an increase. Most loading errors (81%) occurred on passenger flights (rather than freight), however this can be explained to some extent by the relative proportions of passenger flights (97%) and cargo flights

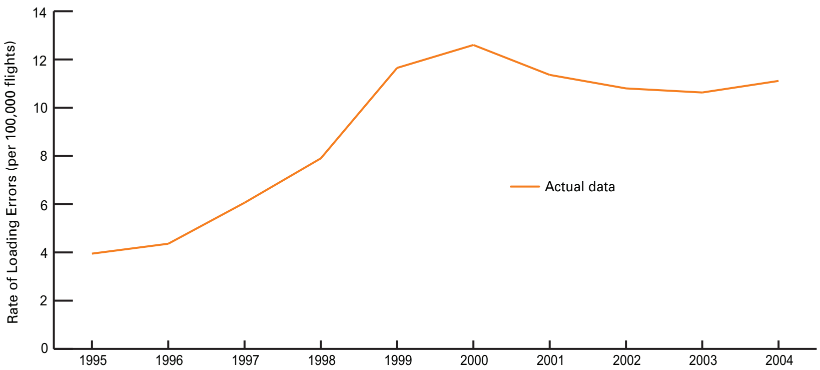


Figure 9. Rate of Loading Error MORs 1995 - 2004

(3%). The vast majority were not detected until after departure.

Mechanisms to guard against errors exist at each stage of the loading process. However, whilst the system may appear to incorporate a number of safeguards the data indicates a need for improvement.

The CAA has already responded to this situation by the recent appointment of a specialist Loading Inspector and revisions to the CAA's operator oversight methodology. Consequent actions include a higher frequency of cargo ramp inspections; increased in-depth specialist consideration of operator's loading policies, processes and procedures; and increased emphasis on loading issues during routine oversight activities. The effectiveness of these actions must be monitored in order to ascertain whether any further intervention is necessary.

The CAA will monitor MOR data to assess the effectiveness of ongoing actions.

3. Flight Handling

Flight handling includes the ability of the crew to re-establish stable control of the aircraft following a disturbance or manoeuvre. Analysis of world-wide fatal accident data by the CAA's Accident Analysis Group shows that, since 1980, approximately 10% of the total of 837 accidents analysed identified flight handling as the primary causal factor and around 25% had it as a causal factor. The figures for the last 10 years are similar. Flight handling in highly automated aircraft is the subject of some significant ongoing research work (see 'Supporting Pilot Performance') sponsored by SRG at the CAA's FORCE. However, closer examination of the data reveals some specific situations that are most commonly associated with unsuccessful flight handling by the crew, such as:

- Inadequate Recovery from In-Flight Upset: e.g. American Airlines Airbus A300-600, 12 Nov 2001 at Queens, NY
- Inadequately Flown Go-around: e.g. China Airlines Airbus A300-600, 16 Feb 1998 at Taipei. *(another similar accident involving the same operator and aircraft type at Nagoya in 1994)*
- Inadequate Recovery from Extreme Attitude: e.g. Crossair Saab 340, 10 Jan 2000 at Zurich. *(Note: the Flash Airlines Boeing 737 accident at Sharm-el-Sheikh on 3 Jan 2004 appears to have occurred in similar circumstances)*

These accidents did not occur in the UK. However, for UK operations in UK airspace MORS contains records of level busts following go-arounds, and stick-shakes/stall warnings (excluding those associated with technical problems or meteorological effects). Most involve inadequate speed and/or attitude control.

On approach, there have been numerous occurrences involving turbulence, windshear, crosswinds, etc., resulting in missed approaches and hard landings. Issues identified fall into two main categories: go-arounds from high and go-arounds from low level.

When initiating a go-around at high level, the control of maximum thrust can be challenging, possibly leading to a level bust, and aircraft system design is not always helpful in this situation. During the fatal accident to a China Airlines Airbus A300-600 on 16 Feb 1998 at Taipei, the stall apparently occurred some 39 seconds after the start of the go-around. This accident had certain elements in common with a fatal accident at Nagoya in 1994.

Go-arounds in adverse weather conditions are often from very low level and/or unusual situations such as from the flare. Obviously this means that the decision to go-around has to be taken very late in the approach and can result in a high workload situation during a very high energy manoeuvre that can easily lead to the development of an unusual attitude.

Of course, flight crew receive thorough training and testing in flight handling skills, but there is a need for sustained vigilance to ensure that the training provided continues to be adequate. The data suggests particular attention should be paid to training and procedures related to upsets, including recovery from unusual aircraft movements or attitudes (e.g. due to turbulence or distraction) and also go-arounds, especially those situations that are less frequently practiced. This would entail an investigation of current requirements for UK operators to establish the the training and procedures associated with upsets and go-arounds, followed by consideration of any need for change.

The review would include the characteristics of simulation tools currently being used for training, their suitability for the intended training goals, and even any risk of negative training if the fidelity of simulator responses outside the normal flight envelope is poor. A relevant fatal accident occurred to an American Airlines Airbus A300-600, on 12 Nov 2001 at Queens NY, where the NTSB Accident Investigation criticised 'elements of the American Airlines Advanced Aircraft Manoeuvring Program'. The perceived risk is that some simulation devices may not be entirely accurate representations of aircraft behaviour in extreme situations, and that this could create a false expectation in the minds of the crew.

The CAA will review guidance and requirements relating to training and procedures for upsets and go arounds, including issues associated with high level and low level go arounds (particularly in adverse weather).

4. Aircraft Icing

In the ten years 1995 - 2004, there have been 14 fatal accidents to large public transport aeroplanes world-wide where ice contamination resulted in loss of control. The most prevalent causes of these accidents were ice accumulation in flight and aircraft departing with ice contamination. In addition, the CAA continues to receive MOR reports of de-icing fluid residues re-hydrating and then freezing, causing stiffness or jamming of flight controls.

4.1 Ice Accumulation in Flight

Of the 14 fatal accidents mentioned above, 7 related to ice forming in flight, of which 5 were airframe ice, and 2 were engine ice.

The systems to protect the aircraft from in-flight icing are built into the aircraft at manufacture and go through a rigorous certification process. Flight crews are trained to both use the systems and make appropriate judgements about when to exit the icing conditions. These systems are considered to be effective for most large public transport aircraft applications.

However, a condition that is not currently considered in certification is known as supercooled large droplet (SLD) icing. These meteorological conditions occur in various parts of the world including Europe and North America. For the large majority of aircraft designs these conditions do not interfere with the safe operation of the aircraft despite the lack of specific certification design criteria. The loss of several aircraft of a particular type (super critical winged turboprops) has been the subject of an international project to examine the icing certification envelope for future aircraft as well taking specific actions for the aircraft type concerned.

The CAA has supported the Ice Protection Harmonization Working Group (IPHWG) with both expertise and research projects to investigate changes to the icing certification method. The CAA presented the research to EASA in 2005 and will continue to support the IPHWG with expertise.

4.2 Fluids Residues Freezing Flight Controls

There were a significant number of incidents during winter 2004/2005

reporting control problems on certain aircraft types due to de-icing fluid. A side effect of some de-icing agents is that, on drying out, they can leave a residue, which on contact with water forms a gel and may subsequently refreeze around control runs. This causes problems from stiffness in the controls to complete jamming of an individual control surface. This seems to be an issue for a limited number of large public transport aircraft with non-powered controls, however the anti-icing fluid residue problem is not fully understood, with some operators having no incidents of control problems and others having a number of incidents.

Manufacturers are addressing the residue problem with additional cleaning and inspection regimes. However there is the possibility of it occurring on future aircraft types or types not previously exposed to the thickened de-icing fluids.

The CAA will investigate both the causes of residues freezing around flight controls and mitigation methods that will protect all aircraft types.

4.3 Aircraft Departing with Ice Contamination

Removal of frozen contamination is a relatively simple process but continues to be a cause of accidents and incidents; flight crew sometimes elect not remove frozen contamination and, depending on other uncontrolled factors, this may result in an accident.

Research conducted by a major manufacturer in the 1980s, has shown the effects of frozen contamination on aircraft performance. The findings showed that even a slight roughness reduced the margin between stick shaker activation and aerodynamic stall from 7 knots to 1 knot and reduced single engine climb rate by 50%. With more severe roughness the aerodynamic stall occurred before the stick shaker activated and single engine climb capability was negative. The roughness also created an out or trim condition such that the aircraft tended to over rotate requiring pilots to excerpt a 'push force' on the flight controls to maintain pitch attitude rather than the 'pull force' that would be their normal action in that regime.

Where de-icing and/or anti-icing is requested by the crew, the subsequent process is heavily dependent on good working practice by de-icing/anti-icing crews, often in adverse conditions. The larger the aircraft, the less opportunity there is to check the effectiveness.

Of the 14 fatal accidents related to aircraft icing (1995-2004), 7 related to take-off with ice contamination; of which 5 were ice or frost on the wing, degrading lift and controllability, 1 had a frozen pitot-static affecting flight instruments, and 1 had ice in the engine air intakes causing double engine failure. UK experience includes an SD360 fatal accident in 2001 caused by double engine failure as a result of failure to remove ice which had accumulated overnight while the aircraft had remained parked; and a fatal accident to a US registered Canadair Challenger business jet at a UK airport in Jan 2002, where frost deposits were not removed prior to flight and caused a loss of control. There have been at least 45 MORs over the past 10 years involving large aeroplanes with ice-contaminated airframes prior to departure, of which 37 related to inadequate de-icing by ground personnel. A further 17 MORs cited inadequate ground de-icing procedures.

The removal of ice prior to takeoff is a ground handling task with multiple people and organisations involved in multiple countries. It is this aspect that makes it more difficult to maintain a robust process over many millions of departures. The CAA produces a regular winter operations Aeronautical Information Circular. An Ice Aware video was produced following the Challenger accident and the CAA is co-operating with the FAA and Transport Canada to produce another web based training aid. The CAA also held a mini-conference on Ground de-icing during 2005.

4.3.1 Decision to De-Ice

The aircraft Commander has responsibility for ensuring the aircraft's critical surfaces are free from frozen contamination (JAR-Ops). However, in many of the fatal accidents where frozen contamination was a primary causal factor, the aircraft were not de-iced at all.

In addition to the fatal accidents there is evidence from MOR reports and Confidential Human Factors Incident Reporting Programme (CHIRP) that aircraft occasionally depart with ice on a critical surface.

The issues summarising the decision to de-ice will be addressed as part of the work detailed in 4.3.2 below.

4.3.2 De-Icing Effectiveness

The industry standard for removing ice is to spray a hot, freeze point depressant fluid over the critical surfaces of the aircraft. A number of issues have been highlighted by MORs and audit findings. These include:

- Confusion between de-icing service providers and flight crew over who is responsible for inspecting and removing ice from engines or static ports and who is responsible for the post de-icing inspection
- Split responsibility at the organisational level within an operator can result in ground de-icing being shared between Engineering, Flight Operations and Ground Handling Departments

The flight crew are, to a large extent, unable to verify many of the tasks conducted by the ground de-icing service provider. This means that there is considerable reliance on the operator's quality system to ensure correct fluids are applied, and the operator's procedures are being followed. In addition, the critical pre-take off check has been highlighted as being less than optimally effective therefore there are opportunities to improve consistency and support to crew.

Therefore the CAA will join industry initiatives to review ground de-icing.

The CAA will raise the following issues:

- The effectiveness of oversight of ground de-icing service providers.

- How operators share the responsibility for inspection and de-icing of various critical items including engines, probes, static ports, wings, tail and fuselage between themselves and the service provider.

- Methods for managing the variety of standards required of service providers as this increases the likelihood of human error.

- The current oversight process for application of fluids, including adequacy in detecting equipment faults that could result in de-icing fluids being applied with reduced viscosity or incorrect temperature.

- A more consistent approach to the pre-takeoff check, which may include supporting information on the benefits of having standard reference surfaces, guidance on the visual characteristics of a failed fluid and guidance on relating actual weather conditions to those specified in the Hold Over Time tables.

5. Contaminated Runways

In world-wide fatal accidents between 1995 and 2004, runway contamination due to adverse weather was cited as directly causal in 2 accidents and circumstantial in 10 more. In the UK, runway contamination has been reported in 30 MORs since January 2000 of which 2 were accidents and 2 were serious incidents.

Feedback via MOR, ASR and CHIRP reports suggests that better information on the contamination present on a runway would assist pilots to make a more informed decision prior to take-off or landing in such conditions, particularly where the contamination is slush or wet snow. At present this information is limited to the depth and description of contamination on the runway. The UK AIP states: *"...because* *of the effects of drag, friction machines can produce misleading readings when operated in slush. In addition, because of the infinitely variable characteristics of the contaminant, no satisfactory method of assessing braking action in slush exists. For these reasons reports containing estimates of braking action derived from readings in these conditions do not include plain language and pilots will be informed on the RTF of the extent and depth of the contamination only."*

The Air Accident Investigation Branch (AAIB) has made recommendations to the CAA on this subject: Safety Recommendation 2003-96 states that the CAA should encourage research into how braking action on runways could be accurately measured under all conditions of surface contamination. In 2004 the CAA established a working group with industry to review the potential for the development of improved runway friction measurement and correlation of the measurement results with those factors used in aeroplane performance. Manufacturers of friction measurement devices were represented and, in conjunction with the Engineering Science and Data Unit (ESDU) some progress has been made.

Further work is however needed and having secured the agreement of the relevant parties, including UK licensed aerodromes, **the CAA will progress this under a collaborative arrangement linking the science from ESDU with the expertise of performance specialists at Boeing and Airbus.**

6. Technical Failure

While modern aircraft design is extremely tolerant of technical failure, loss of control following a technical failure does still occur. Some failures may make the aircraft difficult or impossible to control; some result in a situation that should be controllable but are not successfully managed due to misdiagnosis, inappropriate action or distraction. Of 63 accidents identified by the SRG Accident Analysis Group as loss of control involving a Technical Failure over the ten year period from 1995 to 2004, one third were loss of control subsequent to the failure of one or more engines.

6.1 Handling Engine Malfunctions

The most prevalent technical cause of loss of control is engine failure, especially on twin engine aircraft. An international, industry-led working group studied 63 accidents world-wide involving propulsion system malfunction plus inappropriate crew response (PSM+ICR), and made numerous recommendations. In the UK, there are an average of 82 MORs per year where engine loss is an aspect of the report. While there were few realised consequences these all carry the potential for this type of accident.

The CAA will:

- **Review the recommendations of the PSM+ICR study and report on their application and effectiveness in the UK**
- **Complete and distribute a turboprop engine failure awareness video**

6.2 Ensuring the Ongoing Airworthiness of Composite Structures

To a large degree, current requirements and processes for the maintenance of structures are based upon the characteristics of metal structures. These may need to be revisited as composite primary structures come into service and field damage inspection and repair techniques have to be produced to ensure safe operations. For example aircraft engineers whose experience has been mainly working with metal structure may not immediately recognise the degree of underlying damage that a very small surface blemish could conceal. Events have been reported where a leading edge visual inspection appeared satisfactory but the structure was later found to have significant underlying damage. Experience of current composite secondary structures may be an indicator of the type of issues that could arise. Inspection techniques, which have been developed for these structures should be examined.

The CAA has already completed research on important changes to composite structure and the results have been provided to EASA.

Work continues on integration reliability.

The CAA will complete research into reliability of visual inspection on composite structures. Results will be reviewed for potential use in engineer training or industry guidance. EASA will be informed of any relevant findings.

Summary of Actions

Issue	Actions	Dates
Loading Error	Monitor MOR data to assess effectiveness of ongoing actions	ongoing
Flight Handling	Investigate Training and SOPs related to Upsets and Go Arounds	March 08
Ice Accumulation in Flight	Monitor MOR data to assess effectiveness of ongoing actions.	March 08
Freezing Residues	Investigate the causes of de-icing fluid residues that may freeze and methods for mitigating them.	October 06
Ground De-Icing Effectiveness	The CAA will join industry initiatives to review ground de-icing.	June 07
Contaminated Runways	Facilitate research on measuring runway friction, linking ESDU expertise with performance specialists at Boeing and Airbus.	November 09
Handling engine malfunctions:	Review the PSM+ICR report's recommendations and their application and effectiveness in the UK. Complete and distribute a turboprop engine failure awareness video.	October 06 July 06
Continued airworthiness of composite structures	Complete research into reliability of visual inspection on composite structures. Results will be reviewed for potential use in engineer training or industry guidance.	February 09

Controlled Flight Into Terrain

Controlled Flight into Terrain has decreased significantly since improved Ground Proximity Warning Systems (GPWS) and later Terrain Avoidance Warning Systems (TAWS) were introduced. However, it continues to be a relatively common type of fatal accident world-wide. CAA action areas will include:

- **The approach and landing phase of flight**
- **Flight crew and crew resource management issues**

1. Introduction & Background

The CAA Accident Analysis Group has determined that between 1995 and 2004, inclusive, there were 115 fatal CFIT accidents worldwide leading to over 3,000 fatalities; this equates to 30% of all fatalities in this period. Flight Safety Foundation figures indicate that between 1993 and 2004, inclusive, for jet aircraft with an MTOW greater than 60,000lbs, there were 57 hull loss accidents classified as CFIT. Many of these accidents occurred in the less developed areas of the world, but regions such as Western Europe and North America also suffered CFIT accidents.

The last large public transport CFIT accident in the UK was a DHC6 Twin Otter crashing into a hillside on approach to Islay in 1986, whilst carrying out a visual approach. However, between 1995 and 2004 the MOR database shows that there have been some 16 'near CFIT' occurrences to large public transport aircraft involving unsafe descent or near collision with high ground, of which 5 were classified by the AAIB as serious incidents. In addition, a recent analysis of flight operational data for 15 UK operators, over a 6 month period involving 392,000 flights, showed 75 'hard' GPWS warnings. This is equivalent to 1 per 5,000 flights.

The analysis of CFIT accidents and near CFIT incidents by the CAA brought to light some 130 issues or areas of concern. These have been classified, taking into account their significance, and the likelihood of occurrence, and are categorised under the headings below.

2. The approach and landing phase of flight

A study was undertaken, on behalf of ICAO, of 40 CFIT accidents and near CFIT incidents for a 5 year period, 1986 to 1990. The study identified that the majority of aircraft involved in CFIT incidents/accidents were on the runway centre line when 10 miles out and maintained a constant 3 degree glide slope but were below the intended glide path. Most of the impacts were between the outer marker and the runway.

Destabilised approaches increase the possibility of flight crew's attention becoming diverted. Since 1985 there has been one UK reportable accident (a Twin Otter on the approach to Islay in 1986) and 9 Serious Incidents, as determined by the AAIB, involving descent below safety altitude by large public transport aeroplanes. Of these, 6 involved poorly executed or poorly planned approaches. However, approaches with vertical guidance are not available at many airfields. Most CFIT accidents occur during non-precision approaches. In addition, unstable approaches may further exacerbate the difficulties by increasing crews' workload and the possibility of descending below minimum safe altitude.

Air Traffic Service Units (ATSUs) that are not equipped with Secondary Surveillance Radar (SSR) do not have the ability to monitor aircraft level data via the “Mode C” height readout facility transmitted by the airborne equipment. In addition, an ATSU without SSR is unable to benefit from the use of an Approach Monitoring Aid (AMA) with a vertical monitoring component in addition to the azimuth monitoring of the approach. An AMA would provide the controller with an aural/visual alert when the aircraft flies outside defined parameters whilst on approach. Some of the larger airports in the UK have elected to install AMAs, but only one, it is believed, is fitted with the vertical monitoring component.

Depending upon the type of surveillance radar equipment available at an ATSU, local instructions (The Manual of Air Traffic Services (MATS) Part 2) may place a responsibility upon controllers to monitor radar approaches by aircraft where a pilot interpreted final approach aid is being utilised. Clearly, the ability of controllers to achieve this becomes increasingly more difficult at larger airports that have consistently high traffic levels and where other demands on them have a higher priority.

The CAA will undertake a cost benefit analysis (CBA) to determine benefits or

otherwise of the Introduction of Secondary Surveillance Radar and/or other Approach Monitoring improvements at UK airports.

The CAA will complete the design and assessment work for the Gatwick 'Approach with Vertical Guidance' (APV) BaroVNAVtrial and the 6 GNSS trial approaches. It will include a feasibility study of UK airfields with the aim of replacing non-precision approaches with approaches with vertical guidance (APV) or precision approaches.

The CAA will complete the development of a GNSS approach validation tool and make available for use. This will be achieved through the CAA Institute of Satellite Navigation (Leeds University and Imperial College London).

3. Flight crew and crew resource management issues

Separate studies undertaken by ICAO and the Flight Safety Foundation highlight that crews do not always react immediately to hard GPWS warnings. Time is spent assessing whether the warning is genuine, particularly when the crew are visual with the runway. However, guidance does exist:

- CAA Safety Intervention 05/02 on R/T discipline (see Safety Plan 2005):
  - FODCOM 6/99 entitled "Controlled Flight into Terrain (CFIT) - Operational and Training Considerations".
  - CAP 516 "Ground Proximity Warning Systems: (GPWS)"
  - Draft JAA TGL "Guidance for operators on training programmes for the use of TAWS"
  - Issue identified in ICAO training material

Communication failures and language misunderstandings can also contribute to CFIT accidents or near CFIT incidents. There can be a lack of flight crew awareness of human factor issues associated with interpreting ATC clearances, especially when anticipating a specific response. In the 10 year period between 1995 and 2004 there have been at least 2 fatal accidents involving missed or misunderstood communications. At least one UK reportable accident involved a read back error.

In the 10 years between 1995 and 2004 there have been 19 worldwide fatal accidents involving crews pressing on in other than ideal circumstances. In 5 of these the "press on" tendency was cited as the primary factor. The joint experience of flight crews, particularly knowledge of an airfield with a high CFIT risk factor, is not always taken into account when rostering. Inadequate knowledge of the route or airport was deemed to be a factor in the DHC6 Twin Otter accident in 1986 and was a factor in 2 serious incidents.

There is no requirement for circling approaches to be assessed during recurrent simulator or line checks. It is no longer a mandatory item of the JAR FCL Licence Skills Test or Licence Profiiency Check, although it is still required to be trained during a Type Rating training course.

These issues indicate that more emphasis should be placed on CFIT awareness and training.

CAP 516, "Ground Proximity Warning Systems: (GPWS): Guidance material", will be reviewed and updated if necessary to take account of operational procedures and enhanced equipment.

The CAA will continue to encourage operators to review their training procedures with respect to GPWS warnings.

Summary of Actions

Issue	Actions	Dates
Approach and Landing	Undertake a cost benefit analysis of SSR and/or other approach monitoring improvements.	December 07
Approach and Landing	Complete the design and assessment work for the Gatwick 'Approach with Vertical Guidance' (APV) BaroVNAV trial and the 6 GNSS trial approaches.	December 06
	Complete the development of a GNSS approach validation tool and make available for use.	March 07
	Prepare strategy for APV implementation based on the results of the trial.	July 07
Crew Resource Management	CAA to encourage operators to review training procedures on how to deal with GPWS alerts	February 07
	Review CAP 516	January 07

Aircraft Fire

Fire is frequently a cause of fatalities following accidents that would have been otherwise survivable and in-flight fires are a concern. CAA action areas will include:

- **Cabin Crew Fire Training**
- **Operational Implications of Integrated Fire Suppression Systems**
- **Enhanced Ground Fire Fighting**

1. Introduction

Fire is an omnipresent threat to life, exacerbated in aircraft by the large quantities of highly flammable fuel and limited possibilities of escape. Substantial flammability improvements have been made in recent years in cabin materials, aircraft evacuation is more effective and ground fire-fighting is improved. However, MORS records over 3,000 fire incidents in the last 10 years, many with the potential for catastrophe, with around 40 fatal fire accidents worldwide during the same time frame.

The CAA has been very active in this area in the past:

- Cabin safety/fire database funded by the CAA, FAA and Transport Canada (TCCA), lithium battery fire investigations, studies on fire accident trends, CAA organisation of Fire Research Conference 2004, research on integrated fire suppression systems using nitrogen and water mist

- Participation in European Commission funded FIREDASS and FIREDETEX research programmes for the development of new fire suppression technologies. Participation in the VERRES study on the evacuation of large aircraft

- Development of test facility in the UK for international fuselage burn-through studies considering insulation to protect against external post crash fire

- Command and control studies for fire officers, development of 500 seat double-deck research cabin simulator at Cranfield, Type III automatic overwing exit studies, passenger briefing at Type III exits, development of airEXODUS evacuation model, cabin crew evacuation management, composite materials fire hazards

A significant fire risk to manage is that of the initial ignition, generally electrical in nature and frequently associated with cables; this is particularly a risk in older aircraft. Due to be published in 2006, a recent CAA-managed study reported 268 UK cases since 2002 of fires associated with cables (not limited to older aircraft). The internationally supported 'Ageing Transport Systems Regulatory Advisory Committee' (ATSRAC) is considering these issues (http://www.mitrecaasd.org/atsrac/). The ATSRAC output may result in regulatory changes relating to electrical wiring, inspection and maintenance. Separately, initiatives such as inerting fuel tanks through the use of nitrogen may reduce risk of ignition in fuel tanks and this technology could also be applied to other vulnerable areas of aircraft. It should be noted that these airworthiness issues are now being progressed by EASA.

Under international agreements, CAA receives funding from FAA and Transport Canada to support research in this area, co-ordinated by the Cabin Safety Research Technical Group (CSRTG). The work of the Group was presented in 2004 its fourth (triennial) fire and cabin safety research conference, the details of which may be found at: (http://www.fire.tc.faa.gov/2004Conference/html/intro.htm).

Many of the studies use the CSRTG accident survivability database, funded by the CAA, FAA and TCCA, which will continue to be updated.

2. Cabin Crew Fire Training

JAR-OPS-1 (subpart O) requires practical fire-fighting training for cabin crew every 3 years. There are similar requirements in subpart N for the training of flight crew. Further information is provided in CAP360 and in FODCOMs. One of the major training issues in recent years has been the ban on the discharge of Halon during training.

In some instances cabin crews have been unable to break integral extinguisher integral seals, thus discarding fully operable extinguishers before attempting to fight a fire. The integral seals that are part of the design of some fire extinguishers are not always replicated in extinguishers used for training. Other difficulties have been experienced in differences between training equipment and operational equipment. For example some PBE is difficult to remove from its packaging and this is not always replicated in training. Also, the tightness of neck seals and associated clothing is not easily achieved in training.

The CAA believes that the current training practices and standards may no longer be totally appropriate; recent in-service experience indicates that consideration should be given to the implications of larger cabin fires than are currently experienced in training.

The current training practices and standards will be reviewed. The CAA will also work with the FAA Technical Center and will continue to ensure that training standards and equipment take account of the FAA fire research programme. Additionally, the CAA plans to develop new video training material for cabin crew and flight crew in conjunction with the FAA and TCCA.

With around several thousand aircraft crew undergoing fire training in the UK each year, there might be cost impliations that will need to be considered and be balanced against the potential benefits.

The CAA will carry out a Training Needs Analysis for cabin crew fire training and standards will be reviewed if necessary

The CAA will develop training material in conjunction with FAA and TCCA

3. Operational Implications of Integrated Fire Suppression Systems

The development of an Integrated Fire Suppression System concept is being co-ordinated by the Systems Fire Protection Working Group run by the FAA. It is envisaged that an Integrated Fire Suppression System would combine different approaches such as fuel tank inerting, and use of water/nitrogen inerting for fire suppression. Introduction of such systems could significantly increase survivability for in-flight and post-crash fires. In particular, the use of water mist/nitrogen inerting for fire suppression as an alternative to Halon for the cargo area may significantly affect the cost-benefit situation for cabin water mist.

Through extensive CAA research in the early 90s, cabin water mist systems are known to be very effective at increasing post-crash fire survivability and may have in-flight benefits, however regulatory action was not taken at that time due to unfavourable cost-benefit analysis. Internationally, all other regulatory authorities took the same decision. However, if the carriage of water for cargo fire suppression were mandated, (and the weight of water is a major factor in the in-service cost) it would be possible to use the same water for the cabin.

A further factor in the Integrated Fire Suppression System is the opportunity for nitrogen produced for fuel tank inerting to be used in other areas of the aircraft for fire suppression.

Whilst responsibility for certification matters now rests with EASA, potential operational cabin aspects are of interest to the CAA. Additionally work to date within the International Fire Test Materials Group indicates potential concerns regarding increased flammability of materials in the hidden areas of the cabin, such as behind the cabin panels, due to longer term environmental contamination from cleaning material vapour residues, disinfection etc plus the accumulation of flammable material such as dust and lint.

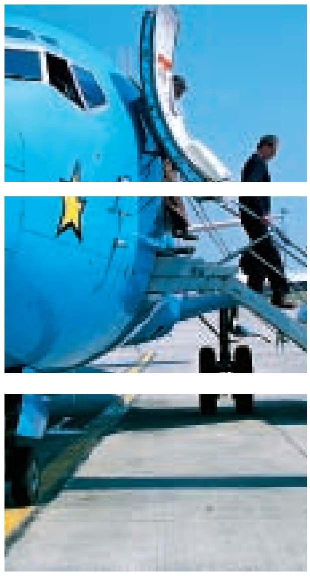
The CAA will work with the International Fire Test Materials Group to establish operational policies to reduce flammability risks.

The CAA will manage internationally funded research studies to develop the Integrated Fire Suppression System concepts, in particular operational aspects. Co-ordination through the Systems Fire Protection Working Group and the Cabin Safety Research Technical Group will result in research reports and concepts to reduce flammability risks.

The CAA will continue to support the relevant international working groups, to ensure that appropriate risk and operational considerations are included in international studies to the benefit of UK safety.

4. Enhanced Ground Fire Fighting

The Critical Area concept for post crash fire



fighting is well established internationally and defines the amount of fire fighting media to be held at aerodromes. The Critical Area is calculated taking into account the length and width of the fuselage with an allowance for wind conditions. However, the Critical Area concept deals exclusively with external fire fighting and does not define requirements for post-crash cabin fire fighting.

Ground fire fighting assumes clear access to the accident site, and it is essential that evacuated passengers do not hinder the rescue and fire-fighting crews. With the introduction of new generation large transport aircraft, the management of evacuated passengers is a potential area of concern since substantial numbers of passengers in the vicinity of the crash site may hinder rescue of the remaining passengers. A potential reduction of this risk could be the deployment of readily identifiable passenger muster areas, the form and operation of which would need detailed consideration.

The CAA will conduct a review of ground cabin fire fighting and passenger management to identify potential safety benefits. This work will be co-ordinated with appropriate international bodies to ensure that any identified benefits may be developed for incorporation within the appropriate ICAO standards.

In the UK, CAP 168 defines complementary media that may be used for post-crash cabin fire-fighting but only limited consideration is given to cabin dimensions. The subject of post-crash cabin fire fighting for rescue needs to be reassessed, particularly in the light of modern cabin configurations and new generation large aircraft. The CAA will explore new technology/media in conjunction with other national aviation authorities and contribute to the development of a new ICAO standard. Advanced fire fighting media will enhance extinguishing capability and provide environmental benefits.

The CAA will work with other National Aviation Authorities to develop a new ICAO specification for advanced extinguishing agents.

Summary of Actions

Issue	Actions	Dates
Cabin Crew Fire Training	Carry out Training Needs Analysis	September 07
	FAA/CAA/TCCA requirement to produce updated training material reflecting latest research into in-flight fire fighting. Video/DVD/Web. Filming funded by FAA with UK script development.	December 07
Operational Implications of Integrated Fire Suppression Systems	Work with the International Fire Test materials Group to establish operational policies to reduce flammability risks.	December 08
	Manage internationally funded research studies to develop the Integrated Fire Suppression System concepts, in particular operational aspects. Co-ordination through the Systems Fire Protection Working Group and the Cabin Safety research Technical Group will result in research reports and concepts to reduce flammability risks.	December 08
Enhanced Ground Fire Fighting	Conduct studies of cabin fire fighting and post evacuation passenger management.	October 07
Enhanced Ground Fire Fighting	The CAA will work with other National Aviation Authorities in the development a new ICAO specification for advanced extinguishing agents.	April 08

Airspace

UK Airspace is some of the busiest in the world, accommodating commercial air transport, general aviation and military traffic.

This chapter covers work on:

- Mid air collision
- Operational Policy and Procedures for UAVs

Mid-Air Collision

Mid-air collisions are statistically rare but the result is usually catastrophic. UK airspace is relatively crowded with a wider mixture of traffic than many other parts of the world. CAA action areas will include:

- **Public transport operations**
- **Use of airborne collision avoidance systems**
- **Airspace infringements**
- **Communication difficulties**
- **Level busts**

1. Introduction

In the last 10 years (1995-2004) there have been 7 fatal mid-air collision accidents worldwide involving large fixed-wing turbine-powered aeroplanes, resulting in 451 fatalities. Although there has not been such an accident in UK airspace since 1949, there have been several high profile 'near-misses'. The UK Airprox Board (UKAB) judged that there was an actual risk of collision in eight Airprox involving a passenger or cargo operated aeroplane in UK airspace in the last five years.

Public transport flights take place both in controlled and uncontrolled airspace, and neither is immune from risk.

2. Public Transport Operations Outside Controlled Airspace

The number of air transport movements at UK airports outside controlled airspace increased by nearly 13% in 2004. In addition, a move away from 'hub and spoke' operations to 'point to point' services is prompting more operators (and their smaller franchise partners) to increasingly seek more direct routing. This results in increasing numbers of public transport flights being flown either partly or wholly outside controlled airspace. Although public transport flights in uncontrolled airspace are not a new phenomenon, the probability of such flights experiencing a mid-air collision will rise as the number of operations outside controlled airspace increases, unless further measures are taken to mitigate the risk. In the five years since the formation of the UK Airprox Board in 1999 (2000-04) there have been 21 risk-bearing Airprox (including 4 category A - actual risk of collision) involving passenger or cargo aeroplanes outside controlled airspace.

Issues that contribute to the risk of collision include:

- The lack of a known traffic environment that can lead to confliction with traffic whose intentions may not be known and indeed may not be displayed on primary or secondary radar systems

- A reduction in the level of air traffic service provided (e.g. from Radar Advisory Service (RAS) to Radar Information Service (RIS) can potentially lead to an increased risk of loss of separation, an increased risk of failure to detect the loss of separation and an increased risk of failure to alert the flight crew

- Inadequate co-ordination procedures between different control units sharing air traffic service provision responsibilities within a particular airspace may impact upon a controller's ability to offer the safest possible service. This situation may be exacerbated, once a potential conflict has developed, by the length of time that may be taken for one unit to contact another in order to resolve it

The principal means of avoiding collisions in uncontrolled airspace is “see and avoid”. Available evidence suggests that the effectiveness of “see and avoid” is questionable when used in isolation (i.e. not in conjunction with a radar service), implying an increased risk of failure to detect a loss of separation. UKAB cited late or non-sighting by one or both aircraft involved in 15 of the 21 risk-bearing Airprox involving public transport aeroplanes outside of controlled airspace in the last five years. Of these 15, only five aircraft were in receipt of a RAS and only three were equipped with an operational ACAS that gave a Resolution Advisory (RA) warning.

“See and avoid” is significantly less effective against high-speed traffic, in conditions of poor visibility and/or at night. This is further complicated by the fact that military aircraft may operate at speeds above those limitations applicable to civil aircraft. Of the 21 risk-bearing Airprox outside of controlled airspace in the last five years, 13 involved conflictions with high-speed military traffic and nine of these were caused by late or non-sighting.

The CAA will publish guidance appropriate for General Aviation resulting from the

Conspicuity Working Group and Regulatory Impact Assessment on hte carriage of transponders.

Many of the issues involving public transport operations outside of controlled airspace, identified by the top-down analysis process, were also raised by the North East Airspace Team (NEAT). NEAT was jointly sponsored by CAA and MOD to review the risk of collision in Class F and G airspace, between military fast jets and public transport aircraft, in the North East of the United Kingdom. The NEAT recommendations are currently being reviewed and implemented under the auspices of the CAA Outside Controlled Airspace Steering Group (COCASG).

The CAA will continue implementation of the NEAT recommendations.

3. Use of Airborne Collision Avoidance Systems

Despite the recently expanded mandate for the installation and use of ACAS[1], it is not without its limitations. Evidence suggests that ACAS is increasingly and, sometimes inappropriately, being used to routinely monitor separation rather than solely as an anti-collision safety net as was originally intended. Examples from recent Eurocontrol information include: pilots making inappropriate turns following misinterpretation of traffic shown on their ACAS display (resulting in loss of separation): pilots questioning an ATC instruction based on their interpretation of the display (resulting in an ACAS advisory warning during the ensuing discussion) and pilots reducing speed too early in order to increase separation with the preceding aircraft (resulting in disruption to sequencing of aircraft behind). Although clearly providing an overall safety benefit, the limitations and use of ACAS need to be clearly defined to avoid over-dependency by flight crews and to identify opportunities for improved effectiveness.

The CAA has mandated the carriage and operation of at least Mode S Elementary Surveillance airborne equipment for most aircraft by March 2008. ACAS will become more effective with increased use of transponders.

The JAA Operational Procedures Steering Group (OPSG) is presently reviewing the instructions given to pilots in respect of how to respond in the event of conflicting ATC instructions and ACAS RAs. NPA-OPS 39 has been issued for comment.

Aircraft are permitted, in accordance with internationally agreed requirements, to operate with their ACAS equipment unserviceable for up to 10 days, irrespective of the airspace in which they fly. This increases the risk of failing to detect any loss of separation. ACAS unserviceability may become a more significant factor, as its effectiveness increases through greater use of altitude reporting transponders (particularly following the implementation of the Mode S mandate). In the last five years there have been at least 36 reports of suspected ACAS malfunction, unserviceability and/or unavailability (due to failure of other systems) involving UK registered public transport aeroplanes. An AAIB serious incident (and foreign Airprox) near Frankfurt in 2005 involved a foreign operated B737 climbing into conflict with a UK operated A320 (as a result of an ACAS TA). The A320 pilots were unaware of the situation because their ACAS equipment was unserviceable.

ACAS is ineffective when the conflicting traffic is not transponding , and only partially effective against aircraft with non-altitude reporting transponders and/or high performance aircraft such as military fast jets undertaking high-energy manoeuvres. This increases the risk of a mid-air collision where the primary means of separation assurance is unavailable, unused or ineffective, e.g. when “see and avoid” is not properly undertaken due to over-reliance on ACAS, or is rendered less effective in poor visibility and/or at night.

ICAO Annex 6 was amended in 2006 to include standards requiring all pilots of aeroplanes equipped with ACAS II to be appropriately trained to competency in the

[1] From 1 January 2005, civil turbine jet or turboprop aeroplane having a maximum take-off mass exceeding 5,700kg, or which may carry more than 19 passengers, will be required to be fitted with and operate, ICAO SARPs compliant ACAS II equipment within UK airspace.

use of that equipment and the avoidance of collisions. In order that UK implementation encompasses General Aviation operations, including some smaller aircraft where voluntary fitment has taken place, regulatory provisions related to the use of ACAS will require amendment.

The CAA will review the requirements for General Aviation flight crew training in the use of ACAS in line with the guidance provided in JAA Ops Division Safety Communication No3 and recent ICAO Annex 6 amendments and publish a Letter of Intent to amend the Air Navigation Order accordingly.

4. Airspace Infringements

Unauthorised penetration of controlled airspace, without detection, poses a significant risk of mid-air collision to public transport aircraft operating in such airspace. Nine of the 30 risk-bearing Airprox involving public transport aeroplanes within controlled airspace in the last five years were caused by unauthorised infringements by light aviation or military aircraft. Nearly 12% of the 1,348 reported controlled airspace infringements over the same period resulted in a loss of minimum ATC separation.

Pilots being lost or unaware of their actual location is a principal causal factor in airspace infringements, which leads in turn to a potentially increased risk of loss of separation. Efforts to resolve either situation places an additional distraction upon pilots, thus potentially reducing the effectiveness of "see and avoid".

Many light aircraft are either not fitted with a transponder or are equipped but pilots elect not to switch them on. This reduces the chances of infringements being detected either by controllers or, in cases of reduced separation, by ACAS. Even where transponders are available and used, they may not be altitude reporting, which impairs conflict resolution. In addition, such aircraft may not be displayed on a controller's screen, e.g. where conspicuity codes are suppressed in order to reduce radar display clutter.

There have been a number of high-risk Airprox involving infringements of controlled airspace by gliders. Although the number of infringements involving gliders is low, the consequences may be greater due to their streamlined shape, small size, and normally all white colour schemes. Four risk-bearing Airprox (including two category A Airprox) were caused by unauthorised penetration of controlled airspace by gliders over the past five years.

There is also the issue of public transport aircraft infringing notified airspace structures (e.g. danger areas) and coming into conflict with other segregated activities such as high-energy manoeuvring military aircraft or live firing of munitions. Infringements of airspace structures outside controlled airspace by public transport aircraft can arise through lack of crew awareness and/or inadequate or incomplete availability of safety information. In the last five years there have been 11 infringements of active danger areas by such aircraft. There is also the possibility of aircraft systems on modern Flight Management System (FMS) equipped aircraft treating a waypoint close to a danger area boundary as "fly-by" such that the aircraft's turn radius onto the next track infringes the danger area.

The issues involving airspace infringements are being addressed through the CAA Airspace Infringement Working Group (AIWG), a follow-up of the 'On Track' project. AIWG seeks to improve pilot awareness of the problems associated with infringements through various initiatives. Not least among these is the development of appropriate guidance and publicity material, identifying the scope for improvements in pilot training, airmanship, charts, and enhanced liaison between pilots and ATC. Although the thrust of the On Track report was aimed at general aviation pilots, many of the lessons learnt can be translated across to all aviation sectors. AIWG's remit is to consider the causes and prevention of infringements by all airspace user groups, which is reflected in the broad membership of the Group. The effectiveness of its work is monitored by the Directorate of Airspace Policy and SRG's Flight Operations Department.

In conjunction with NATS, the CAA will investigate, propose and co-ordinate an education programme for NOTAM users, primarily focused on the GA community. In addition, the CAA will investigate with NATS improved methods of linking NOTAMS associated with the same event.

5. Communication Difficulties

Communication difficulties arising from misunderstood ATC instructions and/or poor radio telephony (RTF) discipline can have an adverse effect on safety, for example by contributing to level busts. The worst mid-air collision in history (a Boeing 747 and a IL-76 near Delhi in 1996 resulting in 349 fatalities) was caused by a level bust. Frequency congestion is a problem in its own right in busy airspace. This is a significant impediment to effective communication and is likely to become more critical as traffic levels continue to increase.

Issues that contribute to communication difficulties are as follows:

- Poor message content, due to incorrect RTF phraseology and/or inadequate read-back, contributes to communication difficulties and generates additional RTF traffic which could, for example lead to a loss of separation arising from a failure to communicate the correct avoiding action. Some 15% of the 1,853 reported level busts in UK airspace over the past five years involved some form of communication difficulty (e.g. incorrect read-back not detected by the controller, taking a clearance meant for another aircraft or simultaneous transmissions). Whilst controllers have to satisfy an annual requirement that their RTF standard reaches an acceptable level, no parallel arrangement is in place for pilots. This situation is exacerbated by a lack of realistic simulation of ATC in aircraft flight simulators.

- Poor message quality due to poor standards of, or heavily accented, English, and/or poor radio reception also contribute to communication difficulties which could lead to loss of separation and/or failure to communicate the correct avoiding action. In UK airspace, linguistic problems are usually attributed to foreign pilots. In some foreign airspace, controllers may use their native language when speaking to national operators, leading to erosion of situational awareness for non-national flight crews.

- The ability of controllers to issue instructions and of pilots to acknowledge them can be hindered by frequency congestion, which can in turn lead to loss of separation arising from a failure to communicate the correct avoiding action. This can be due to the high number of aircraft on frequency but is often exacerbated by communication difficulties, which generate additional RTF traffic due to the need for clarification. In some instances controllers may, for a variety of reasons, be reluctant, slow or unable to split sectors or frequencies even when traffic and RTF levels requires it.

The issues involving communication difficulties are being addressed through two existing CAA safety actions: on level busts under the auspices of the Level Bust Working Group (see section 6 below) and on radio telephone discipline (see 'Supporting Pilot Performance' earlier in this document).

6. Level busts

Figure 10 shows the trend in level busts since the 12 months ending June 2001. The CAA's work on level busts has the objective

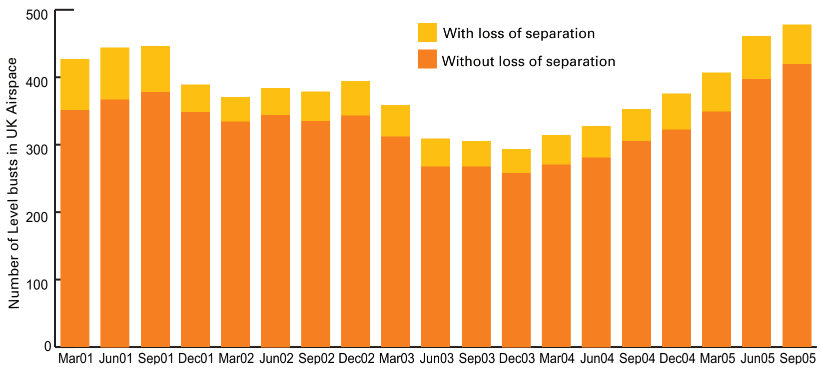


Figure 10. Number of Level Busts

of reducing the number of level busts made by UK Public Transport and corporate operators. As a result of previous initiatives, the number of level busts in UK airspace had decreased in the period to

2003; thereafter the trend shows an increase.

In response, the CAA constituted a working group, with industry, to determine 'best practice' in the prevention of Level Busts through improved operating procedures and more comprehensive training guidance. The results of this work was published in June 2005 as FODCOM 13/2005, 'Level Bust Prevention - Best Practice'.

The Working Group has since completed a review of existing documentation relating to Level Bust prevention and is updating the following material:

- CAP 413 Radiotelephony Manual
- AIC Pink 94/2000 Level Busts

The CAA will analyse level bust incident data for the periods Feb-Jul 2005 and Oct 2005-Mar 2006 and ascertain whether a 5% improvement in the yearly moving average number (or rate) has been achieved. The Working Group will continue to address the issue of level busts with the objective of further reductions.

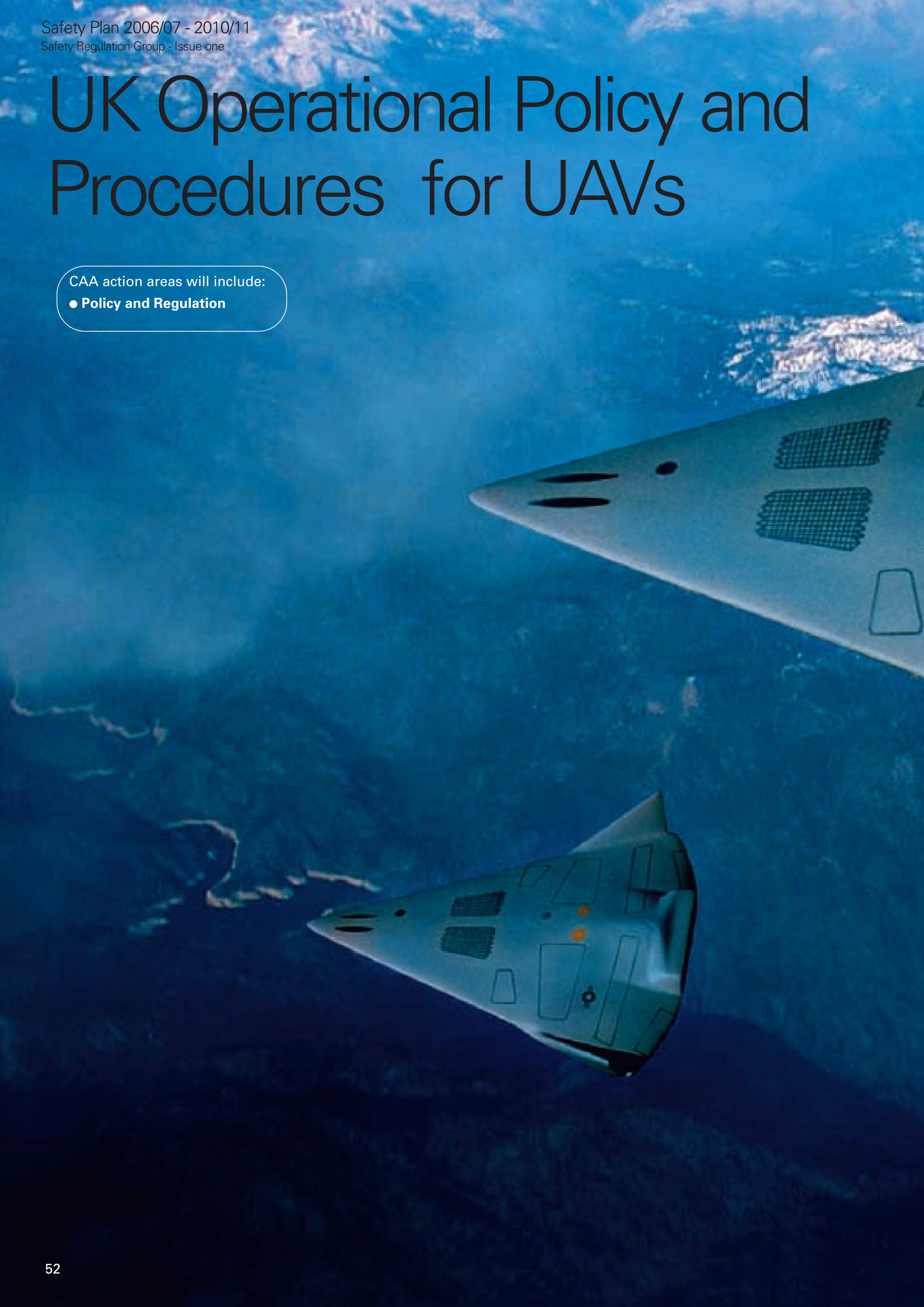
Summary of Actions

Issue	Actions	Dates
Public Transport Operations Outside Controlled Airspace	Publish guidance appropriate for general aviation resulting from the Conspicuity Working Group and the Regulatory Impact Assessment on the wider carriage of transponders.	July 07
	Continue implementation of the NEAT recommendations.	December 06
Use of Airborne Collision Avoidance Systems	Review the requirements for general aviation flight crew training in the use of ACAS	April 07
Airspace Infringements	In conjunction with NATS, investigate, propose and co-ordinate an education programme for NOTAM users, primarily focused on the GA community. In addition, investigate with NATS improved methods of linking NOTAMS associated with the same event.	January 07
Level Busts	Analyse level bust incident data for the periods Feb-Jul 2005 and Oct 2005-Mar 2006 and ascertain whether a 5% improvement in the yearly moving average number (or rate) has been achieved.	March 06

UK Operational Policy and Procedures for UAVs

CAA action areas will include:

- **Policy and Regulation**



1. Introduction and background

A significant increase in both civil and military UAV flying is anticipated, much of which will require routine access to all classes of airspace if it is to be commercially viable and/or operationally effective.

2. Policy and Regulation

Whilst the majority of UAVs in the UK are operated by the military, it is anticipated that civil applications will be developed in the near future, and a significant increase in both military and civil UAV flying can be expected. It is considered that UAVs operated in the UK must meet at least equivalent safety and operational standards as manned aircraft.

The key areas of operational concern are: segregated airspace; operator qualifications; command and control frequencies (spectrum); the development of sense and avoid capability; and third party interests, including risks to the public.

A revised edition of CAP 722 UAV Operations in UK Airspace - Guidance was published in November 2004 and the CAA is working with industry to develop policy and procedures for UAV operations in UK airspace. CAA is also examining Eurocontrol specifications for the use of military UAVs as operational air traffic outside segregated airspace.

A final report from the JAA / Eurocontrol Task Force, addressing the development of a concept for European regulations for civil UAVs was published on the JAA website in 2004 and has been submitted to EASA. EASA is now developing policy for the certification of UAVs above 150kg.

The CAA will continue to work with other Government agencies in developing and establishing UAV policy and regulation. Specific actions will be published in future editions of this plan.

Airports

143 aerodromes in the UK hold a permanent aerodrome licence. In addition, through the course of a year, the CAA expects to issue in the region of 12 seasonal or temporary aerodrome licences to cover short-term aviation activities, such as special events, corporate days etc., where the organisers need or wish to have an aerodrome licence.

This chapter covers work in the following areas:

- Runway Incursions
- Apron Safety
- Birdstrike Reporting

Airports

Aerodrome safety is as critical to the overall safe operation of aircraft as any other sector. CAA action areas will include:

- **Runway Incursions**
- **Apron Safety**
- **Improved Birdstrike Reporting**

1. Introduction

This section looks at airport related safety in three main areas: Runway Incursions, Apron Safety and Bird Strikes.

A Runway Incursion is defined as any occurrence at an airport involving the unauthorised or unplanned presence of an aircraft, vehicle or person on the protected area of a surface designated for aircraft landings and departures. In the last ten years (1996-2005) there have been over 600 Runway Incursions at UK licensed airports. Since 2002 a risk category, based on the FAA Severity Matrix, has been allocated to these incidents. Considering the Runway Incursions analysed since 2002, 69% have been categorised as having the lowest risk category, i.e. little or no chance of collision.

Apron Safety is of concern to the CAA because there are an increasing number of incidents occurring on aprons at airports, some of which have merited AAIB involvement.

Bird Strike reporting was not mandatory until fairly recently. Even so, since 2000 there have been approximately 500 birdstrike incidents reported to CAA through the MOR system.

2. Runway Incursions

There exists a risk to the safety of aircraft from an increasing number of runway incursion incidents both in the UK and on a global basis. The CAA Runway Incursions Steering Group (RISG), which includes representation from the Airport Operators Association (AOA), BAA, and National Air Traffic Services (NATS) believes that the highest probability of an aircraft/aircraft or aircraft/vehicle collision in the UK stems from this risk.

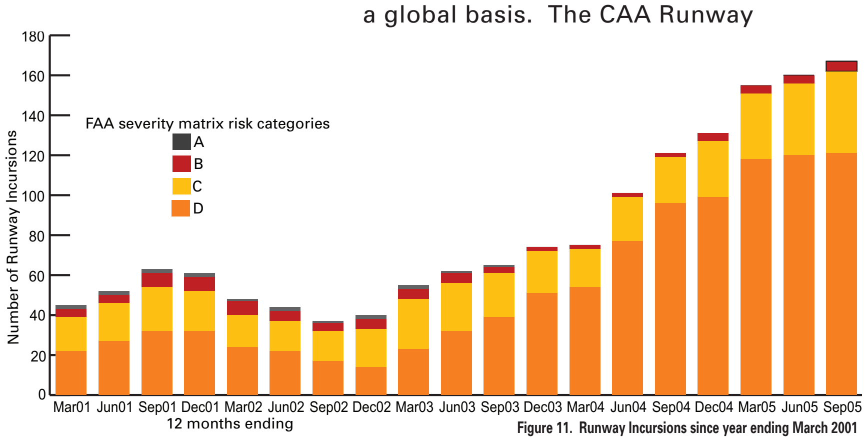


Figure 11. Runway Incursions since year ending March 2001

A review of driver education and airfield signage was completed and presented to the RISG. Recommendations were made that drivers operating in the manoeuvring area should undertake standardised training as is required for airport drivers operating on the apron area. Industry considered that this recommendation would be difficult to implement due to the differences in manoeuvring areas between airports. However it was agreed that some aspects of driver training, such as radio usage, could be improved. The review of airfield signage identified five airports where the designations and signage of the taxiway system could be enhanced. These airports were required to provide an improvement plan and an agreed date by which the plan would be implemented and all have now implemented their plans.

An industry awareness campaign was initiated in March 2003. Posters were sent to various industry groups including pilots and drivers. In addition, an Air Traffic Services Information Notice (ATSIN) was published in May 2003, and a second ATSIN and a Notice to Aerodrome Licence Holders (NOTAL) were published in October 2003. These included best practice guidance for Air Traffic Controllers and flight crews, with wider dissemination via Aeronautical Information Circular. The campaign was originally due to have been completed in April 2004, but due to the very positive feedback from industry, the campaign continued throughout 2005. As a combination of these actions a Runway Incursion Prevention Programme has been introduced at all UK airports. A monitoring function is still ongoing with the possibility of further action if required.

The RISG has also maintained contact with the Eurocontrol Working Group on Runway Incursions, to assist in maintaining a unified approach to the output of incursion prevention material.

In addition to the education, awareness and procedures initiatives, the Runway Incursions Technical Sub Group (RITSG) reviewed potential technological solutions aimed at preventing or reducing incursions.

One of the key developments has been the installation of "Runway Ahead" markings at Manchester International Airport. A paper has been submitted to the ICAO Aerodromes Panel for consideration of this priority incursion prevention measure. If successful, global adoption of effective taxiway markings could result.

No single technological solution has been found to offer the complete solution to the problem of Runway Incursions, so the RITSG will continue to monitor new proposals and innovations under development.

Using the actions outlined above, the CAA will target a reduction of 5% in runway incursions per movement, for the period April 2005 to March 2006, based on the established rate per movement for the period April 2004 to March 2005.

2. Apron Safety

The increasing number of incidents occurring on aprons is a cause for concern. Whilst the majority of incidents that occur on aprons relate to the health and safety of operational staff and therefore fall within the remit of the Health and Safety Executive (HSE), there is an area of joint HSE and CAA interest where there is an effect on aircraft or airport operations. The HSE's focus is the safety of persons, in this case the operating staff involved, whereas CAA's focus is on the aircraft, infrastructure standards and passenger safety. The conditions of an airport licence encompass the competency of employees working on aprons and the implementation of adequate apron working and safety procedures.

Although the number of fatal accidents is fortunately low, the financial impact and disruption to operations from apron incidents are considerable. Furthermore, as the number of incidents increases the potential for more fatal incidents becomes greater. In a worst-case scenario, an apron incident could be a causal factor in a catastrophic accident in flight, following undetected damage to aircraft in a ramp incident.

Since November 2003, following AAIB recommendations for improved safety oversight, the CAA has carried out a series of joint apron audits with the HSE. The joint audits identified a number of issues that merited action. As a result of the experience gained during these joint audits it was agreed there was scope for more structured and timely audits, with a clear focus on re-enforcement and re-education of the published guidelines and procedures.

To achieve this, a series of further, structured, joint audits were planned for completion by December of 2005. Further work may be identified as a result of any findings arising from these additional joint audit activities.

The CAA will complete follow up actions from completed HSE/CAA audits, and will consult with industry as necessary.

3. Improved Bird Strike Reporting

Bird strikes continue to cause a potential hazard to aircraft. A recent change to UK legislation has resulted in the mandatory reporting of birdstrikes and the CAA has determined that it is appropriate at this point to assess the level of birdstrike reporting.

The CAA will publish a report considering the completeness and accuracy of bird strike reporting in the UK.

In addition, the CAA has drafted an update to CAP 680, Aerodrome Bird Control.

The CAA will publish a revised CAP 680, Aerodrome Bird Control.

Summary of Actions

Issue	Actions	Dates
Runway Incursions	Monitor ongoing actions and analyse the resultant change in runway incursion rates per movement for the period Apr 2005 to Mar 2006, based on the established rate per movement in Apr 2004 to Mar 2005, with a target reduction of 5%.	April 06
Apron Safety	Follow-up actions from joint CAA/HSE audits completed, timescales subject to Industry consultation.	December 06
Bird Strike Reporting	Publish a report considering the completeness and accuracy of bird strike reporting in the UK.	September 06
	Publish a revised CAP 680, Aerodrome Bird Control.	December 06

Large Public Transport Helicopters

Large public transport helicopters are crucial in supporting the substantial UK oil and gas industry offshore. A relatively small part of UK public transport, these operations represent a statistically higher safety risk because of their challenging nature and often hostile environment.

This chapter covers work in the following areas:

- Helicopter airworthiness
- Operational improvements
- Helideck safety

Large Public Transport Helicopters

Significantly funded by industry and other external contributions, CAA action areas will include:

- **Helicopter Airworthiness:**
- **Operational Safety:**
- **Helideck Safety:**

1. Introduction and Background

Achieving and maintaining a satisfactory level of safety is fundamentally more challenging for helicopters than for fixed wing aircraft. They are mechanically more complex and there are fewer opportunities for designing in redundancy. This results in helicopters having a significantly larger proportion of components which if they failed in flight, would have a catastrophic outcome.

An additional challenge to helicopter safety is the nature of the operations in which they are typically engaged. The majority of public transport helicopter operations in the UK are those conducted in support of the offshore oil and gas industry. In this application helicopters are typically flown long distances over hostile waters in bad weather with relatively little in the way of navigation aids, mostly in uncontrolled airspace, to offshore installations which, themselves, can present risks to aircraft in terms of turbulence, wind shear, hot turbine exhaust gas plumes, flammable gas releases, obstacles and, for floating installations, movement of the landing pad.

During the period 1976 to 2002, offshore helicopter operations accounted for a total of 2,716,899 hours. Over this period there were 11 fatal accidents resulting in 98 fatalities, giving a fatal accident rate of 4.1 per million flight hours. Since the beginning of 1992 there have been 2 fatal accidents, one in March 1992 (a CFIT accident) and one in July 2002 due to the in-flight failure of a main rotor blade.

The current programme of helicopter safety research is funded and monitored by the CAA-run Helicopter Safety Research Management Committee (HSRMC), which consists of representatives from industry, UK Government, EASA, the Norwegian CAA and the oil industry. The funding provided by the organisations represented is supplemented by European research funding.

To date, a total of over 20 projects have been undertaken covering helicopter airworthiness, operational issues, and helidecks. Largely due to the high voluntary take-up of the results of the research by the customers of the helicopter operators, significant progress has already been made in addressing a number of key safety issues. These include; with regard to airworthiness, all UK North Sea offshore helicopters are fitted with Health and Usage Monitoring Systems (HUMS); concerning operational matters, helicopter flight operations monitoring either has been or is being implemented by two of the three UK offshore helicopter operators; on offshore helidecks, revised lighting systems are being installed on a growing number of oil and gas platforms.

2. Helicopter Airworthiness

2.1 Helicopter Health & Usage Monitoring Systems (HUMS)

Although HUMS is already providing worthwhile safety benefits, in-service experience and the results of the two HSRMC funded helicopter main rotor gearbox seeded defect test programmes have indicated that there is significant scope for improving the effectiveness of HUMS data analysis.

Human operators alone cannot effectively examine the large quantities of data generated by HUMS systems in a timely manner. Earlier research work demonstrated that advanced data analysis techniques could provide a more precise and simple indication of the health of the helicopter being monitored.

Following on from this work, the CAA has commissioned an in-service demonstration of an Artificial Intelligence based anomaly detection and diagnostic system. The system will comprise a development of a state-of-the-art data mining tool that is currently being applied to fixed wing aircraft engine data. A demonstration system will be trialled in 2006, and evaluated alongside conventional vibration health monitoring (VHM) analysis techniques using vibration data downloaded from a North Sea AS332L Super Puma helicopter fleet during normal operations.

The CAA will publish the final report on the development and demonstration of enhanced HUMS VHM data analysis.

It is generally acknowledged that rotor system failures account for a similar number of fatal helicopter accidents as transmission failures. Although HUMS systems for engines and transmissions have been in service for around 15 years, little or no progress has been made with their application to rotors. One reason for this was the mistaken belief that rotor track and balance (RTB) systems address the majority of rotor system potentially catastrophic failures. However, in-service experience has indicated that, far from helping to detect these failures, RTB adjustments can actually mask them.

In an attempt to redress the balance, a number of small studies on health monitoring for rotor systems were commissioned during the period 1990 - 1991. The results were never published and no significant development is known to have taken place since the completion of this work. However, a fatal accident near the Leman field in the southern North Sea in 2002 has served to refocus attention on this area.

In order to ensure that any further actions are based on the latest information, a literature review will be conducted of all relevant work (including the unpublished work above) in order to form a consolidated view of the current status of the application of VHM techniques to the detection of rotor system failures. Depending upon the outcome of this review, further work aimed at developing and demonstrating enhancements to existing HUMS will be considered.

The CAA will commission, through the HSRMC, a review of the current status of the application of HUMS techniques to detect of rotor system faults, and publish the final study report.

2.2 Helicopter Emergency Flotation.

Research into the improvement of helicopter ditching stability and the crashworthiness of helicopter emergency flotation systems has indicated the potentially significant safety benefits that could accrue from locating additional flotation devices high on the fuselage in the vicinity of the main rotor gearbox and engines.

In the event of a capsize post ditching or water impact, the side floating system prevents total inversion of the helicopter thus retaining an airspace within the cabin, reducing the time pressure to escape. The system also ensures that some of the doors and windows forming the escape routes remain above the water level, therefore facilitating egress. The extra flotation units required for this scheme also serve to significantly improve the crashworthiness of helicopter emergency flotation system by increasing the flotation unit redundancy.

Responsibility for design requirements has now passed to EASA. The significant research work completed to date in this area by the CAA has been collated into a summary document and published on the CAA website, such that it may be taken up by any interested party and progressed.

The CAA will collate all available information on helicopter emergency flotation systems, in particular the side floating scheme, and forward this information to EASA.

3. Helicopter Operational Safety

3.1 Helicopter Flight Operations Monitoring

An aspect of operational monitoring unique to helicopters is the need for a measure of low airspeed in order to fully monitor the operation of the aircraft during the more demanding flight phases of take-off and landing. The pitot-static systems with which helicopters are equipped become increasingly inaccurate with reducing airspeed, primarily due to the influence of the main rotor wake, and effectively cease to function below a threshold airspeed of 20 to 50 knots (depending on helicopter type), and in sideways or rearwards flight.

Alternative mechanical sensors and

algorithmic solutions have been investigated, but they suffer from a number of disadvantages that make them inappropriate for a flight data monitoring programme.

A potential non-mechanical approach to synthesising low airspeed, utilising only existing flight data parameters, is to employ an Artificial Neural Network (ANN). Earlier work has demonstrated the potential of ANNs to predict low airspeed (and direction). An accuracy level of ±4 knots (95%) was obtained when the technique was applied to Lynx and EH101 flight data that had been collected during low speed handling and performance trials.

Work on developing an ANN based measure of helicopter low airspeed for use with helicopter flight operations monitoring programmes started in 2000. The first phase of this work entailed the use of an existing data set to train an ANN. The accuracy achieved was inadequate, however. A second phase has therefore been added to the programme to conduct a flight trials programme to generate a more accurate training data set, repeat the Phase 1 exercise, and produce a module for incorporation into helicopter FDM ground stations. All preparation work for the trials has been completed and the conduct of the trials presently awaits a suitable weather window.

The CAA will publish the final report on the development of an artificial neural network based measure of helicopter low airspeed to extend helicopter operations monitoring to the low speed envelope.

3.2. Use of GPS for Offshore Helicopter Operations

A need exists for an accurate and reliable instrument approach aid for conducting low visibility (<5km) operations to offshore platforms. Currently, the only equipment available is the aircraft's weather radar, which is neither designed nor certificated for the task. A series of trials activities and follow-on data analysis has demonstrated that Differential GPS (DGPS) could fulfil this need.

A three-phase safety assessment of the use of GPS for helicopter operations in the North Sea is being conducted. The first phase, covering the use of GPS for en-route navigation, has been completed. The second phase, addressing the use of existing North Sea helicopter GPS equipment to enhance the existing weather radar approaches, is essentially complete. Use of GPS in this phase is limited by equipment capability/design to displaying the range and bearing to the destination for cross-checking the weather radar display, i.e. using GPS as a pseudo VOR/DME located on the platform.

The third phase will commence with a safety assessment of existing weather radar approaches to identify the weaknesses that a full GPS approach will need to address. A system and procedure will then be jointly formulated by UK and Norway and subjected to a safety assessment.

In addition to the hazard analysis, the European Union 6th Framework GIANT project includes optional work on the North Sea helicopter application of GPS. The option presently comprises a data collection and analysis exercise to establish suitability of the European Geostationary Navigation Overlay System (EGNOS) to provide the wide area differential corrections that are expected to be required, and simulator trials for pilot evaluation of the approach procedures. This work is very likely to proceed and will be jointly funded by CAA Norway. As part of the GIANT project, this work will benefit from a 50% subsidy from the European Union.

Following successful completion of the current work, full in-service trials of the DGPS based approach guidance system and procedures will be required to validate the system and procedure design prior to implementation. This will involve the development and installation of prototype equipment on a limited number of helicopters for evaluation.

The CAA will publish the final report on the three phase safety assessment of the

use of GPS for helicopter operations in the North Sea.

The CAA will commission, on behalf of HSRMC, the EGNOS data collection and analysis exercise and publish the final study report.

3.3 Mid-Air Collision

Helicopter operations occur mostly in uncontrolled (Class G) airspace under visual flight rules. ATC provides either a Radar Advisory Service (RAS), a modified RAS (MRAS) or a Radar Information Service (RIS) to helicopters operating in surveillance radar coverage (up to about 80 miles from Aberdeen and most of the southern North Sea area). Outside of this, where VHF coverage exists, an Enhanced Flight Information Service (EFIS) is provided, which includes information on known conflicting traffic. As well as the main helicopter traffic, military and other civil aircraft also use the airspace. Special operations, such as trawler monitoring, also take place.

Between 2000 and 2004 there have been 21 Airprox occurrences involving helicopters flying to/from offshore platforms. Of these one third were Cat B (safety not assured) and two thirds Cat C (no risk of collision). Just over half (11) involved military aircraft, three involved other helicopters, three involved fixed wing commercial air transport, three light aircraft and one a model aircraft. Approximately three quarters (16) occurred in Class G airspace, four in Class D and one in Class F. The most significant underlying factors are therefore flight in Class G airspace and military traffic. This is consistent with the fixed-wing passenger operational experience in UK airspace over the same period.

Fixed wing aircraft have demonstrated the significant safety benefits of Aircraft Collision Avoidance Systems (ACAS) in reducing the threat of mid-air collision. However it is not entirely clear whether ACAS can provide the desired level of safety benefit to North Sea helicopter operations. The ability of helicopters to achieve the required climb/descent rate for the vertical avoidance manoeuvres has been questioned, and the effectiveness of the latest standard, ACAS II, against fast moving aircraft may be limited. It is therefore proposed that trials of ACAS II on a North Sea helicopter be carried out to investigate these and any other technical and operational issues unique to helicopters in general and to the North Sea airspace environment in particular.

The CAA will commission, on behalf of HSRMC, operational trials of ACAS II on North Sea helicopters and publish the final trials report.

4. Helideck Safety

4.1 Helideck Environmental Issues

Previous research conducted by the CAA has suggested the need to review the criterion for the vertical component of airflows over helidecks currently published in CAP 437. In addition, experience from wind flow studies of offshore installations indicates that it is seldom possible to fully comply with the criterion, which may be imposing an unnecessary and significant burden on the industry.

Available helicopter flight data monitoring (FDM) records are being analysed to map the values of maximum torque (normalised by aircraft mass) and maximum two-second increase in torque (expressed as % torque margin) as a function of wind speed and direction for each offshore installation. These plots will be related to the topsides layouts of the installations, and to any entries in the Helideck Limitations List (HLL), to attempt to establish the nature and presence of any undesirable wind effects that will not be covered by the introduction of new turbulence criterion.

In the event that the current work indicates the need for a new criterion to replace the vertical wind component criterion, for example by a wind shear criterion, further work will be required to develop and validate the criterion prior to introduction in CAP 437.

The CAA will commission, on behalf of HSRMC, the development and validation of a wind shear criterion for inclusion in CAP 437 and publish the associated study report.

4.2 Operations to Moving Helidecks

Helideck motion limits are presently specified in terms of a maximum pitch, roll and heave amplitude. Whereas these parameters may be appropriate for the landing itself, in-service experience and analysis indicate that they are poor predictors of whether the helicopter will tip or slide once landed on the helideck. Furthermore, the present limits take no account of wind (speed, relative direction and gusting), which can significantly affect on-deck stability.

A programme of research is been carried out to devise and validate a new Motion Severity Index (MSI), based on helideck accelerations, and an associated Wind Severity Index (WSI). Helicopter operating limits in terms of the MSI and WSI are being established in the form of a chart that will be added to the helicopter Operations Manual.

Work on the computer model that will be used to generate individual helicopter operating limits in terms of the MSI and WSI is essentially complete. The accuracy of the model has been established and used to produce initial operating limits for the S-76 and Super Puma. These limits are based on worst case values of the operational parameters and a sensitivity analysis has been conducted to establish which parameters have the greatest influence on the limits.

The initial operating limits are very conservative and, if implemented, would present an unacceptable restriction to operations. A quantitative probabilistic safety assessment will therefore be performed which will take account of the statistical variability of the input parameters and generate limits that relate to the required overall target level of safety.

The CAA will commission, on behalf of HSRMC, a probabilistic safety assessment of operations to moving decks and generate operating limits for the two main helicopter types operating in the North Sea. A limited introduction to service trial of the new scheme, in parallel with the existing limits, will follow the establishment of agreed MSI/WSI-based operating limits.

The CAA will then commission, on behalf of HSRMC, a limited introduction into service trial of the new helicopter moving deck landing criteria.

The CAA will publish the final report on the development and trials of the new helicopter moving deck landing criteria.

4.3. Helideck Lighting

Concern regarding the adequacy of various aspects of the visual cueing environment at offshore helidecks at night has been raised within the Industry. Three main problems exist with current helideck lighting systems:

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

Two dedicated flight trials were performed at an onshore site (Longside Airfield) during 2002. As a result, it is now believed that just one circle of lights around the landing circle is required, and an outline 'H' is sufficient in the absence of a helideck net.

An additional set of onshore trials was completed at Norwich Airport in 2004. These trials established an interim (pending introduction of the aiming circle and 'H' lighting) glare-free floodlighting solution using existing products, examined the detailed characteristics of the aiming circle and 'H' lighting, and evaluated a number of alternative lighting concepts, all both with and without a helideck net fitted. As a result of these trials:-

- guidance material on the interim floodlighting solution (Stage 1) has been produced, issued to the Industry in mid-2004, and incorporated in CAP 437
- a specification for the aiming circle and 'H' lighting (Stage 2) has been produced and used to tender for the development and supply of two prototype systems

The two main versions of the interim floodlighting solution have been installed on the ExxonMobil Gallahad and Lancelot platforms in the southern North Sea for in-service trials during winter 2006/7.

Contracts have been let for the development and supply of two prototype systems. The two prototype systems are to be installed on the BP Miller and ExxonMobil Thames A platforms for in-service trials during winter 2006/7.

The CAA will commission, on behalf of HSRMC, trials of the Stage 1 and Stage 2 helideck lighting systems during winter 2006/7 and publish the results.

4.4 Helideck Friction

The current, long-standing helideck friction criterion in CAP 437 has been challenged by the industry. In addition, CAA research into helicopter operations to moving helidecks has raised questions over the present criterion and the usefulness of a landing net. At the present minimum helideck friction coefficient (μ value) of 0.65, preliminary computer modelling has indicated that the helicopter will always tip before it slides. This may imply that the present criterion could be relaxed and/or that the requirement for a landing net on all moving decks could be relaxed.

Furthermore, a study performed in Holland, by NLR, has raised questions regarding the measurement of helideck friction, in particular the effect of surface temperature, which is not presently considered.

Once it has been fully validated, a computer model will be used to provide definitive values of minimum friction coefficient for offshore helidecks. The effect of helideck temperature, and any other relevant factors, on surface friction readings will also be investigated. The existing CAP 437 helideck friction criterion will then be reviewed in the light of the results of these studies and revised as appropriate.

The CAA will commission, on behalf of HSRMC, a review of existing CAP 437 helideck friction criterion and publish the final report.

Increasing use is being made in the industry of aluminium helidecks and aluminium helideck tiles. Friction surveys of these surfaces conducted using standard measuring equipment produce marginal results that are noticeably directional. The standard equipment was not designed for use with this type of surface, which relies on mechanical 'locking' of the helicopter wheels in holes in the helideck rather than surface friction for resisting sliding. Spot testing devices are also unsuitable as the reading is very dependent on the exact positioning of the tester. There is therefore a need to identify an alternative means of establishing whether the degree of resistance to sliding provided by these surfaces is adequate. A means of establishing the adequacy of the resistance to sliding provided by aluminium helideck surfaces will therefore be devised, and a representative range of example surfaces tested.

The CAA will commission, on behalf of HSRMC, the development of a new criterion for aluminium helidecks, and publish the final report.

Summary of Actions

Issue	Actions	Dates
Helicopter Airworthiness	Publish the final report on the development and demonstration of enhanced HUMS VHM data analysis.	March 07
	Publish a review of the state of the art of the application of HUMS techniques to detect rotor system faults.	December 06
	Present to EASA all available information on helicopter emergency flotation systems, in particular the side floating scheme.	June 06
Operational Safety	Publish the final report on the development of an artificial neural network based measure of helicopter low airspeed to extend helicopter operations monitoring to the low speed envelope.	March 07
	Publish the final report on the three phase safety assessment of the use of GPS for helicopter operations in the North Sea.	December 06
	Publish EGNOS data collection and analysis exercise.	March 07
	Publish final report detailing operational trials of ACAS II on North Sea helicopters.	September 08
Helideck Safety	Publish a report detailing the development and validation of a wind shear criterion for inclusion in CAP 437.	March 07
	Publish the final report on the development and trials of the new helicopter moving deck landing criteria.	December 07
	Publish a report on the Stage 1 Stage 2 helideck lighting systems trials during winter 2006/7.	September 07
	Publish a review of existing CAP 437 helideck friction criterion.	September 07
	Publish a new criterion for aluminium helidecks.	September 07

General Aviation

There are approximately 19,000 GA aircraft on the UK register, flying in excess of 1.2 million hours per year.

This chapter covers work on:

- General aviation aeroplanes
- General aviation helicopters
- Gyroplanes
- Balloons

General Aviation Aeroplanes

CAA action areas will include:

- **Carburettor Icing**
- **Ex-Military Aircraft**
- **Decision Making by GA pilots**
- **Low powered light aviation SSR transponder (LP-LAST)**
- **National private Pilots Licence (NPPL) Medical Standards**
- **Recreational Aviation Activities**

1. Introduction

CAP 667 Review of General Aviation Accidents 1985 - 1994 was published in 1997. In 2003 the CAA considered that a further review of General Aviation (GA) accidents was timely. The General Aviation Safety Review Working Group (GASWRG) composed of CAA, AAIB, and industry representatives was formed to undertake this review. It covered fatal and serious accidents and serious incidents involving aeroplanes with a maximum take off weight of less than 5,700kgs, other than those involved in the carriage of fare paying passengers.

The working group concluded that the same factors continued to cause accidents and incidents as had been identified by earlier reviews, and that 70% of GA fatal and serious accidents and serious incidents could be attributed to the following four common and recurring factors:

- Flight handling skill
- Poor judgement or airmanship
- Lack of training or inexperience
- Omission of action or inappropriate action

Three primary areas for action were identified:

- Regulatory issues which could be addressed within the CAA
- Resource issues which could facilitate technical and material enhancements to the benefit of safety
- Training issues where the effectiveness, completeness and quality of training were in doubt

The working group developed an action plan aimed at these recurring factors. With the exception of reviews of instructor training and pilot training syllabi, which were deferred in order to assess the impact of recent changes in these areas, most of the items on the action plan developed by the group have been completed. Those that are still outstanding are detailed in the sections below.

Some of the initiatives, such as carburettor icing and the work on recreational aviation activities have relevance to more than just GA aeroplanes, but are included here for convenience.

2. Carburettor Icing

Since 1976 Carburettor Icing has been a contributory factor in 14 fatal accidents and in over 250 other occurrences in the UK with numerous AAIB recommendation to SRG. Progress has repeatedly been hampered by the lack of data on where ice forms, how quickly and how much heat is effective in removing it. There has also been some doubt that the level of carburettor heat required by the Airworthiness Requirements (e.g. EASA CS-23) is adequate to mitigate the risk. CAA has conducted research using a specially designed carburettor test rig in conjunction with Loughborough University and an industry partner for systematic data collection.

The CAA will publish a report on carburettor icing, including potential mitigations.

3. Ex-military Aircraft

Accidents involving ex-military aircraft appear to occur at a somewhat higher rate than other GA aircraft. To date, no specific work has been conducted in this area, but the CAA is committed to identifying improving the safety of these often historic aircraft.

The Ex-Military Aircraft Safety Review Working Group (EMSRWG) was established in 2004 as a subgroup of the GASRWG. The EMSRWG reviewed accidents and serious incidents involving ex-military aircraft on the UK Civil Register from 1994 to 2004, and recommended safety interventions for consideration by the GASRWG.

The Group concluded that the majority of accidents and serious incidents could be attributed to four main factors, the first three of which were the same as the main factors previously identified for all GA accidents:

- Poor judgement or airmanship
- Flight handling skills
- Omission of action or inappropriate action
- Engine failure or malfunction

The Group will continue to review ex-military accidents as a long-term subgroup of the GASRWG. It also proposed that a number of existing CAA initiatives relating to training and safety programmes be targeted widely across the ex-military community.

4. Decision Making by GA Pilots

The GASWRG identified 'poor judgement or airmanship' and 'omission of action or inappropriate action' as two of the top four causes of GA accidents. To address this situation, a research project into decision making by GA pilots is being undertaken on behalf of the CAA by Cranfield University, with the participation of representatives of the GA community. The results will be used to inform the development of training material to improve decision making on weather conditions and airspace infringements.

The CAA will produce a training package to help improve decision making with a particular focus on weather conditions and airspace infringements.

5. UK Low Powered Light Aviation SSR Transponder (LP-LAST)

The CAA is moving towards compliance with ICAO requirements for increased transponder carriage in light aircraft. For aircraft with power supply and size limitations, a battery powered, low power transponder may allow wider carriage. The CAA will continue to provide advice and support to initiatives to enable commercial development. It is likely that the LP-LAST will incorporate 1090MHz Extended Squitter to allow interoperability and future proofing.

The CAA will launch a Regulatory impact Assessment considering the wider carriage of transponders.

6. National Private Pilot Licence (NPPL) Medical Standards

Phase 1 of this project in July 2002 introduced a National PPL for recreational flying in the UK. The National Private Pilot Licence allows people to fly who have previously been denied a medical certificate. The NPPL standards are based on the DVLA driving medical requirements, and the pilot's declaration of fitness has to be countersigned by a GP who has had access to the medical records.

The medical standards allow pilots to learn to fly or continue flying with medical conditions that would preclude a medical certificate under JAA regulations. However, to be sure there is no degradation of safety, the CAA collected data on the number of pilots with a NPPL, the specific driving medical standard that they reached (professional or private) and the accident rate due to medical causes.

The report for 2005 for the National Private Pilot Licence (NPPL) medical standards confirmed that the rate of licence issue has remained steady. The initial surge of applications from those applicants who had previously failed the JAR Class 2 medical has tailed off with the majority of single engine piston student pilots still opting for the JAR PPL.

In response to the first of two AAIB Safety Recommendations made, the CAA conducted a annual review of the NPPL medical standards. In addition to NPPL medical standards, the medical standards specific to instructors were also considered and deemed appropriate for the type of instruction conducted under the privileges of the NPPL. The second AAIB Safety Recommendation referred to the need for the CAA to re-emphasise its advice to pilots that they must discuss any changes in medical condition with their GP. Various mechanisms for promoting this requirement are now in place.

7. Recreational Aviation Activities

Some types of aviation carry a significantly higher risk of personal injury when compared with a Public Transport flight on a scheduled airline service. The marketing of some of these activities has changed significantly in recent years and a number of Recreational Aviation Activities are now available to the public.

Some of these activities pose significant safety risks to the participants. The concept of a recreational aviation activity revolves round permitting the general public to partake as passengers, whether for payment or not, in an activity that cannot meet the Public Transport standards applied to airlines. This must be on the basis that they have been clearly informed of the risks involved and have made their own decision on whether to accept that risk, in the same way that they may choose to participate in other high-risk recreational activities.

The CAA has developed, in conjunction with industry, the measures to put Recreational Aviation Activities into a clearer operational framework by establishing a common Code of Practice providing basic guidelines for providers of Recreational Aviation Activities. The Recreational Activities Manual was published on the CAA website in June 2005 as CAP 755. The British Microlight Aircraft Association (BMAA) and the British Gliding Association (BGA) will conduct a trial during summer 2006 using CAP 755.

In conjunction with industry, the CAA will undertake a review of the trial results.

The respective industry bodies should then develop more detailed guidance for specific activities to ensure the risks are minimised. While there will be a continued need in certain areas for some level of permission and oversight from the CAA, accountability for safety will be more clearly assigned to the operators.

Summary of Actions

Issue	Actions	Dates
Carburettor icing	Complete the research programme to identify possible solutions to carburettor icing and resultant handling problems, report on potential mitigations.	February 07
Decision Making by GA pilots	Define and produce training material to improve decision making on weather conditions and airspace infringements.	August 07
LP-LAST	Launch a Regulatory impact Assessment considering the wider carriage of transponders.	June 06
Recreational Aviation Activities	Complete review of findings of trial period of activities manuals.	December 06

General Aviation Helicopters

CAA action areas will include:

- Degraded Visual Cueing

1. Introduction

A sudden and marked increase in the number of accidents to small helicopters during the 1990's, peaking in 1994 at a 3 year moving average of 120 accidents involving fatal or serious injuries per million flight hours, led to the establishment of a joint industry group, now called the Small Helicopter Working Group. This group conducted a review of small helicopter safety and developed an action plan to address the issues identified.

2. Degraded Visual Cueing

An analysis of accidents performed as part of the review identified inadvertent entry into IMC and subsequent disorientation as the largest single cause (32%) of fatal accidents, which was surprising given that such accidents formed only a small proportion (4%) of all accidents. At the time of the review, the CAA was already collaborating with the UK MoD on a programme of research into how pilots use visual cues in the process of helicopter flight guidance and stabilisation. This research included a review of the accident data to establish the nature and extent of the problem and, for the period 1976 to 2004, found a total of 54 accidents involving 100 fatalities and 36 casualties. These statistics served to reinforce the severe consequences of loss of situational awareness/disorientation type accidents.

The accident data was also used to construct a representative matrix of visual cueing conditions, types of manoeuvre and helicopter handling characteristics for study during a programme of simulator trials. The visual scene content for each test scenario was analysed using contemporary techniques to gain objective measures of the level of cueing available. This project has been completed and the final report is being produced for publication on the CAA website. The results of this work have been used to inform and support the present change to the ANO in respect of helicopter VFR weather minima.

The CAA will publish the final report on the research into flight in degraded visual cueing conditions.

Summary of Actions

Issue	Actions	Dates
Degraded Visual Cueing	Inadvertent Flight in IMC - publish the final report on the research into flight in degraded visual cueing conditions.	September 06

Gyroplanes

CAA actions areas will include:

- **Aerodynamic Characteristics**
- **Gyroplane Pilot licensing**
- **Training of pilots, instructors and examiners**

1. Introduction

Gyroplanes have a significantly higher fatal accident rate than other classes of recreational aircraft, as shown by the chart below, which is an expansion of the GA chart shown in the Aviation Safety Statistics section of this document. The CAA has been investigating the reasons behind this and have identified some specific actions to help improve the safety record of these machines.

2. Aerodynamic Characteristics

As a result of a number of fatal accidents in the 1990s the AAIB recommended that a research programme into the aerodynamic characteristics of gyroplanes be undertaken. Consequently, the CAA commissioned Glasgow University to undertake a multi-phase research project. Results from this research have included identification of the significance of the magnitude of the thrust line / vertical centre of gravity displacement in determining the longitudinal stability of gyroplanes and the consequent need for changes to BCAR Section T.

BCAR Section T (Light Gyroplanes), CAP 643, was reissued on 12 August 2005 to incorporate those changes made to BCAR Section S (Small Light Aeroplanes), CAP 482, that could be seen as equally applicable to BCAR Section T. This change also accommodated both the results of research into gyroplane longitudinal stability and experience gained in the application of existing requirements to particular projects.

Two fatal accidents, one in 2003 and one in 2004, and resultant AAIB recommendations led to the actions in this plan.

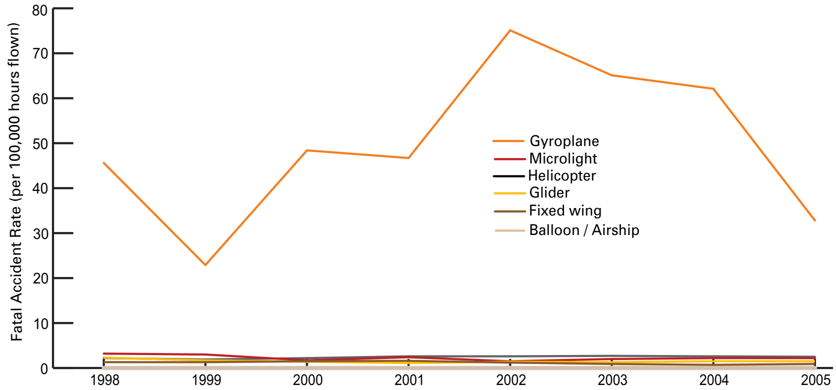


Figure 12. General aviation Fatal Accident Rate by Type.

2.1 Effect Of Thrust Line/Vertical CG Offset

The CAA undertook a series of flight tests to assess the handling qualities of certain UK single seat gyroplane types. As part of this investigation, the thrust line/vertical centre of gravity displacement was determined for each machine. Following the findings, a Mandatory Permit Directive (MPD) was issued on 24 August 2005 that applied certain operational limitations on all single seat gyroplanes. Many of the limitations may be removed if acceptable evidence is presented to the CAA that the thrust line/centre of gravity offset is within ±2 inches. Any modification required to bring the offset to within ±2 inches must be approved by CAA and the Popular Flying Association.

The CAA also intends to conduct an assessment of the handling qualities of a two seat gyroplane type. As part of this investigation, the thrust line/vertical centre of gravity displacement will be accurately determined. The need for changes to the Design Standards of BCAR Section T will be considered on completion of the assessment.

The CAA will conduct an assessment of the handling qualities of a two seat gyroplane type.

2.2 Rotor Teeter Behaviour

The CAA sponsored investigation into gyroplane stability by Glasgow University has been conducted using a computer model, validated by flight trials of 2 instrumented gyroplanes. The rotor teeter (flapping) angle was not instrumented on either aircraft, however, and problems have been experienced in the validation of the model. A further flight trial has now taken place using Glasgow University's gyroplane fitted with additional instrumentation and the data gathered has addressed a lack of knowledge of rotor flapping behaviour. This is expected to enable further validation of the computer model. The findings will also assist in the further development of BCAR Section T.

The CAA will review the validation of the gyroplane computer model in the light of the results of the work on teeter behaviour, modify the model and revise the earlier studies as appropriate, and consider any necessary changes to BCAR Section T.

2.3 Rotor Aeroelastic Characteristics

The CAA is also funding research into the dynamic behaviour of gyroplane rotors with the objective of identifying parameters that lead to safe and reliable characteristics. The aim is to understand the load, stiffness and mass-balance requirements of rotors with a view to aeroelastically tailoring the rotor so that it can better sustain reduced 'g'.

The CAA will complete the study of rotor elastic characteristics, review the validation of the gyroplane computer model on completion of the study, modify the model and revise the earlier studies as appropriate, considering any necessary changes to BCAR Section T.

3. Gyroplane Pilot Licensing

The licensing of gyroplane pilots has not changed in line with the licensing of pilots of other classes of aircraft. A useful model is the licensing of microlight aircraft, where aircraft up to 450Kg maximum take off mass can be flown by holders of an National Private Pilots Licence with a microlight rating - the NPPL(M). With the current United Kingdom gyroplane fleet certificated to BCAR Section T, or having a proven level of acceptable service, consideration might be given to the introduction of a National Private Pilot's Licence Gyroplane rating, to permit licence holders to fly as pilot in command or co-pilot of gyroplanes certificated to BCAR Section T limits.

The United Kingdom PPL(G) will remain to enable licence holders to fly gyroplanes that are not certificated in accordance with BCAR Section T, and for the retention of legacy rights and privileges of existing licence holders. Even though there is no current demand for such gyroplanes in the UK, there are larger gyroplanes available in other states, notably the USA, and provision should be made for their introduction should the demand arise.
The UK CPL and ATPL for helicopters also include gyroplane privileges, but the equivalent JAR-FCL CPL and ATPL do not. Accordingly, where a holder of a UK CPL(H) or ATPL(H) converts to the JAR-FCL equivalent, their gyroplane privileges are not preserved. In addition, there is no provision for the initial issue of a CPL or ATPL for gyroplanes under JAR-FCL. Even though there is currently no demand for such licences, for completeness, consideration should be given to such provision.

The CAA will review gyroplane pilot licensing, in consultation with industry, with a view to revising gyroplane pilot licensing to meet the needs of the wider gyroplane community, and to meet potential future licensing requirements.

4. Training of Gyroplane Pilots, Instructors and Examiners

Lack of experience and of recency were both factors identified in the analysis of gyroplane accidents. The current ab-initio gyroplane training syllabus for the issue of a PPL(G) contains a provision for part of the training to be carried out on single seat gyroplanes. These can have markedly different handling characteristics compared to two seat gyroplanes. Consideration should be given as to whether it is appropriate for students to convert to single seat gyroplanes during ab-initio training, and whether it is appropriate for all ab-inito gyroplane training to be carried out on two seat, dual control gyroplanes approved for the purpose of flying training.

Extensive fixed wing flying experience has also been cited as a contributory factor in some gyroplane accidents. The current system of credits for previous experience may not be appropriate for pilots with existing fixed-wing experience.

The current syllabus for training

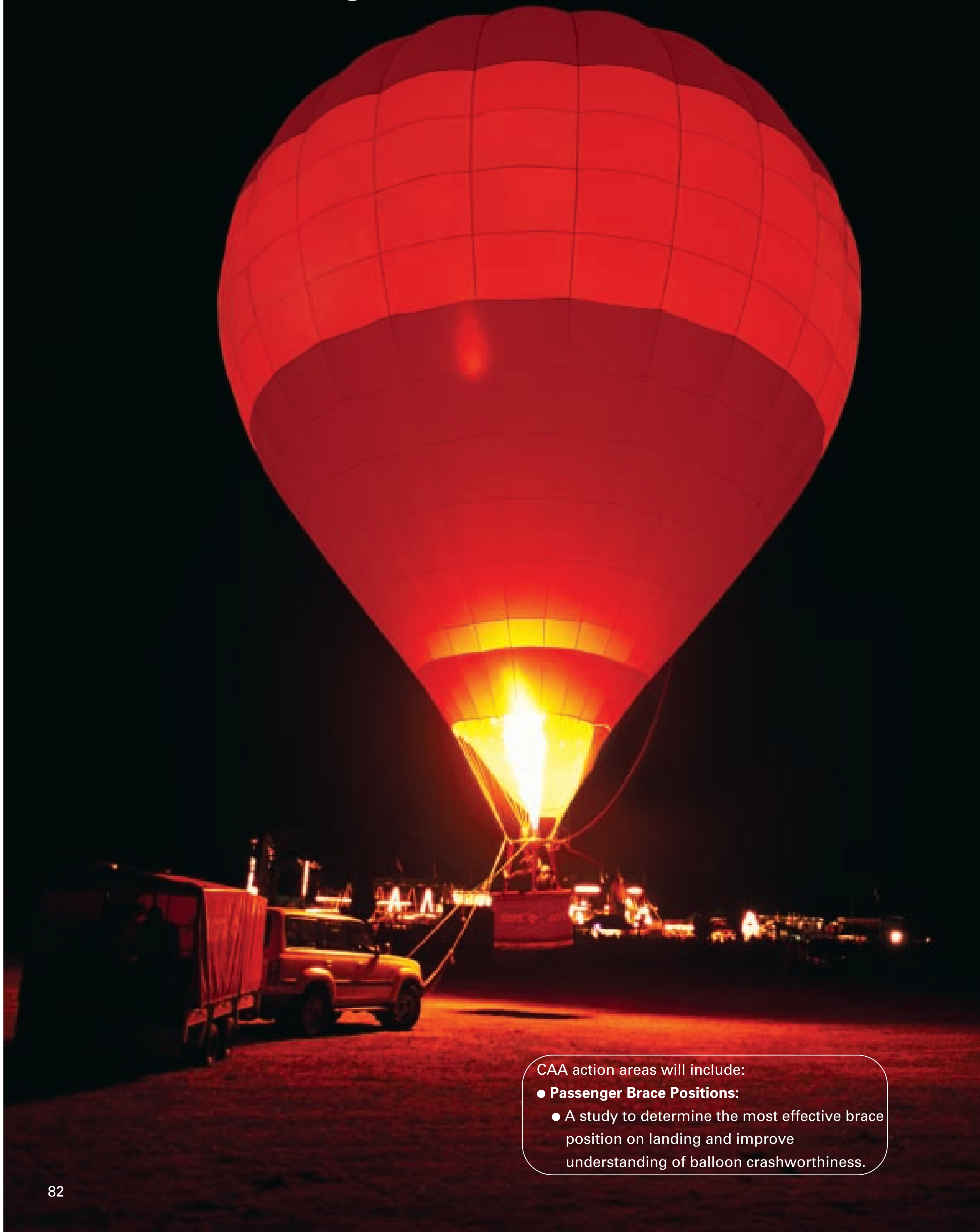
gyroplane instructors and examiners is very loosely specified. Consideration should be given to revising the training syllabus, improving training materials and improving the standardisation of gyroplane instructors and examiners, in order to ensure regulatory compliance and to improve the consistency and quality of gyroplane training.

The CAA will review the training arrangements for gyroplane pilots, instructors and examiners, in consultation with industry, with a view to revising training syllabus and materials.

Summary of Actions

Issue	Actions	Dates
Aerodynamic Characteristics	Assess the handling qualities of a two seat gyroplane type. Consider regulatory action in line with that taken for single seat gyroplanes.	October 06
Aerodynamic Characteristics	Review the validation of the gyroplane computer model on completion of the work on teeter behaviour and rotor aeroelastics, modify the model and revise the earlier studies as appropriate and consider any necessary changes to BCAR SectionT.	October 08
	Complete the study of rotor elastic characteristics, review the validation of the gyroplane computer model on completion of the study, modify the model and revise the earlier studies as appropriate, considering any necessary changes to BCAR Section T.	October 08
Gyroplane Pilot Licensing	The CAA will review gyroplane pilot licensing, in consultation with industry, with a view to revising gyroplane pilot licensing to meet the needs of the wider gyroplane community, and to meet potential future licensing requirements.	December 06
Training of Gyroplane Pilots, Instructors and Examiners	The CAA will review the training arrangements for gyroplane pilots, instructors and examiners, in consultation with industry, with a view to revising training syllabus and materials.	December 06

Ballooning



CAA action areas will include:

- **Passenger Brace Positions:**
  - A study to determine the most effective brace position on landing and improve understanding of balloon crashworthiness.

1. Introduction and Background

Although ballooning is an extremely safe sport, regulated by both the CAA and the British Balloon and Airship Club (BBAC), the nature of a balloon flight means that landings can on occasions be quite firm. Over the years, balloon operators have developed a variety of landing positions for passengers but none has been based on scientific evidence.

2. Passenger Brace Positions

This project aims to enhance the safety of passengers on (Public Transport) balloon flights during landing. These balloons can carry anything up to 19 people, the size of a small turboprop aircraft. Building on existing work on airliner seating impact studies and helicopter crash protection, the work will use computer programs to replicate the effects on the human body of balloon landings in order to optimise protection and also determine if further protection can be provided inside the balloon basket. The ballooning industry has been very involved in the project through the Balloon Consultative Group.

The CAA will sponsor a study to determine the most effective brace position on landing and improve understanding of balloon crashworthiness.

Summary of Actions

Issue	Actions	Dates
Passenger Brace Positions	sponsor a study to determine the most effective brace position on landing and improve understanding of balloon crashworthiness.	October 06

Supporting Approved Organisations

The CAA approves, licences and monitors:

- 200 aeroplane and helicopter AOC operators and nearly 80 balloon AOC operators
- 145 airports
- 170 air traffic service providers (including 80 air traffic control units)
- 600 aircraft maintenance organisations
- 200 production organisations

The CAA also carries out oversight of around 75 design organisations on behalf of EASA.

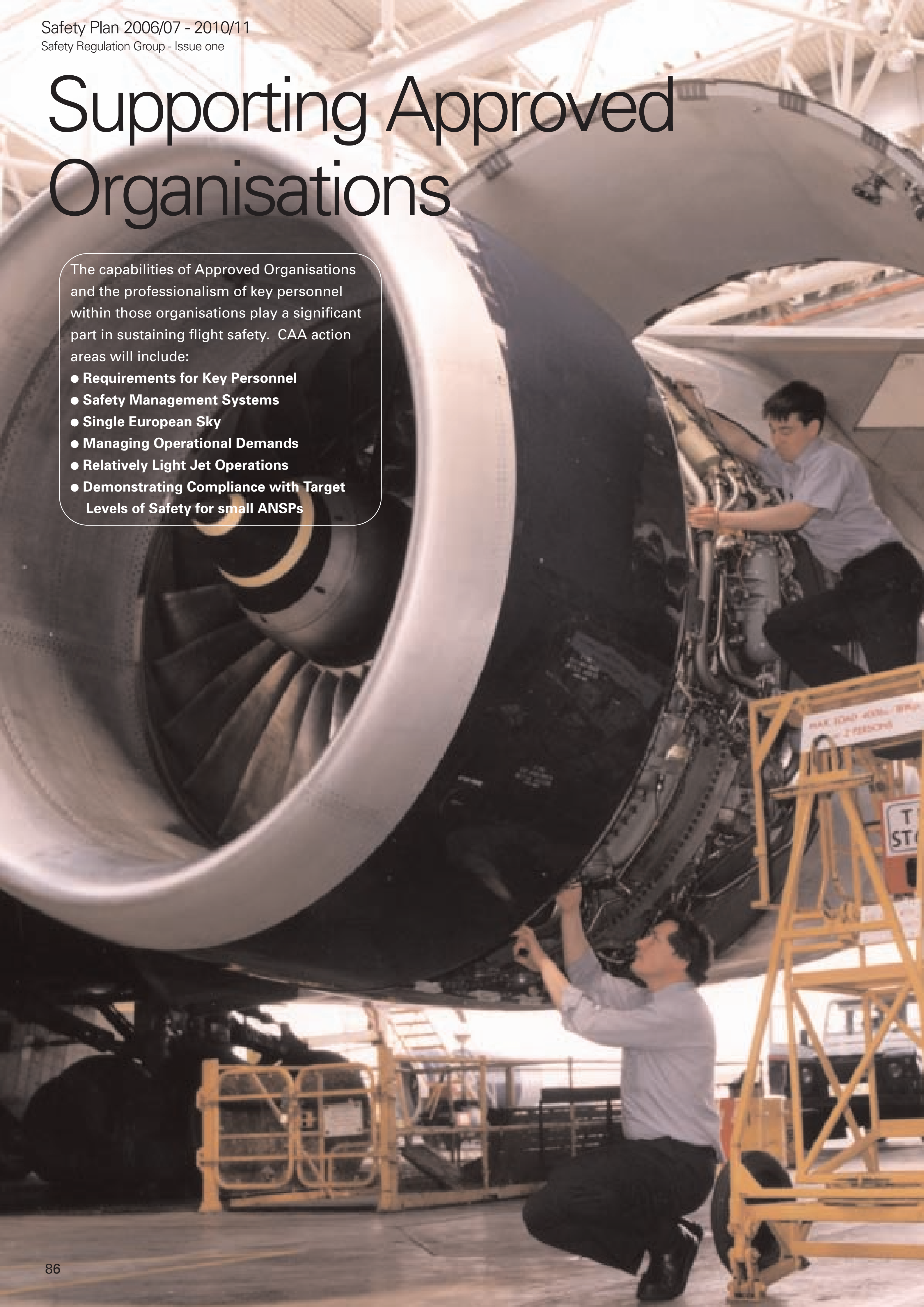
This chapter covers work on:

- Requirements for key personnel
- Safety Management Systems
- Single European Sky
- Managing operational demands
- Relatively light jet operations
- Demonstrating compliance with target levels of safety for small ANSPs

Supporting Approved Organisations

The capabilities of Approved Organisations and the professionalism of key personnel within those organisations play a significant part in sustaining flight safety. CAA action areas will include:

- **Requirements for Key Personnel**
- **Safety Management Systems**
- **Single European Sky**
- **Managing Operational Demands**
- **Relatively Light Jet Operations**
- **Demonstrating Compliance with Target Levels of Safety for small ANSPs**



1. Introduction & Background

In addition to the contribution of individuals, organisations play a crucial role in the safety of aviation. Accident analysis has often shown that whilst the final action in an accident may be attributable to human error, there are contributory causes related to management, structure or culture of an organisation.
Organisational safety is influenced by many factors, including:

- competence of personnel in key positions
- clearly identified mechanisms for assuring safety
- thorough monitoring of safety performance indicators
- mechanisms for the feedback and review of safety performance indicators
- safety culture: open reporting, avoiding complacency, and sustained allocation of adequate resources.

2. Requirements for Key Personnel

CAA recognises that competence and skill of key industry personnel play a major role in the safety of aviation and are an integral part of the regulatory framework. To promote the importance of key industry personnel, **the CAA will issue guidance for Operators on how to assess the capability of Accountable Managers and posts that are crucial to safety.**

3. Safety Management Systems

A Safety Management System (SMS) is a systematic approach within an organisation to managing safety, including the necessary organisational structures, accountabilities, policies and procedures to establish, monitor and improve the safety of flight. The CAA recognises SMS as an effective safety concept that provides traceable risk management.

Guidance on SMS is contained in several CAA publications including CAP 712 for Aircraft Operators, and CAP 670, CAP 726, CAP 728 and CAP 730 for Air Traffic Service Providers and aerodrome licensees. In addition to the CAA's routine process of updating material, formal direction from ICAO and legal imperatives underpinning the Single European Sky initiative are among new drivers to review SMS guidance material and its application.

There are core similarities in the principles of SMS across a range of organisations within the aviation industry but the detail will differ according to the particular context and industry sector. The review and harmonisation of CAA oversight and published guidance on SMS for aircraft operations, air traffic services and airports has been identified as a priority for review. These teams carrying out the reviews will co-ordinate their work to ensure consistency of general philosophy and application.

Therefore the CAA will review published SMS guidance and practice within specialist areas to ensure that it reflects best practice for the emerging regulatory and industry environment.

Co-ordinate the SMS philosophy from each area and consider the most appropriate strategy for communicating core policy to industry.

4. Single European Sky

The Single European Sky (SES) is one of the most fundamental changes to the Air Traffic Management industry for many years. In order to support the UK industry in preparation for SES, **the CAA will continue to provide a broad range of information on the Single European Sky initiative, including briefing material, workshops and seminars for Service Providers** to ensure that they have the appropriate information and provide answers to any questions that they may have.

5. Managing Operational Demands

Operational aviation is complex and there are many factors that vary on a day to day basis. It is recognised that the pilot's workload will be affected to some extent by individual changes, the number and variety of different system elements, and commercial pressures. This means that a systematic approach must be used to managing the risk of overloading the pilot in the operational context.

Flight safety regulations are a comprehensive set of minimum standards to address each individual element of operating an aircraft. However, they do not fully address the accumulation of multiple small or marginal issues that could never be specified in regulation but whose cumulative effect can create a demanding situation for the crew. Examples include:

- Take-off with an engine in operative:
  - With flight crew both relatively inexperienced on type
  - With flight crew fatigued, possibly into discretionary hours
  - In marginal weather
- Implementation of a new charter route:
  - That passes through busy uncontrolled airspace
  - With noise abatement procedures that create a challenging flight path especially when coupled with a gusty cross wind
  - Where holding for extended periods or long taxiways before take-off in falling temperatures could result in icing

For the vast majority of accidents there is no single factor that is the sole 'cause' of a fatal aviation accident; more frequently, there is a multitude of small errors, poor decisions, and other cumulative factors. These cumulative factors can place an unrealistic demand upon the expected performance of the pilot.

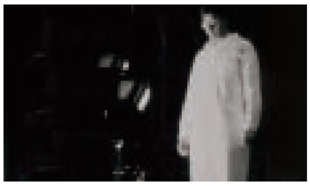
The CAA, with limited resources, needs to be able to direct these resources as effectively as possible in the oversight of approved organisations, particularly Air Operator's Certificate (AOC) holders.

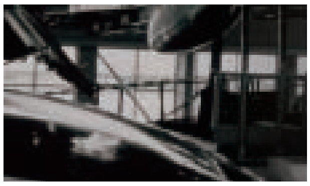
It is possible to reduce the likelihood of cumulative factors becoming a safety issue by the effective use of a effective risk management processes, in particular risk assessment. The CAA has identified that there is sufficient variability in the application of risk management techniques to indicate that additional guidance to Operators on how to best manage risk, including a best practice example of how to conduct risk assessments, would be beneficial to the industry. However, it must be clear that the CAA is not taking responsibility from the Operator for the risk assessment they make.

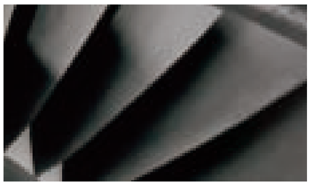
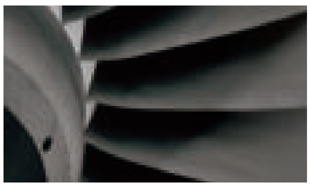
The CAA has tasked FORCE to produce a Risk Management Model to support the CAA in allocating scarce resources to the oversight of approved organisations and, in particular AOC holders. This methodology could then be further developed to assist operators in the development of their own risk assessment models. This is fully in accordance with the principles defined in the Hampton Report[1]. It will be considered whether new guidance on Risk Management, including Risk Assessment, is best embodied in the general SMS Guidance (CAP 712) or whether it should be presented separately.

6. Safety of Relatively Light Jet Operations

Analysis of accidents to large aeroplanes (i.e. those over 5,700kg) reveals that the majority of fatal accidents feature aeroplanes that are at the 'small' end of this broad category, often those categorised as business jets. When the SRG Accident Analysis Group (AAG) analysed fatal accidents world-wide in 2004, it was found that 50% involved aeroplanes below 10 tonnes and 70% were below 27 tonnes. Data on this class of operation is limited, but as shown in the safety statistics earlier in this Plan, the last 10 years of data for UK registered aircraft in this class shows a significantly higher accident rate per million hours flown (9.0) than for other classes of aircraft (the next worst is turboprops at 1.2 per millions hours flown). Producing a complete picture of these aircraft in the UK is further complicated by the fact that many of the resident aircraft in this group are not on the UK Register.





[1] Reducing administrative burdens: effective inspectionand enforcement Philip Hampton, March 2005.

The CAA will conduct a study of safety among the relatively light jet aircraft operations, to ascertain the safety of this class of operations in the UK and, if necessary, identify further action.

7. Demonstrating Compliance with Target Levels of Safety for small ANSPs

A target level of safety for the air traffic system is embodied in ESARR 4. However, methods for demonstrating compliance for individual air traffic service providers are not specified. This is a complex issue in the UK because, unlike most European states, air traffic services are provided by multiple private companies. It is not possible to use simple 'accident rates' because mid air collisions are extremely rare, but the UK is not free from Airprox and loss of separation events, some of which have been categorised as being at risk of collision. The CAA has already produced a method by which large ANSPs could be assessed for compliance in meeting their 'share' of the target level of safety.

Further research is necessary to identify a method that would be suitable for assessment of small ANSPs, because their low traffic volumes and type of operation make the methods devised for large organisations ineffective.

The CAA will undertake new research on methods to assess small ANSPs for compliance with ESARR4 target levels of safety. This will include the contribution of ground equipment to the safety equation.

Summary of Actions

Issue	Actions	Dates
Competence of Key Personnel	Produce guidance material for the assessment of persons nominated as accountable managers and posts that are crucial to safety.	September 06
Safety Management Systems	Update Guidance on SMS and promote effective use within Operating industry.	May 07
Single European Skies	Continue to provide a broad range of information on the Single European Sky initiative, including briefing material, workshops and seminars for Service Providers.	Ongoing
Managing Operational Demands	Produce a Risk Management Model to support the CAA in allocating scarce resources to the oversight of approved organisations and, in particular AOC holders.	January 08
Safety of 'Light' Jet Operations	Conduct a study of lighter jet operations in the UK, to ascertain whether the safety of this class of operations is in need of further attention.	July 06
ESARR 4 Compliance	Complete research into means of compliance for ANSPs to meet ESARR4. This will include the contribution of design aspects of ground equipment.	June 07

Status Report on Existing Safety Plan Initiatives

Previous Title of Item	Status	Comments
SI 05/01 Level Busts	Open	See 'Airspace Safety'
SI 05/02 Radio Telephony R/T Discipline	Open	See 'Large Public Transport Aeroplanes'
SI 05/03 Reduce Incidents of Fatalities Resulting from Helicopter Ditching	Open	See 'Large Public Transport Helicopters'
SI 05/04 Carbon Monoxide Detection	Open	See 'General Aviation'
SI 05/05 Reduction of Accident rates for Gyroplanes	Open	See 'General Aviation'
SI 05/06 Development of a GA Helmet	Closed	Withdrawn from Safety Plan
SI 04/01 Prolonged Loss of Communications (PLOC) and 'Sleeping Receiver' Events		See 'Large Public Transport Aeroplanes'
SI 04/02 Passenger Education on Dangerous Goods		See 'Large Public Transport Aeroplanes'
SI 04/03 Reduction of Operating Risks to General Aviation Aeroplanes		See 'General Aviation'
SI 03/01 Health and Usage Monitoring Systems (HUMS)	Closed	See 'Large Public Transport Helicopters'
SI 03/03 In Flight Entertainment (IFE) - In-service Failures Leading to Potentially Hazardous Situations	Open	See 'Large Public Transport Aeroplanes'
SI 03/06 Crews of Highly Automated Aircraft are Unable to Deal Adequately with Situations in which the Automatics Fail		See 'Large Public Transport Aeroplanes'
SI 03/07 The Potential for an Accident or Incident is Increased by the Pilot Misinterpreting the Checklist Due to Poor Design		See 'Large Public Transport Aeroplanes'

Previous Title of Item	Status	Comments
SI 03/11 Airport Apron Safety	Open	See 'Airports'
SI 03/12 National Private Pilot Licence (NPPL) Medical Standards		See 'General Aviation'
SI 03/15 Continued Airworthiness of Ageing Aircraft Structures		See 'Large Public Transport Aeroplanes'
SI 03/19 Further Development of the System for Analysing and Using Flight data Monitoring	Closed	See 'Large Public Transport Aeroplanes'
BP 6.1.1.12 Runway Incursions	Open	See 'Airports'
RE 05/01 Experience / Knowledge of Accountable Managers and Other Nominated Postholders	Open	See 'Large Public Transport Aeroplanes'
RE 04/01 Recreational Aviation Activities		See 'General Aviation'
RE 03/02 NATS Safety Performance	Closed	Withdrawn from Safety Plan
RE 03/04 UK Operational Policy and Procedures for Unmanned Aerial Vehicle Systems (UAVS)		See 'Airspace Safety'
RE 03/07 Terrain Avoidance Warning System (TAWS)	Closed	See 'Large Public Transport Aeroplanes'
EI 03/01 Introduction of New Generation Large Aircraft (NGLA)		See 'Airports'
EI 03/03 Flying Experience and Medical Unfitness to Fly	Open	See 'Large Public Transport Aeroplanes'

Acronyms and Abbreviations

AAG	Accident Analysis Group
AAIB	Air Accidents Investigation Branch
AALSD	Aerodrome, Air Traffic and Licensing Standards Division
AIC	Aeronautical Information Circular
AMSD	Aircraft Maintenance Standards Department
AN	Airworthiness Notice
ANO	Air Navigation Order (UK)
ANSP	Air Navigation Service Provider
AOC	Air Operator's Certificate
ACAS	Airborne Collision Avoidance System
ARAC	Aviation Rulemaking Advisory Committee
ASD	Aerodrome Standards Department
ATCO	Air Traffic Control Officer
ATSSD	Air Traffic Services Standards Department
BEA	Bureau Enquetes - Accidents (French AAIB)
CAP	Civil Aviation Publication
CAST	Commercial Aviation Safety Team
CFIT	Controlled Flight Into Terrain
CHIRP	Confidential Human Factors Incident Reporting Programme
CNS/ATM	Communication, Navigation and Surveillance / Air Traffic Management
CO	Carbon monoxide
CofA	Certificate of Airworthiness
DAP	Directorate of Airspace Policy
DGAC	Direction Generale Aviation Civile (French CAA)
DPSD	Design and Production Standards Division
EASA	European Aviation Safety Agency
EC	Executive Committee (SRG)
EGPWS	Enhanced Ground Proximity Warning System
FAA	Federal Aviation Administration
FDM	Flight Data Monitoring
FOD	Flight Operations Department
FODCOM	Flight Operations Department Communication
FOI	Flight Operations Inspector
FTL	Flight Time Limitations
GA	General Aviation
GAD	General Aviation Department
GASRWG	General Aviation Safety Review Working Group
GDSR	Group Director Safety Regulation
GNSS	Global Navigation Satellite System
GPS	Global Positioning System

HARP	CAP 491 "Review of Helicopter Airworthiness"
HOMP	Helicopter Operations Monitoring Programme
HPL	Human Performance and Limitations
HSE	Health and Safety Executive
HSM	High Strength Material
HUMS	Health and Usage Monitoring Systems
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFE	In Flight Entertainment
JAA	Joint Aviation Authorities
JSSI	Joint Strategic Safety Initiative
LACC	London Area Control Centre (Swanwick)
LTCC	London Terminal Control Centre (West Drayton)
MARS	Medical Administration Records System
MOR	Mandatory Occurrence Report
MTWA	Maximum Take-off Weight Authorised
NDT	Non-destructive Test
NGLA	New Generation Large Aircraft
NPA	Notice of Proposed Amendment
NPPL	National Private Pilot Licence
OIAC HLG	Offshore Industry Advisory Committee - Helicopter Liaison Group (of the Health and Safety Commission)
OSD	Operating Standards Division
PED	Portable Electronic Device
PLOC	Prolonged Loss of Communication
RTF	Radio Telephony
RFFS	Rescue and Fire Fighting Services
RHOSS	CAP 641 "Review of Helicopter Offshore Safety and Survival"
RMD	Research Management Department
SES	Single European Sky
SESMA	Special Events Search and Master Analysis
SPC	SRG Policy Committee
SRG	Safety Regulation Group
SRP	Safety Risk Panel
SSC	Safety Steering Committee
TAWS	Terrain Avoidance Warning System
TCCA	Transport Canada (CAA)
TGL	Temporary Guidance Leaflet
UAV	Unmanned Aerial Vehicle
UKBSC	UK Birdstrike Committee