AAIB
Air Accidents Investigation Branch

Annual Safety Review 2018

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Foreword

Investigations

The AAIB's purpose is to improve aviation safety by determining the circumstances and causes of accidents and serious incidents, and promoting action to prevent reoccurrence. I am pleased to introduce the AAIB's 2018 Annual Safety Review which includes information on our activity and the safety action taken or planned, by operators, manufacturers and the aviation authorities, in response to investigations concluded in 2018.

The AAIB received 706 occurrence notifications in 2018 and opened 26 field investigations, 9 of which were into fatal accidents in the UK resulting in 16 deaths. A further 221 investigations were opened by correspondence. In addition, the AAIB appointed an accredited representative to 64 overseas investigations, including 23 involving UK registered aircraft.

There is a wealth of statistical information in the following pages that highlights the predominant causes of these accidents and serious incidents. Most fatal accidents involved the loss of control in flight of General Aviation aircraft; whereas the majority of serious incidents with Commercial Air Transport were attributed to system/component failure or malfunction.

Two formal reports were published in 2018. C-FWGH, was a Boeing 737 which failed to achieve the required takeoff performance due to a critical data entry error. This was the latest in a series of accidents and serious incidents worldwide associated with abnormal takeoff performance and so the AAIB has issued Safety Recommendations to ICAO, the FAA and the EASA on the urgent need to develop takeoff acceleration monitoring systems to address this critical issue.

The other formal report concerned G-WNSR, an S-92A helicopter which suffered a loss of yaw control due to failure of the tail rotor pitch change shaft bearing. Fortuitously this occurred when the aircraft was in a low hover and so an expeditious safe landing was possible. This contrasts starkly with the tragic accident at Leicester City Football Stadium involving G-VKSP, an AW169 helicopter, where loss of yaw control at 400 ft had catastrophic consequences. The investigation is ongoing to determine the initiating cause and exact sequence of the failure that resulted in the loss of tail rotor control.

In 2018, the AAIB published 31 field investigation reports and made 15 Safety Recommendations including 8 Safety Recommendations of Global Concern (ie regarding a systemic deficiency having a probability of recurrence with significant consequences at a global level and requiring timely action to improve safety). In addition, AAIB reports provided details of 60 significant safety actions taken by manufacturers, operators and regulators to address safety issues identified in AAIB investigations. Details of them all are in the pages that follow, together with updates on the status of all Safety Recommendations made in 2018.

Developments

The AAIB continues to develop its capabilities and relationships to ensure it is ready for future challenges. I am very grateful to all those who contributed to our Stakeholder Survey in 2018. We greatly valued the feedback and will be using insights from the survey to prioritise areas for development in our working practices and outputs. An article on how and why we communicate is included in this review.

In April 2018 the latest iteration of the UK Civil Aviation (Investigation of Air Accident and Incidents) Regulations 2018 came into force to complement directly applicable EU law (Regulation (EU) No 996/2010). Separate regulations are also now being developed for the investigation of spaceflight accidents, as we prepare to respond to any future mishap with spaceflight launches from the UK.

The rapid growth in unmanned aircraft systems (UAS) usage in the UK continues with a commensurate increase in accidents, incidents and reports of loss of safe separation from manned aircraft. In this review, there is an article to explain when and how we investigate accidents and serious incidents involving UAS, which is an increasingly important part of our remit.

The AAIB has an extensive outreach programme, which included 113 formal visits to the Branch in 2018, and we continue to play a leading role in several national and international forums. We provided training and assistance to a host of different countries in 2018 and this will continue to be an important part of our work, with the objective of improving air safety through the effective investigation of air accidents wherever they occur in the world. Irrespective of the outcome of Britain's exit from the EU, we expect little change to the way we work with State safety investigation authorities in Europe and worldwide, in accordance with Annex 13 to the Convention on International Civil Aviation.

Closer to home, the AAIB and its sister organisations the Marine Accident Investigation Branch and the Rail Accident Investigation Branch, have much in common. Accordingly, the Department for Transport recently established an Accident Investigation Chiefs' Council[1] and appointed Air Marshal Sir Richard Garwood KBE CB DFC as non-executive Chairman. The Board is driving forward a programme of workstreams to maximise the synergy between the three modal branches and form common positions on areas of joint interest, such as the recent agreement of a new Memorandum of Understanding with the National Police Chiefs' Council.

2019 is already proving to be a busy and demanding year for the AAIB and we look forward to engaging with stakeholders on a range of important safety issues. In the meantime, I invite you to peruse this 2018 Annual Safety Review which I trust you will find interesting and useful.

Crispin Orr
Chief Inspector of Air Accidents

1 Formerly known as the Tri-Branch Management Board.

Contents

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How we communicate and why

Good communication is at the heart of every successful air accident investigation and it starts from the moment we are notified of an accident. In this early stage, we could be speaking to dozens of people from the emergency services, operators and manufacturers, and receiving information by phone, email and through social media. Running parallel to the job of gathering evidence and sifting through the evidence, we need to communicate with the wider public whether that is to appeal for witnesses or to provide reassurance by keeping them informed of our activities and our commitment to work out what happened. When our investigation concludes, we need to be able to say what happened and why, and what we have recommended to prevent similar accidents from happening again. Our safety recommendations are exactly that – recommendations – so communication plays a part in ensuring that our voice is heard and nobody is in any doubt as to whose responsibility it is to respond to our findings.

As one of the smallest government organisations in the UK, our formal communication function is lean: we share a communication specialist with our sister branches, the Marine Accident Investigation Branch and Rail Accident Investigation Branch. The communication specialist's role is as much about giving our investigators the tools they need to communicate well, as it is about setting our overarching communication strategy and looking after the inevitable day-to-day media requests. For major accidents, we have arrangements for government communication specialists to assist us with media on site in the early stages after the accident.

Figure 1

Government communicators at an AAIB training day

When an accident happens, we may need to appeal for witnesses. While social media has 'ballooned' over the last decade, local tv, radio and website news continue to be our most important media for trying to reach potential witnesses to come forward with information relevant to our investigation. This is why we encourage our investigators to speak to the media if there are journalists near the accident site and there is an appropriate break in the investigators' work. We prepare our investigators with some basic media training. We do not expect our inspectors to become polished media spokespeople – our ask is only that they are able to get our message across or publicise their witness appeal, while painting a picture for the journalist and their viewers to help them understand how we investigate. We recently published a range of pieces on our website[1] to explain how we work, some of which are concise versions of articles from our previous Annual Safety Reviews.

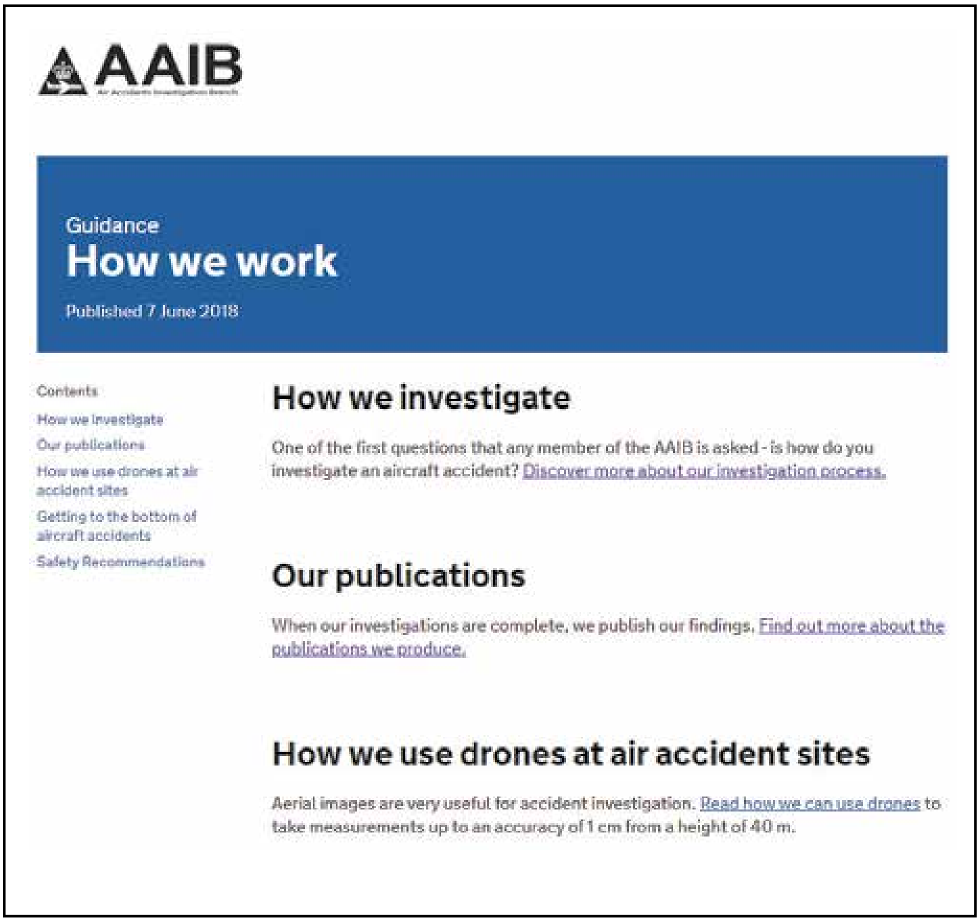


Figure 2

Website articles about how we investigate

Following a high profile accident, it is not unusual for rumours and speculation to surface, often with good intentions but based on limited information. This can be a distressing time for the bereaved and can be frustrating for operators or manufacturers, whose reputation may be on the line. We quell speculation as soon as we can, but first we have to be certain that a theory lacks credibility. This can take time, as many investigation processes are complex.

1 https://www.gov.uk/government/publications/how-we-work/how-we-work

Communication comes in peaks and troughs. For most of our investigations, after a flurry of communication when the accident has happened, the interest is muted as the investigation takes its course. It reignites when we publish our findings at the end of our investigation, or Special Bulletins as safety issues emerge during an investigation. While our public-facing communication may have subdued, during investigations into fatal accidents, our investigators are in regular contact with the next of kin. The level of this communication varies, depending on how much information we are able to convey, and how much information relatives would like. Some families find it useful to visit us in person when we are nearly ready to publish our findings, so that we can go through our draft report and answer any questions. They may find it comforting to see the aircraft wreckage in our hangars. Our investigators also visit relatives at their own homes if they prefer not to visit our site and would like a face-to-face opportunity to go through our findings.

When our investigations conclude, we publish them in a monthly bulletin which is widely distributed in hard copy and is on our website. An ongoing challenge for us is the frequency and format of our reports. Research conducted in autumn 2018 showed divided opinion on whether our reports should be published online as soon as each investigation concludes, or wait for a printed bulletin cycle. It also showed mixed preferences around format, with some reading our reports on screen and others preferring to either receive or print their own hard copy. Our bulletins are particularly important in sharing the lessons of accidents within general aviation and a challenge for the year ahead is how we can communicate our findings more widely to improve aviation safety.

Formal reports are reports on major AAIB investigations. When there is a significant media and public interest in our findings, this will be reflected in our communication approach. We may provide an animation to illustrate something technical, a briefing for journalists to help them understand complex aviation concepts so they can better inform their readers and viewers, and undertake media interviews to explain our findings.

Figure 2

Media at AAIB for publication of the Hunter Accident at Shoreham Airshow formal report

AAIB UAS at rest - picture taken during an investigation

Investigating UAS accidents

Introduction

The AAIB started investigating accidents to Unmanned Aircraft Systems (UAS) in 2015. At the time, the AAIB was only required by regulation EU 996[1] to investigate accidents and serious incidents to UAS when the unmanned aircraft (UA) weighed more than 150 kg, but there were no such UA on the civilian UK register. Under national regulations the AAIB has discretion to investigate accidents to UA of any weight when safety lessons are expected to be drawn.

With the rapidly increasing number of small UAS (less than 150 kg) in UK airspace and the potential risk to 3rd parties, we decided to start investigating accidents to small UAS. Some of the benefits of doing so are:

- It increases AAIB knowledge of UAS and helps to prepare us for an accident involving a serious injury, fatality or a serious mid-air collision.
- It allows us to identify possible trends that might inform the regulations, change operational restrictions or training requirements.
- It enables us to inform UAS manufacturers of potential design issues.
- Unlike regulators and manufacturers, the AAIB can conduct a wholly independent investigation.
- The AAIB can make the investigation findings public and make safety recommendations intended to prevent recurrence.

We have obtained information on 36 UAS accidents to date and published reports on seven of them.

Reporting a UAS accident

Under regulation EU 996 '*any person involved'* who has knowledge of the occurrence of an aircraft accident or serious incident in the UK must report it to the AAIB; 'any person' includes (but is not limited to) the owner, operator and pilot of a UAS. All UAS accidents and serious incidents are required to be reported to the AAIB, regardless of weight or whether they are being used for commercial operations. The definition of an accident and serious incident can be found on our website[2]. In short, an accident has occurred if someone was fatally or seriously injured, or the aircraft has sustained damage beyond a certain level. If only the propeller blades of a multi-rotor UA have been damaged then this would not be classified as an accident. A serious incident is an incident involving circumstances indicating that there was a high probability of an accident.

Footnote

1 Regulation (EU) No 996/2010
2 https://www.gov.uk/government/publications/definition-of-aircraft-accident-and-serious-incident/definition-of-aircraft-accident-and-serious-incident

If in any doubt about whether a UAS accident or serious incident needs to be reported, please report it to us anyway by calling our 24-hour reporting line **+44 (0)1252 512299**.

AAIB UAS accident investigation policy

The AAIB will investigate a UAS accident if it was being operated under a CAA permission or if the UA has a takeoff weight greater than 20 kg. The reason for the weight cut-off is above 20 kg the UA is required to have an airworthiness approval. In practice, this means that any accident involving a commercial operation, or a private operation with a UA greater than 20 kg, will be investigated.

If the UAS accident involves a fatality and the UA was being operated under a CAA permission or it was above 20 kg, then the AAIB will deploy a team to the accident site and carry out a field investigation. If it isn't a fatal accident, the AAIB will send a 'UAS Accident Report Form' to the pilot to collect the details. If there was a serious injury or there appears to be a significant safety issue then an investigation by correspondence will be carried out. This might include calling the pilot, analysing any recorded data and contacting the UAS manufacturer. At the end of the investigation a report will be published on our website. If none of these conditions are met then the information will be recorded on our database. Our decision tree for investigating UAS accidents is shown in Figure 1.

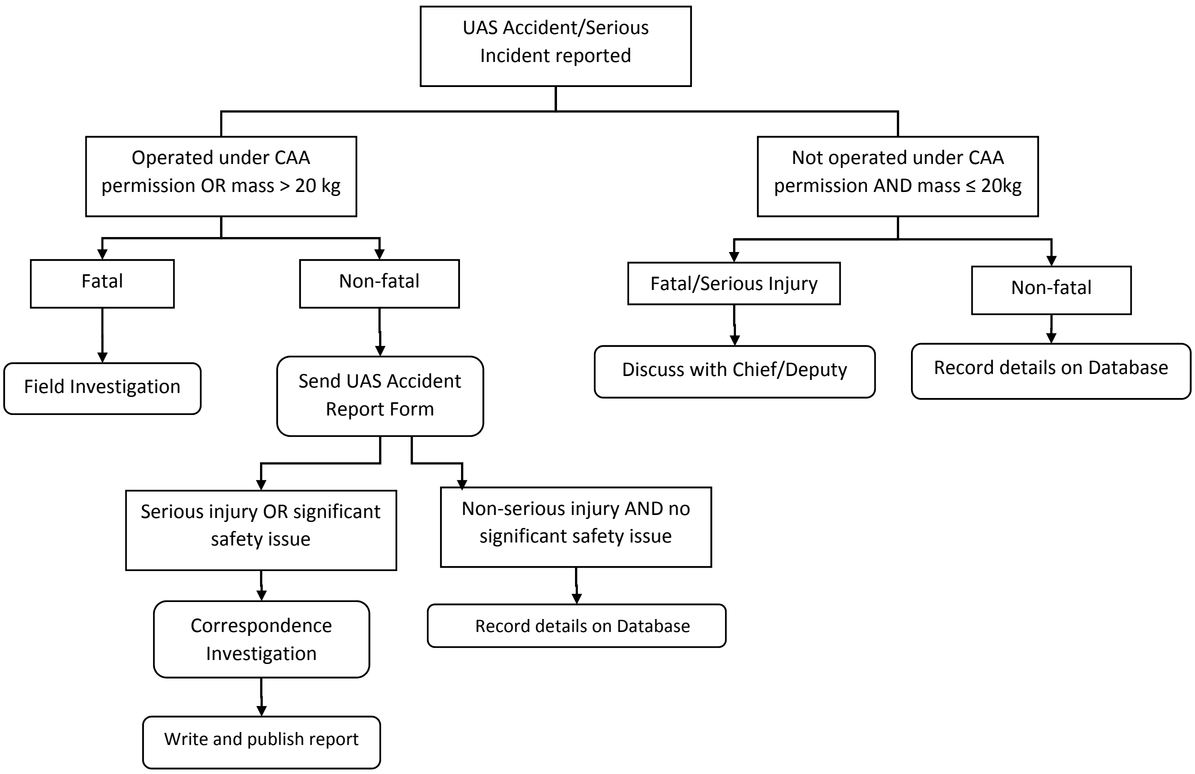


Figure 1
UAS Investigation Decision Tree

UAS accidents investigated by the AAIB

The AAIB has received completed accident report forms on 36 accidents involving UAS since February 2015. Two of these involved mid-air collisions between privately operated model gliders and manned light aircraft[3]. The remainder involved UAS operations under a CAA permission. Seven of these accidents, including the two mid-air collisions with light aircraft, resulted in published reports.

Table 1 lists all 36 accidents by accident type. Most of the 'loss of control' accidents were for technical rather than piloting reasons; however, it is probable that operators are more likely to report accidents to the AAIB involving technical reasons than piloting reasons, and therefore this statistic should not be generalised. A number of the 'loss of control (pilot)' accidents involved gusts of wind. One involved the pilot's remote controller tray harness strap lengthening, causing the pilot to make inadvertent inputs to the throttle which caused the UA to drop to the ground.

The 'loss of control (technical)' accidents were for a variety of reasons including poor compass calibration, magnetic interference, IMU[4] failure and electronic speed controller failure. For some the reason could not be determined.

Of the six accidents involving loss of power, five involved the DJI Matrice 200 series UAS, one of which involved a battery issue and resulted in a published report. The remaining four are still under investigation and appear to relate to battery firmware issues which the manufacturer is working to resolve.

Of the three 'loss of link' accidents, the cause of two was not determined, and the third was caused by a strong gust of wind blowing the UA behind a building where, following the loss of link, a software bug caused the UA to descend rather than return home.

One of the mid-air collisions occurred between an SAS Wildthing model glider (weighing 615 grams) and a Robin DR400 light aircraft near the final approach path to Shoreham airport at about 220 to 320 ft agl. The collision was caught on video and still frames are shown in Figure 2. Despite the light weight of the glider it caused scuffing and scraping damage to the leading edge of the Robin's wing which cost £1,400 to repair. The full report can be found on our website[5]. The other mid-air collision between a model glider and a light manned aircraft occurred in uncontrolled airspace away from an airfield at about 600 ft agl and the report can be found on our website[6]. In both mid-air collisions, the pilots of the model gliders heard the light aircraft approaching but by then it was too late for them to take avoiding action. Both pilots of the light aircraft initially thought they had hit a bird. The third mid-air collision reported to the AAIB was a collision between two UA.

Footnote

3 The model gliders were below 20 kg, but as the accidents involved manned aircraft a correspondence investigation was initiated.
4 Inertial Measurement Unit
5 https://www.gov.uk/aaib-reports/aaib-investigation-to-robin-dr-400-180-f-gsbm-and-sas-wildthing-radio-controlled-model-glider
6 https://www.gov.uk/aaib-reports/aaib-investigation-to-pioneer-300-g-opfa-and-valenta-ray-x-s037996

The four accidents involving CFIT[7] involved collisions with a ship, a rollercoaster, and cranes. In the first two cases the ship and rollercoaster were being filmed. The collisions with cranes occurred at constructions sites which were being surveyed by the UA. In one of these cases a construction site was being re-surveyed using a pre-programmed flight, but a third crane had been erected since the first survey. The UA was programmed to climb to 400 ft which was above the height of the cranes, but the climb occurred while the UA was flying forwards and it struck the new crane before it reached 400 ft. The operator stated that future missions would be planned such that the UA ascended vertically to 400 ft shortly after takeoff, in a safe corridor, before surveying the site and would avoid intersecting the working radius of any of the cranes. He also decided to split the mission in two and to survey the southern boundary by taking off from a new position on the south side. This would avoid flying directly across the site and would afford him a better view of the UA's relative location to the cranes. The report on this accident can be found on our website[8].

Table 2 lists the type of UA that was involved in the 36 accidents in Table 1. The vast majority were multirotor UA. The accident involving the single rotor UA was a Schiebel Camcopter S-100 unmanned helicopter. It had a maximum takeoff weight of 200 kg (Figure 3). While taking off from a ship's helideck it transited rearwards with insufficient height to clear a 19-cm high gunwale. It hit the gunwale causing damage to its tail and resulting in it spiralling into the sea. The aircraft manufacturer came up with a software fix that prevented inadvertent pilot lateral control inputs during the initial phase of takeoff.

Type of accident	Number of accidents
Loss of control (pilot)	7
Loss of control (technical)	10
Loss of power	6
Loss of link	3
Mid-air collision	3
CFIT	4
Other	3
TOTAL	**36**

Table 1
UAS accidents reported to AAIB since February 2015

Footnote

[7] CFIT stands for Controlled Flight into Terrain but it also encompasses controlled flight into obstacles and vehicles.
[8] https://www.gov.uk/aaib-reports/aaib-investigation-to-3dr-solo-uas-no-registration

Type of drone	Number of accidents
Multirotor	30
Single rotor	1
Fixed wing (powered)	3
Fixed wing (unpowered)	2

Table 2
Type of drone involved in the 36 accidents reported to the AAIB

Figure 2
Mid-air collision between SAS Wildthing model glider and Robin DR400 light aircraft

Figure 3
Schiebel Camcopter S-100 unmanned helicopter

Conclusion

In the past three years the AAIB has learnt a lot about UAS and the different factors that can cause or contribute to UAS accidents. Whenever we perceive that there is a significant safety issue or a significant safety lesson to convey, then we aim to publish a report. We have published seven reports on UAS accidents so far and all these reports and any future reports can be accessed at this on our website[9]. We would like to encourage UAS operators to report accidents and serious incidents to us so that other operators and the UAS industry can learn from them.

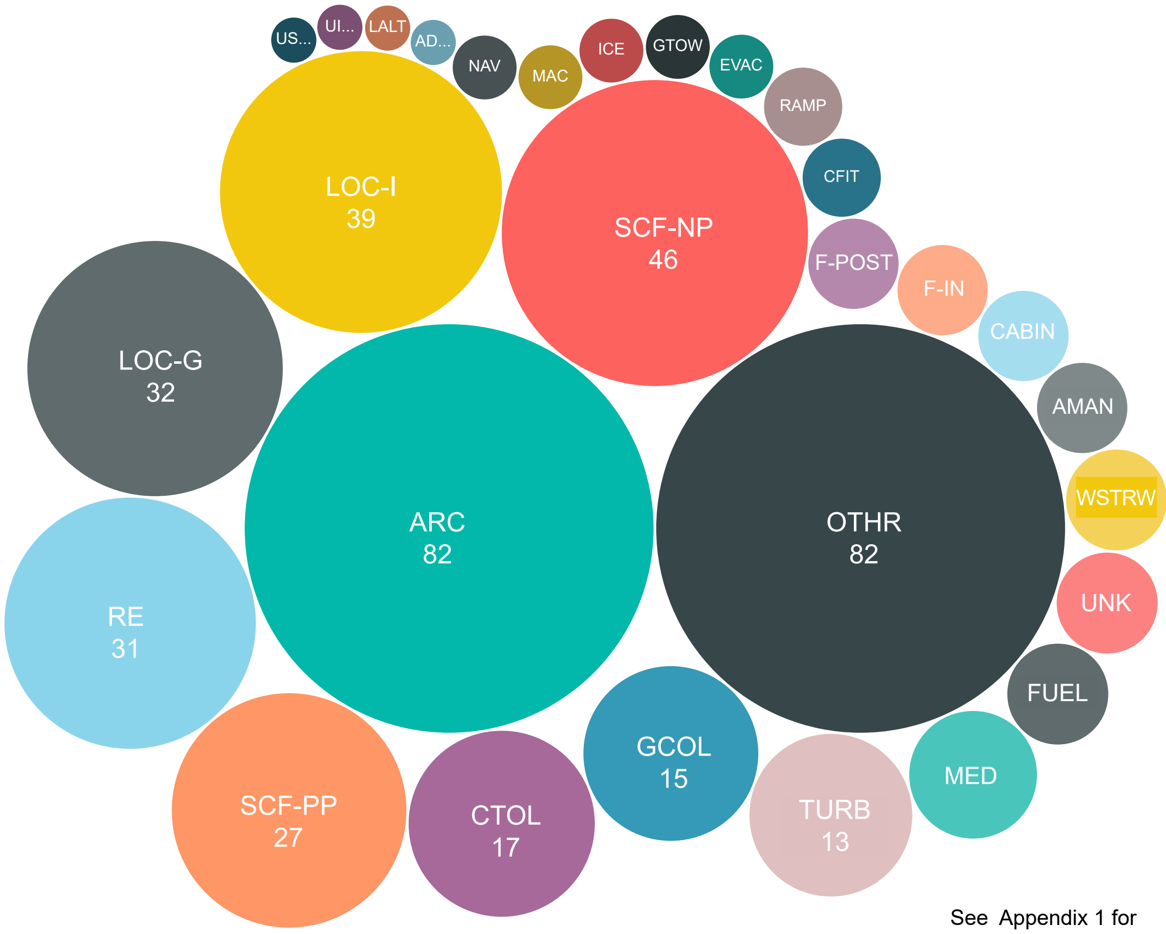
AAIB UAS in use - picture taken for aerial survey during an investigation

Footnote

9 https://www.gov.uk/aaib-reports?keywords=&aircraft_category%5B%5D=unmanned-aircraft-systems&date_of_occurrence%5Bfrom%5D=&date_of_occurrence%5Bto%5D=

CICTT Factors on Investigations by the AAIB in 2018

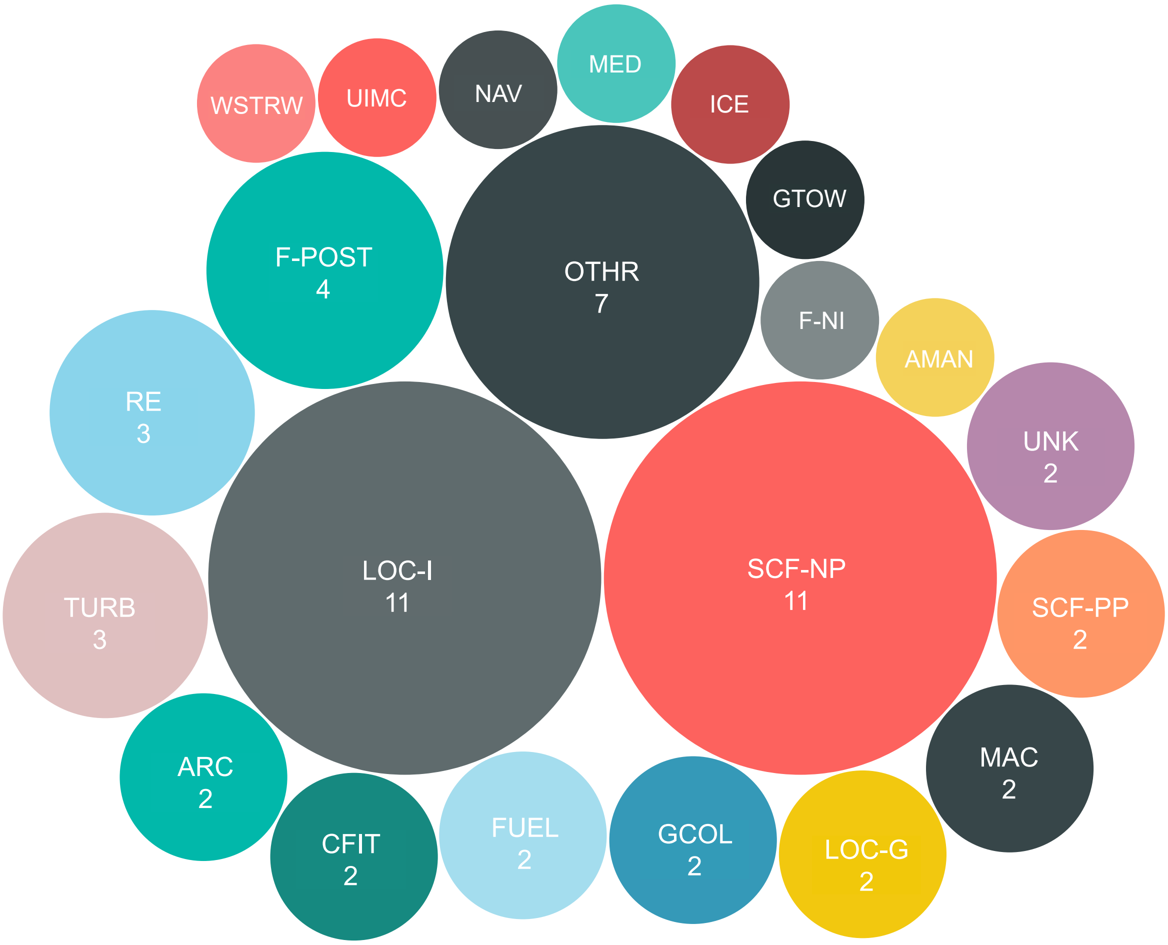
Every occurrence in the UK is recorded on the European Central Repository (ECCAIRS) and is coded using the occurrence taxonomy defined by the CAST/ICAO Common Taxonomy Team (CICTT). This is a worldwide standard taxonomy to permit analysis of data in support of safety initiatives. In the UK the coding of occurrences is carried out by the CAA. It should be noted that they are recorded as multiple factors, for example turbulence (TURB) leading to loss of control in flight (LOC-I). Similarly, other (OTHER) is also used and may include maintenance manual errors or human factors, aspects that do not have specific classifications.



See Appendix 1 for category descriptions

Factors for all investigations reported on by AAIB in 2018

Field investigations



See Appendix 1 for category descriptions

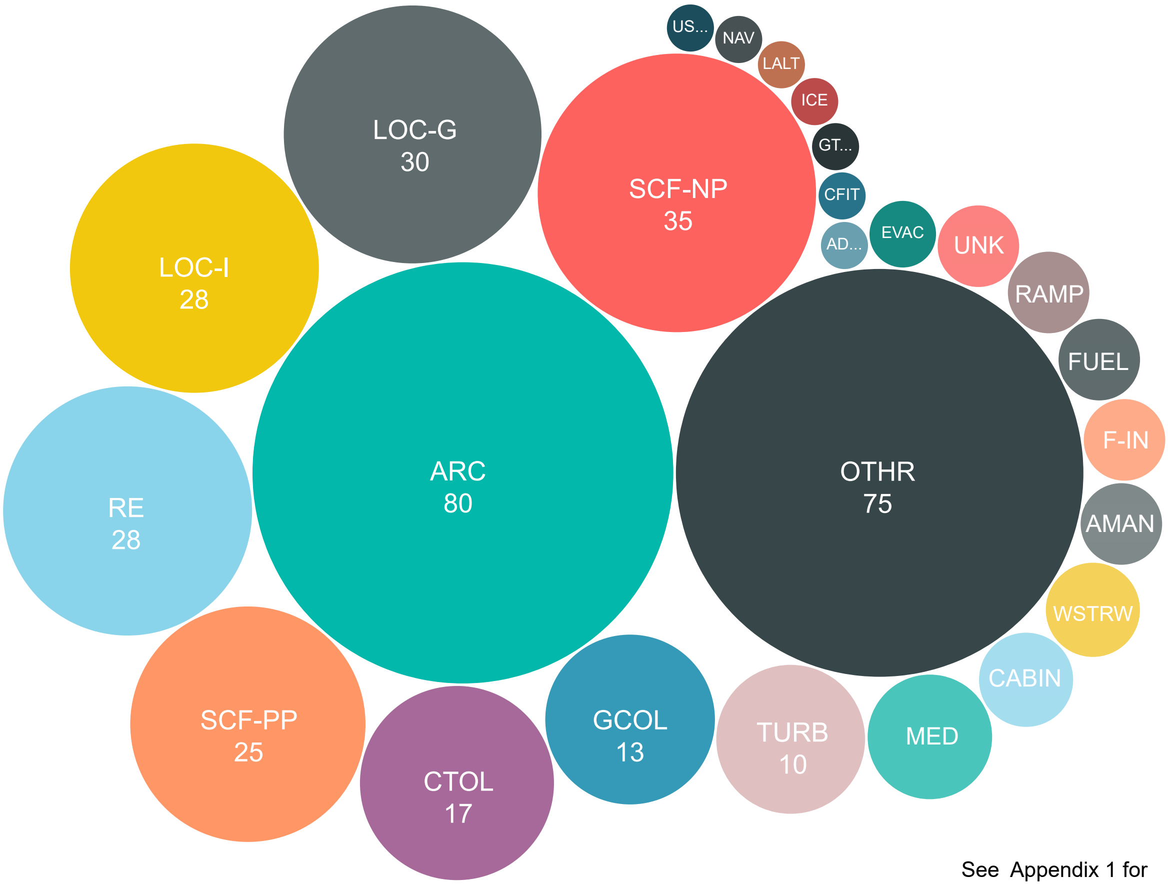
Factors for field investigations reported on by AAIB in 2018

In 2018 the AAIB reported on 31 field investigations, 9 of which were fatal accidents in the UK and 22 were non-fatal accidents or serious incidents.

The 22 non-fatal field investigations that were reported on in 2018 were mostly on serious incidents to commercial air transport (CAT) aircraft. The majority of CAT serious incidents were attributed to system/component failure or malfunction not related to the engines (SCF-NP).

CICTT Factors on Investigations by the AAIB in 2018

Correspondence investigations

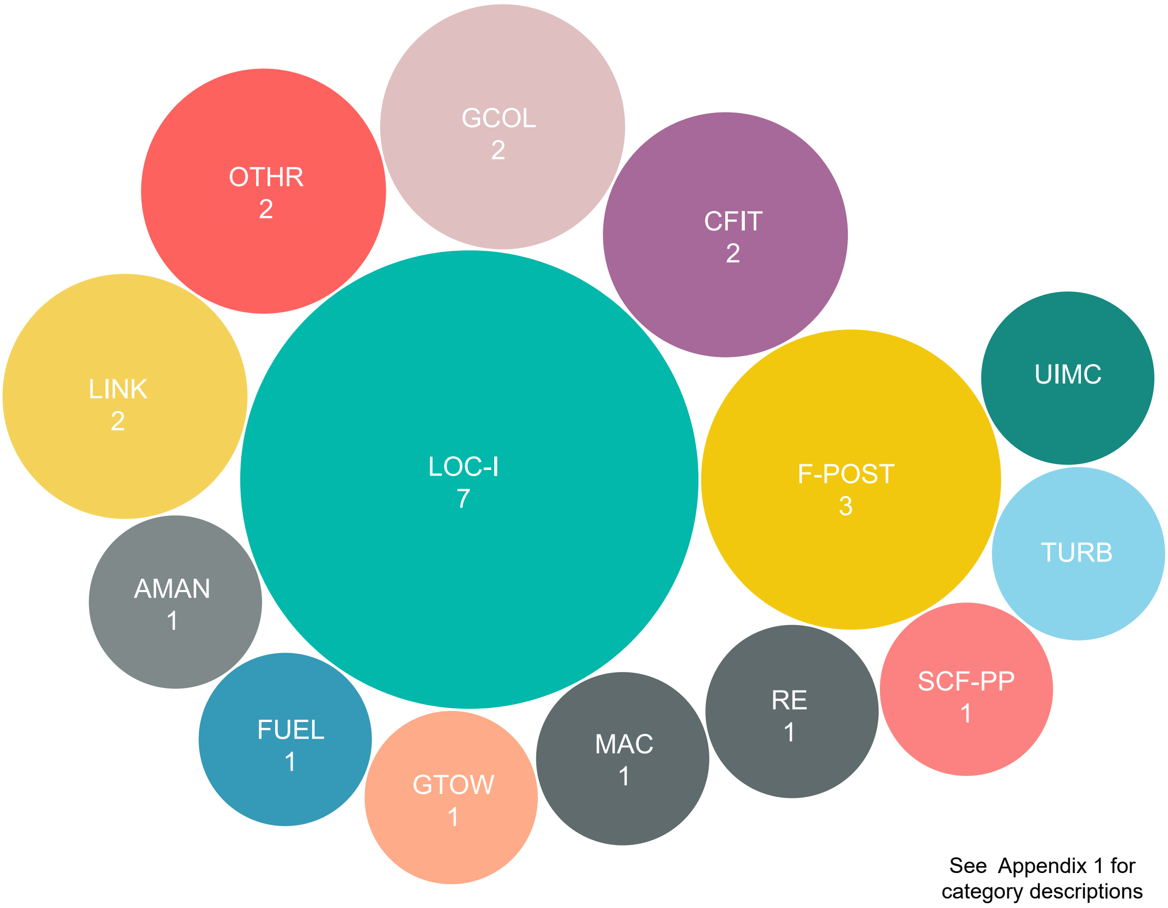


See Appendix 1 for category descriptions

Factors for correspondence investigations reported on by AAIB in 2018

Correspondence investigations are usually conducted on non-fatal accidents on GA aircraft and to some serious incidents on CAT aircraft. The factors most predominant in these occurrences were classified as abnormal contact with the ground (ARC), commonly the result of a hard or bounced landing.

Fatal investigations



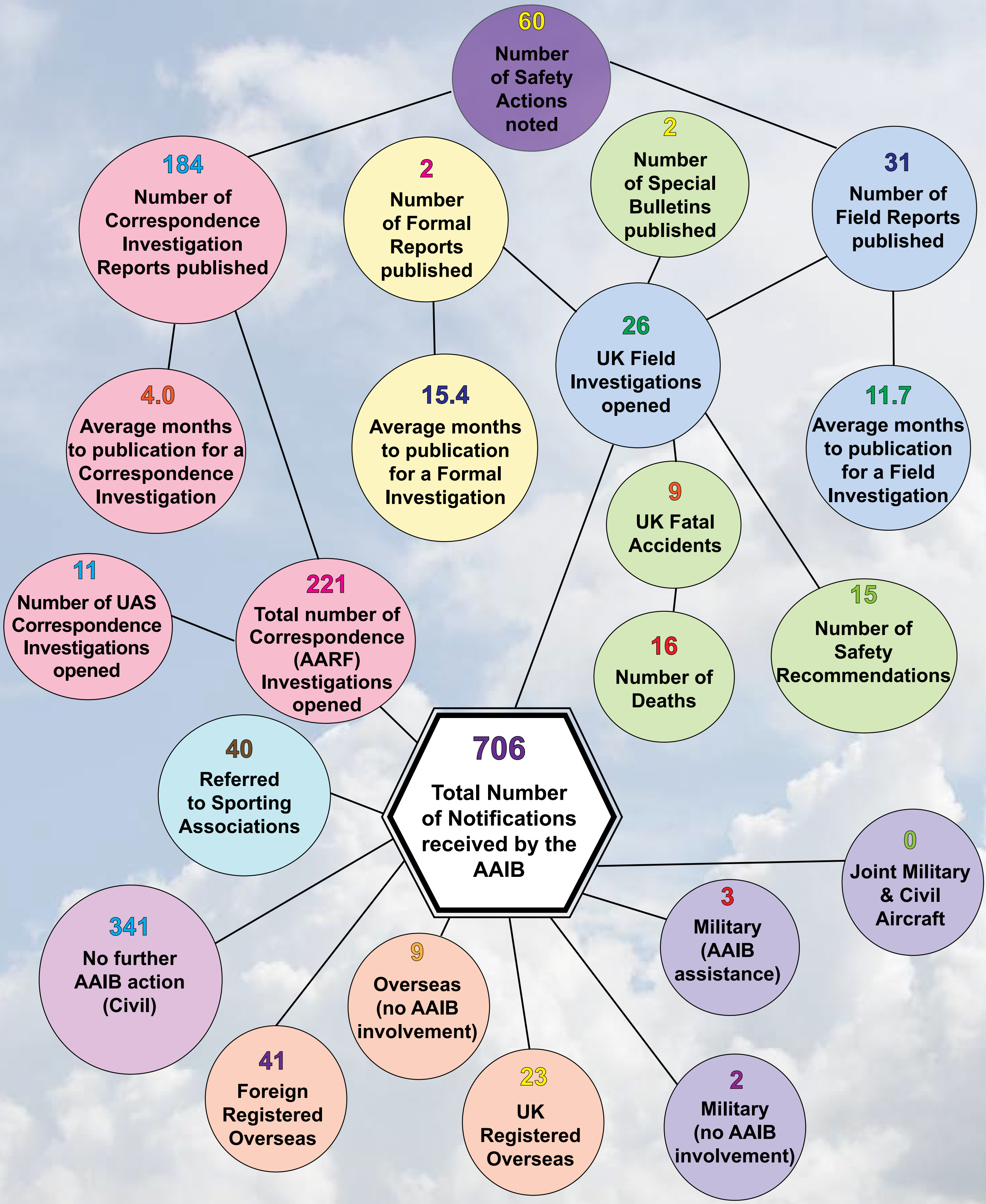
See Appendix 1 for category descriptions

Factors for fatal investigations reported on by AAIB in 2018

The predominant cause of fatal accidents in general aviation, in common with previous years, was loss of control in flight (LOC-I). However, other factors were also identified during our investigations. The post-crash fire (F-POST) is a factor which relates to survivability for the occupants once they are on the ground.

Statistics for 2018

An overview of what we were involved with during 2018 can be seen below:



Introduction

The following pages provide the statistics for 2018, 2017 and 2016, for accidents and serious incidents involving the Air Accidents Investigation Branch.

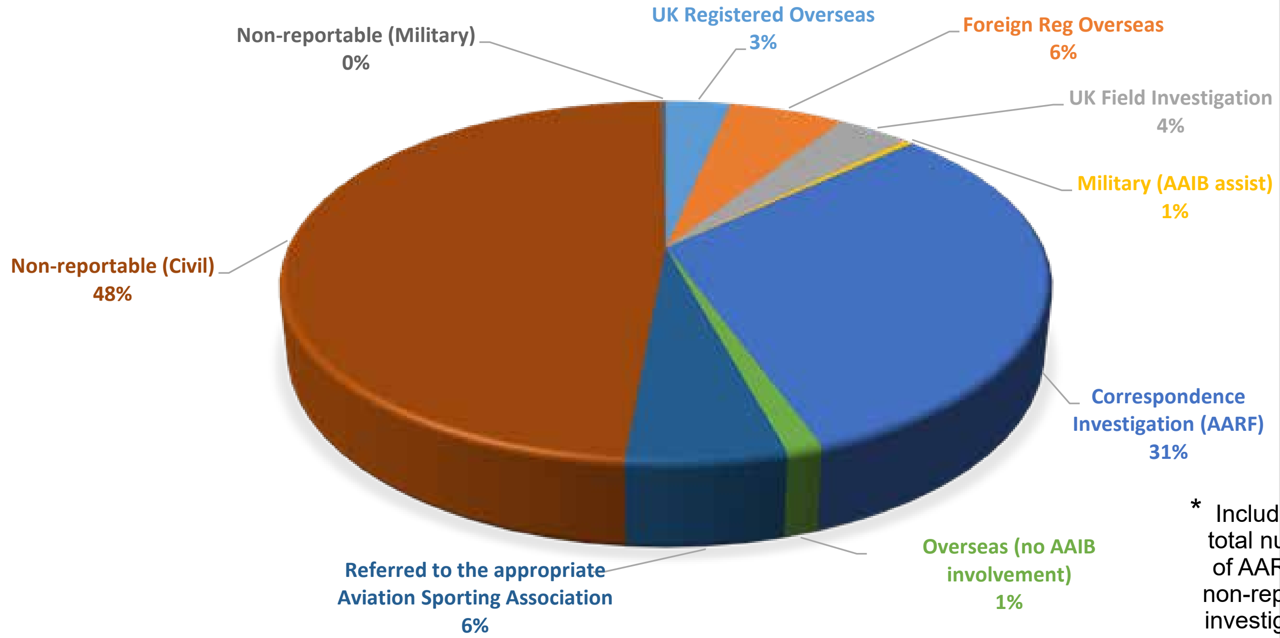
An explanation of the categories is as follows:

Category Definition

UK Aircraft overseas	Investigations involving UK registered aircraft, or aircraft registered in one of the UK Overseas Territories or Crown Dependencies, occurring in a Foreign State where the AAIB has participated in the capacity as the Accredited Representative in accordance with ICAO Annex 13.
Foreign Aircraft overseas	Accidents and serious incident investigations to Foreign registered aircraft occurring in a Foreign State where the AAIB has participated in the capacity as the Accredited Representative or Expert in accordance with ICAO Annex 13.
UK Field Investigations	Investigations involving the deployment of a 'Field' team within the UK or to one of the UK Overseas Territories or Crown Dependencies and those investigations where a team has not deployed but Safety Recommendations are made. Also includes investigations which have been delegated to the AAIB by another State.
Unmanned Aircraft Systems (UAS)	Refer to article on page 7 of this document.
Military with AAIB Assistance	Where an MoD Service Inquiry is convened following an accident / serious incident to a Military aircraft and an AAIB Inspector is appointed to assist.
AARF Investigations	Investigations conducted by correspondence only using an Aircraft Accident Report Form (AARF) completed by the aircraft commander.
Overseas (no AAIB)	Notifications to the AAIB of an overseas event which has no AAIB involvement.
Referrals to Sporting Associations	Investigations referred to the relevant UK Sporting Associations.
No further AAIB action (Civil)	Occurrences notified to the AAIB involving civil registered aircraft which do not satisfy the criteria of an accident or serious incident in accordance with the Regulations.
Military (no AAIB inv)	Notifications to the AAIB concerning Military aircraft with no AAIB involvement.

Notifications 2018

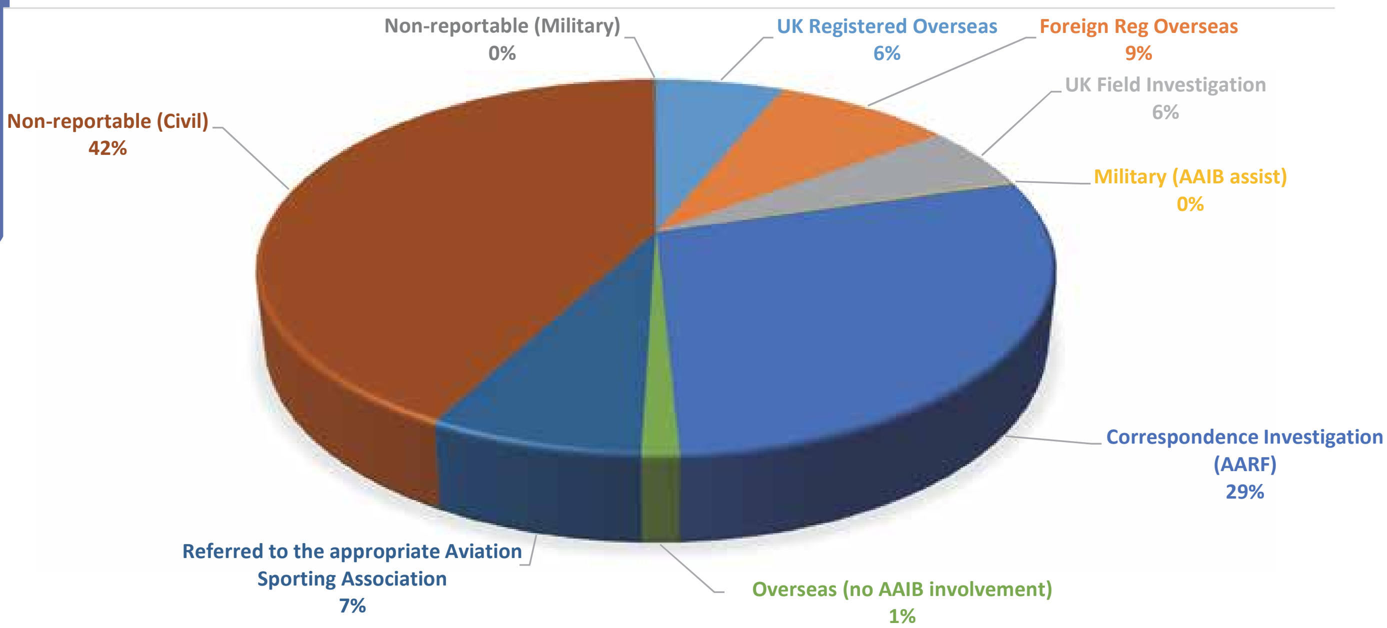
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	2	1	1	2	4	4	3	0	2	4	0	0	23
Foreign Reg Overseas	5	6	3	1	2	5	4	5	1	3	4	2	41
UK Field Investigations	2	4	0	3	2	3	4	2	0	5	1	0	26
Military (AAIB Assistance)	0	0	1	0	0	1	1	0	0	0	0	0	3
Total no of Correspondence Investigations (AARF)	7	14	9	16	28	29	34	24	20	20	12	8	221
Correspondence Investigations (AARF) involving UAS	1	1	0	0	1	1	1	0	2	3	0	1	11*
Overseas (no AAIB involvement)	1	1	1	0	2	0	1	0	1	0	2	0	9
Referred to the appropriate Aviation Sporting Association	1	4	0	3	8	7	6	6	0	3	0	2	40
Total no further AAIB action (civil)	15	22	29	22	28	44	37	50	28	33	23	10	341
Total no further AAIB action (civil) inv UAS	0	0	2	0	1	1	3	2	0	1	1	1	12*
Military (no AAIB involvement)	0	1	0	0	0	0	0	0	1	0	0	0	2
Total	**33**	**53**	**44**	**47**	**74**	**93**	**90**	**87**	**53**	**68**	**42**	**22**	**706**
UK Fatal accidents	**1**	**0**	**0**	**1**	**1**	**3**	**1**	**0**	**0**	**2**	**0**	**0**	**9**
Number of deaths	**2**	**0**	**0**	**2**	**1**	**3**	**1**	**0**	**0**	**7**	**0**	**0**	**16**



* Included in the total numbers of AARF and non-reportable investigations.

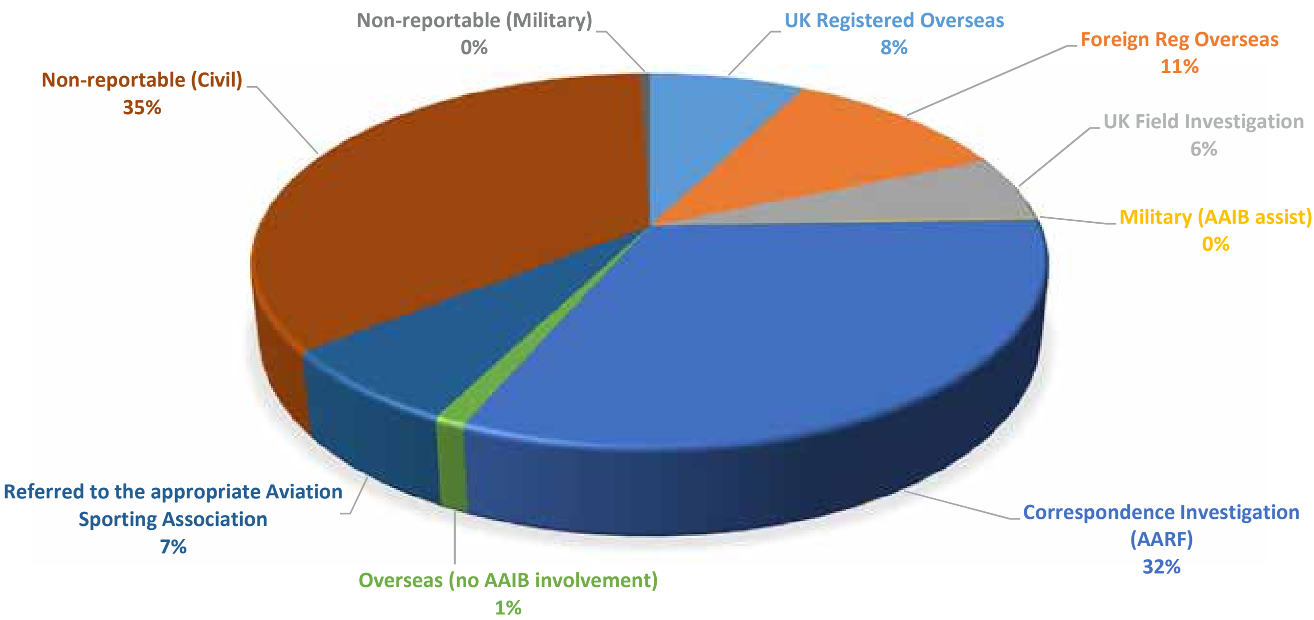
Notifications 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	5	4	3	4	5	4	6	2	5	4	2	0	44
Foreign Reg Overseas	3	3	4	9	6	7	8	4	5	2	3	7	61
UK Field Investigations	2	3	4	2	6	3	2	4	5	1	2	4	38
Military (AAIB Assistance)	0	0	0	0	0	1	0	0	0	0	0	0	1
Correspondence Investigations (AARF)	9	7	15	15	36	29	24	25	17	11	10	6	204
Overseas (no AAIB involvement)	2	1	0	1	0	0	1	1	1	1	0	1	9
Referred to the appropriate Aviation Sporting Association	4	2	1	5	9	9	4	9	3	2	2	2	52
No further AAIB action (civil)	15	19	24	22	22	29	33	27	32	34	18	23	298
Military (no AAIB involvement)	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	**40**	**40**	**51**	**58**	**84**	**82**	**78**	**72**	**69**	**55**	**37**	**43**	**708**
UK Fatal accidents	**1**	**0**	**1**	**1**	**3**	**2**	**1**	**1**	**3**	**0**	**1**	**2**	**16**
Number of deaths	**1**	**0**	**5**	**1**	**4**	**2**	**2**	**2**	**4**	**0**	**4**	**3**	**28**



Notifications 2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	5	3	5	6	6	4	6	4	2	4	3	2	50
Foreign Reg Overseas	1	5	4	7	4	9	3	5	18	8	6	4	74
UK Field Investigations	3	2	2	2	1	3	8	3	3	4	2	5	38
Military (AAIB Assistance)	0	0	0	0	0	0	0	1	0	0	0	0	1
Correspondence Investigations (AARF)	9	15	10	16	19	25	27	31	22	16	8	10	208
Overseas (no AAIB involvement)	1	2	1	1	0	0	0	0	0	2	0	0	7
Referred to the appropriate Aviation Sporting Association	1	2	3	4	4	3	5	9	8	4	0	1	44
No further AAIB action (civil)	18	12	19	20	22	27	29	23	21	11	15	14	231
Military (no AAIB involvement)	0	0	0	1	0	0	0	1	0	0	0	1	3
Total	**38**	**41**	**44**	**57**	**56**	**71**	**78**	**77**	**74**	**49**	**34**	**37**	**656**
UK Fatal accidents	**0**	**0**	**1**	**1**	**1**	**1**	**4**	**1**	**1**	**2**	**0**	**2**	**14**
Number of deaths	**0**	**0**	**1**	**2**	**2**	**2**	**4**	**1**	**2**	**2**	**0**	**2**	**18**

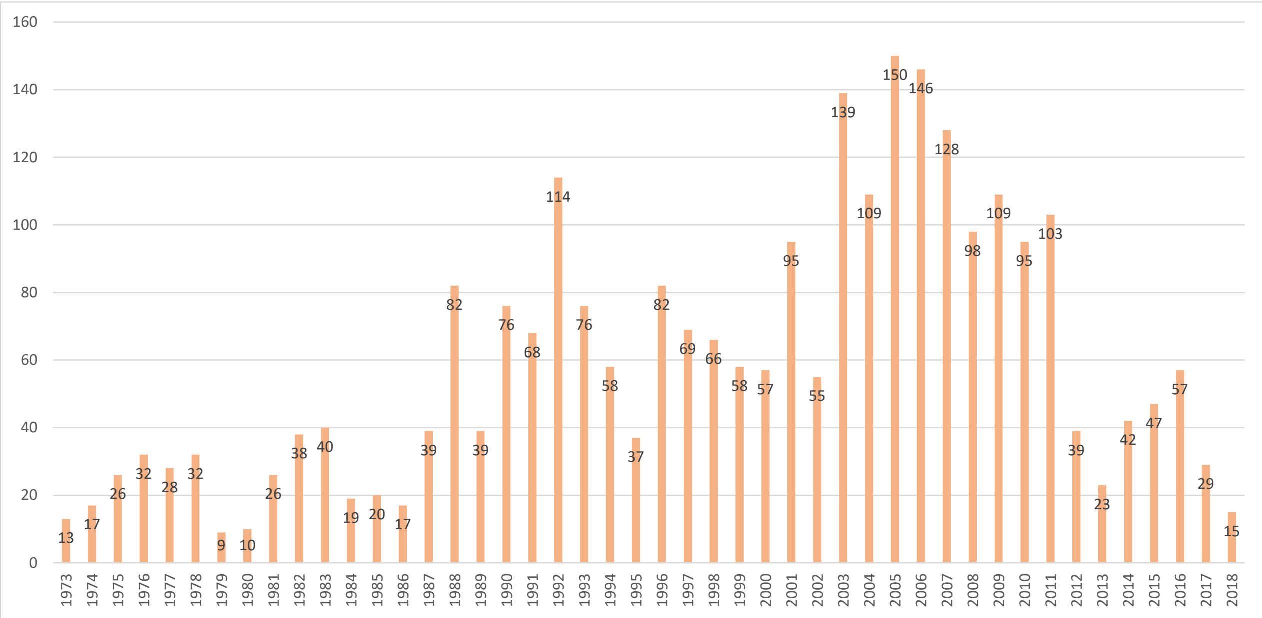


Investigation Statistics

The AAIB organises training courses at its headquarters in Farnborough and overseas

Safety Recommendations in 2018

In 2018 the AAIB issued 15 Safety Recommendations from 8 investigations.



Each Safety Recommendation is classified using the SR Topic taxonomy defined by the European Network of Safety Investigation Authorities (ENCASIA) Working Group 6 (WG6) which the AAIB is a member of. The majority of the Safety Recommendations were dealing with safety issues relating to aircraft operations and safety risk management.

Each addressee to a Safety Recommendation has to respond within 90 days in accordance with European Regulation EU 996/2010 Article 18 and detail what actions have been taken or are under consideration and the time taken for their completion. If no actions are being considered by the addressee they have to provide their reasoning for the decision.

On receipt the AAIB has 60 days in which to assess the response and to inform the addressee on whether it is adequate. If the reply is not adequate or is partially adequate then justification is provided to the addressee.

The responsibility for monitoring the progress of action taken in response to a recommendation lies with the addressee including the authorities responsible for civil aviation safety.

The AAIB will keep open Safety Recommendations where it expects to receive responses from the addressee. If no further response is expected the recommendation is closed. A closed status does not necessarily mean the actions for a Safety Recommendation are complete, nor that the Safety Issue has been addressed.

The chart above shows the recommendation topics. It should be noted that a recommendation can encompass several topics within the classification system.

A '**Not adequate**' assessment means that the response does not address the intent of the Safety Recommendation nor does it address the safety issue concerned.

A '**Partially adequate**' assessment means the response goes someway to meeting the intent of the Safety Recommendation and the action will address the safety issue to a certain extent, but further action would be required to fully address the issue identified.

An '**Adequate**' assessment means that the response fully meets the intent of the Safety Recommendation and the action is expected to address the safety issue.

Of the 15 Safety Recommendations issued in 2018, as of the end of January 2018, responses have been received for 10. Four were assessed to be adequate, 4 were assessed to be partially adequate and 2 have been received recently and are pending AAIB classification. The AAIB is awaiting responses to 5 other recommendations. Following assessment, 6 Safety Recommendations have been closed leaving 9 open at the time of writing.

Each Safety Recommendation is also defined as to whether it is a Safety Recommendation of European Union Wide Relevance (SRUR) or a Safety Recommendation of Global Concern (SRGC). Of those issued in 2018, 7 were SRUR and 8 were SRGC.

The AAIB, as well as all EU Member States, is required to record on the European Central Repository Safety Recommendation Information System (SRIS) all recommendations it raises and the responses received. Data from SRIS is available to view publically at:

http://eccairsportal.jrc.ec.europa.eu/index.php?id=114&no_cache=1

Safety Recommendations issued in 2018

Notes: Safety Recommendation classification correct at the end of December 2018.

Safety Recommendations can also be made through AAIB Special Bulletins and are then also reflected in the final report.

G-GARB EV-97 Teameurostar UK on 18 September 2016

The aircraft was seen cruising at an altitude of around 2,500 ft. At a later point it was seen to pitch nose-up and enter a steep spinning-type descent before striking the ground, resulting in fatal injuries to the pilot and passenger.

The left wing had appeared to fold rearwards in the descent and this was attributed by the investigation to a structural failure near the root of this wing, caused by upward bending of the wing beyond its design limits. No pre-existing material defect, or significant design issue, was found in the wing structure. The failure is most likely to have occurred as a result of an attempted recovery from an inadvertent manoeuvre inducing a structural overload, although the cause of the manoeuvre could not be identified.

It was not possible to determine what events led to the structural overload in this accident but it is of concern that the trim lever in this aircraft type is located in a position, and is of a design, where there is a potential for it to be moved rapidly full-range, either by accident or intent.

There are other microlight aircraft that have pitch trim levers but the LAA and BMAA were not aware of any other that had a pitch trim lever located between the seats as on the EV-97. There have been occasions of inadvertent operation of the trim lever on the EV-97 and the flight evaluation revealed the potential for this causing a significant upset. According to BCAR Section S 677, the trim system should be designed to prevent 'inadvertent, improper, or abrupt trim operation'.

Safety Recommendation 2018-001 made on 2 February 2018

It is recommended that the Civil Aviation Authority require the Light Aircraft Association, the British Microlight Aircraft Association, Light Sport Aviation Ltd and Evektor to conduct a joint review of the design and location of the pitch trim mechanism on the EV-97 Teameurostar UK, and the amateur-built EV-97 Eurostar, to identify whether modification is required to prevent inadvertent, improper or abrupt input.

Response Adequate – Closed

Safety Recommednation and Safety Action Overview

N603AB Cessna 402C on 11 February 2017

The aircraft landed at Virgin Gorda in conditions (of weight, altitude, temperature and surface condition) where the landing distance required was very close to the landing distance available and without the required safety margin. Hence, when the performance of the brakes was not as expected, probably due to debris in the braking system, the aircraft could not be stopped on the runway.

Analysis of the maintenance state of the aircraft involved in this accident indicated that the maintenance capability, processes and planning of its operator were not consistent with the standards expected in conducting international passenger charter services. This appeared also to be the case for the operational procedures and data management.

Safety Recommendation 2018-002 made on 1 March 2018

It is recommended that the Federal Aviation Administration review the maintenance capability, processes and planning of Air Sunshine to ensure that they are sufficiently robust for conducting international passenger charter services.

Response Partially Adequate – Closed

Safety Recommendation 2018-003 made on 1 March 2018

It is recommended that the Federal Aviation Administration review the operations data management and operating procedures of Air Sunshine to ensure that they are sufficiently robust for conducting international passenger charter services.

Response Partially Adequate – Closed

G-CKLR SZD-55-1 on 8 April 2017

During a towed launch, the glider was seen to climb rapidly. After disconnecting from the tow rope with a very high pitch angle, the glider rolled to the right and descended before hitting the ground in a nose-down attitude. The pilot was fatally injured.

The investigation determined that the elevator control connection had not been correctly made when the glider was rigged and this condition was not detected prior to the flight. Consequently, during the launch, the glider would have had no effective elevator control and the pilot would have been unable to control the pitch of the glider.

It was found that an historic and unapproved modification to the glider significantly increased the opportunity for mis-rigging. As a result, the European Aviation Safety Agency have taken safety action to mandate an inspection of similar gliders.

It was not established if, or how, a positive control check was performed by the pilot of G-CKLR after completion of its rigging. However, the guidance in the BGA Safety Briefing Leaflet could be interpreted to mean that these checks are not required for gliders with automatically-connecting controls. The following Safety Recommendation is therefore made:

Safety Recommendation 2018-004 made on 1 March 2018

It is recommended that the British Gliding Association review its policy on the need for positive control checks on gliders with automatically-connecting controls and, where appropriate, amend its relevant publications including the Safety Briefing Leaflet entitled 'Is your glider fit for flight?'.

Response Adequate – Closed

OK-LAZ Let L-410UVP-E on 23 February 2017

The aircraft departed Isle of Man (Ronaldsway) Airport (IOM) on a commercial flight to Belfast City Airport (BHD), in a region affected by a deep low pressure system with associated strong surface winds. After one unsuccessful attempt to land at BHD in a strong crosswind, the crew diverted back to IOM.

When the aircraft landed at IOM the wind was gusting to 63 kt and creating a maximum crosswind component of 40 kt. After touchdown, nearby witnesses saw the right mainwheel lift off the ground and they estimated the left wingtip rolled to within approximately one metre of the runway surface before the landing was successfully completed.

The relevant maximum demonstrated crosswind component for the Let L-410 was 19.4 kt and this was included in the 'Performance Limitations' section of the Airplane Flight Manual (AFM) but the aircraft operator did not apply a limiting component of crosswind to its operations. The only wind limit that was applied and used by the crew was 45 kt for ground operation.

As a result of this serious incident the CAA of the Czech Republic stated that several safety actions have been completed, including:

1. The aircraft operator has increased the time allocated between crew report and the scheduled departure time to 60 minutes and incorporated this in the operations manual Part A.

2. The aircraft operator has updated the crosswind limits in OM Part B. No details of the changes have been provided except a statement that the OM now offers guidance for taking off and landing in a crosswind, and that the EASA SIB 2014-20 has been taken into account.

3. The CAA of the Czech Republic has also stated that recent audits of the aircraft operator have focussed on hazard identification and safety risk management, with particular focus on operations in hazardous weather conditions.

These safety actions address some of the factors identified in this report but there appears to be a number of issues concerning operational control and supervision which still require attention. While this investigation highlighted certain of the operator's policies and procedures which did not comply with regulatory requirements, it is possible that there are areas outside the scope of this investigation that may also require review. To ensure that the aircraft operator's processes and procedures are effectively compliant with the applicable regulations the following safety recommendation is made:

Safety Recommendation 2018-005 made on 1 March 2018

It is recommended that the Civil Aviation Authority of the Czech Republic review Van Air's operational processes, training and operator's guidance to ensure that they are effectively compliant with the applicable regulations for commercial air transport operations.

Response Adequate – Closed

G-WNSR Sikorsky S-92A on 28 December 2016

The helicopter was being operated from Aberdeen on a contract on behalf of an offshore oil and gas company. On 27 December 2017, during a flight on the day prior to the accident, the Health and Usage Monitoring System (HUMS) recorded vibration data which contained a series of exceedances related to the tail rotor pitch change shaft (TRPCS) bearing. Routine maintenance was carried out overnight which included a download and preliminary analysis of the HUMS data. While an anomaly for tail rotor gearbox (TGB) bearing energy was detected by the maintenance engineer, the exceedances were not identified, in part, due to the way they were presented in the analysis tool; the helicopter was released to service without further investigation.

The investigation identified that had HUMS exceedance data been available on the helicopter in near real time, the flight crew would have had at least two pre-departure opportunities to safely abort the flight.

Additionally, should G-WNSR have had such a capability, it is considered likely that, after the initial incident and re-land on the Elgin, the flight crew would have made use of it and that it would have informed their judgement as to whether to depart for the West Franklin.

Furthermore, given the circumstances of this event and the short timescale over which the problem developed, providing flight crews with a simple means to establish the health and serviceability of their helicopter whilst away from a maintenance base could be the only effective barrier remaining to prevent an accident.

Safety Recommendation 2018-006 made on 13 March 2018

It is recommended that the European Aviation Safety Agency commission research into the development of Vibration Health Monitoring data acquisition and processing, with the aim of reducing the data set capture interval prescribed in the Acceptable Means of Compliance to CS 29.1465 and thereby enhancing the usefulness of VHM data for the timely detection of an impending failure.

Response Adequate – Closed

Safety Recommendation 2018-007 made on 13 March 2018

It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that Vibration Health Monitoring data gathered on helicopters is analysed in near real-time, and that the presence of any exceedance detected is made available to the flight crew on the helicopter; as a minimum, this information should be available at least before take-off and after landing.

Response Partially Adequate – Open

G-ZBKF Boeing 787-9 on 29 April 2017

The aircraft was on a scheduled flight from London Heathrow to New Delhi, India. The aircraft was dispatched in accordance with the Minimum Equipment List (MEL) with the left air conditioning (AC) system disabled. Shortly after reaching FL350 the crew were alerted by EICAS that the cabin altitude was increasing above normal, triggered at 8,500 feet. With no additional Environmental control system (ECS) actions available to control cabin altitude, the flight crew initiated a descent. During this descent the cabin altitude exceeded 10,000 ft and the crew completed the relevant emergency actions.

The loss of cabin pressurisation was caused by detachment of the lower right air conditioning recirculation fan duct on a sector where the left air conditioning system had been disabled before flight. As a consequence of this finding, the Aircraft Maintenance Manual has been amended to alter the process of replacing the relevant recirculation fan and maintenance procedures to react to a related Maintenance Alert Message have been altered.

The investigation also identified a software problem related to the volume of the cabin decompression pre-recorded announcement (PRA) in the passenger cabin and makes three Safety Recommendations, concerned with the testing of the installed performance of CVR systems.

A review of the cockpit area microphone (CAM) recordings for the Boeing 787 indicated that airflow in the cockpit from the equipment cooling system appeared to contribute to the high level of ambient background noise, as a significant reduction in background noise is apparent on the CAM recording when the system was turned off. Discussions further indicated that the level of ambient background noise recorded by the CAM may not truly represent that experienced by a human observer in the cockpit. This indicates that the CAM installation is not optimised.

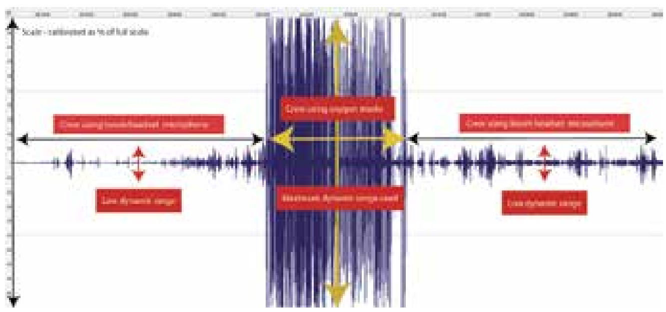
The NTSB has previously made Safety Recommendation A-14-126 to address the performance of the CAM recording on the Boeing 787. As of April 2018 this Safety Recommendation remains 'OPEN', awaiting a final response from the FAA. Therefore, although issues were found in this incident that are similar to those that caused the NTSB to issue Safety Recommendation A-14-126, the AAIB considers that it is not necessary to make a further Safety Recommendation on this subject.

However, this AAIB investigation has highlighted an additional issue with the Boeing 787 CVR performance. A significant difference exists between the recorded dynamic range when the headset and oxygen mask microphones are used. The aircraft manufacturer attenuated the sidetone signal so that ATC communications did not inadvertently mask the crew speech when using the headset microphone. However, when the oxygen masks are used, the sidetone signal can be easily obscured due to the much higher signal level of the oxygen mask microphone. The aircraft manufacturer was aware of this during certification, but considered that it was acceptable.

Although audio processing techniques may be applied to reduce the effect of the issues identified with the CVR recordings of the crew and CAM channels, it is not always possible to recover quieter background sounds and speech. Consequently, information that may be of significance to an investigation may be lost.

Safety Recommendation 2018-008 made on 5 July 2018

It is recommended that the Federal Aviation Administration require Boeing to modify the audio system fitted to the Boeing 787, so that sidetone signals recorded on the cockpit voice recorder crew channels are not masked when flight crew oxygen mask microphones are in use.



Response Received - pending AAIB classification

Safety Recommendation and Safety Action Overview

Safety Recommendation 2018-009 made on 5 July 2018

It is recommended that the European Aviation Safety Agency initiate a review to consider whether a repeatable and objective analysis technique can be applied to audio recordings to establish consistent installed performance of cockpit voice recorder systems.

Response Partially Adequate – Open

Safety Recommendation 2018-010 made on 5 July 2018

It is recommended that the European Organization for Civil Aviation Equipment (EUROCAE) amend their document 'Minimum Operational Performance specification for Crash Protected Airborne Recorder Systems' (currently ED-112A) to include a repeatable and objective analysis technique to establish consistent installed performance of cockpit voice recorder systems.

Response Received - pending AAIB classification

LX-VCF Boeing 747-8R7F on 30 March 2017

Following an uneventful scheduled cargo flight, it became apparent after landing that a large quantity of fuel had leaked from a Bell 412EP helicopter which was being shipped as cargo on the main deck of the freighter aircraft. The escaped fuel then made its way through the lower deck and spilled onto the airport apron. Airport Rescue and Fire Fighting Services (RFFS) attended the aircraft to contain the fuel spill and manage the associated risk of fire and explosion.

The investigation determined that the helicopter, which was disassembled and prepared for transportation some months prior to the incident, had not been shipped in accordance with the required provisions for transportation of such vehicles by air. In particular, the helicopter had not been drained of fuel prior to transportation. Approximately 322 litres of fuel escaped from the helicopter during the flight.

Correspondence and documentation relating to the sale of the helicopter indicated that the seller would assist the buyer in disassembly and preparation of the helicopter for transportation, under the supervision of the buyer's representatives. The buyer believed that these preparations would include defuelling of the helicopter. The seller considered that all transportation matters were the responsibility of the buyer, but was aware of the intention for the helicopter to be transported as air cargo.

Notwithstanding the issue of where the contractual commitment for preparation and defuelling of the helicopter lay, the disassembly of the helicopter and preparations for its transport took place at the seller's facility and were conducted by its staff, despite a substantial amount of fuel remaining on the helicopter. The buyer assumed that the helicopter would be prepared in accordance with guidance published by the helicopter manufacturer, which recommends defuelling as part of the preparations for transportation. The preparations also included packaging of the helicopter using an open flame, which would have represented a significant health and safety risk to those involved. Neither the seller's staff undertaking the disassembly, nor the buyer's representatives who were subsequently in attendance, identified the fact that a substantial amount of fuel remained onboard the helicopter prior to it being packaged and transported.

Safety Recommendation 2018-011 made on 11 July 2018

It is recommended that Bristow US LLC review their procedures relating to the preparation of helicopters for air transportation to ensure they are defuelled.

△ **Response Awaited – Open**

C-FWGH Boeing 737-86J on 21 July 2017

At 1539 hrs on 21 July 2017, a Boeing 737-800 took off from Belfast International Airport (BFS) with insufficient power to meet regulated performance requirements. The aircraft struck a supplementary runway approach light, which was 36 cm tall and 29 m beyond the end of the takeoff runway.

An outside air temperature (OAT) of -52°C had been entered into the Flight Management Computer (FMC) instead of the actual OAT of 16°C. This, together with the correctly calculated assumed temperature thrust reduction of 48°C, meant the aircraft engines were delivering only 60% of their maximum rated thrust. The low acceleration of the aircraft was not recognised by the crew until the aircraft was rapidly approaching the end of the runway. The aircraft rotated at the extreme end of the runway and climbed away at a very low rate. The crew did not apply full thrust until the aircraft was approximately 4 km from the end of the runway, at around 800 ft aal.

The aircraft manufacturer released two service bulletins, prior to this serious incident, detailing the procedure to update the FMC OPS software and the CDS to the BP15 standard on Boeing 737NG aircraft. The aircraft manufacturer recommends that all Boeing 737NG operators embody both service bulletins by January 2019 but such action is not compulsory.

Therefore, given the potential consequences of departing with an incorrectly set N1, and because this serious incident would have been prevented by the OAT crosscheck, the AAIB made Safety Recommendation 2017-016 in Special Bulletin S2/2017. The recommendation asked the FAA to take measures to ensure the OAT crosscheck capability was incorporated into Boeing 737NG aircraft. In its initial response, the FAA stated that it needed to gather more information on the implications of this recommendation before replying more substantively, which it undertook to do by December 2018.

A small number of older Boeing 737 aircraft, which predate the Boeing 737NG series, are also able to implement the OAT crosscheck, so the following Safety Recommendation is made which supersedes Safety Recommendation 2017-016:

Safety Recommendation 2018-012 made on 14 November 2018

It is recommended that the Federal Aviation Administration mandate the use of Flight Management Computer OPS software revision U12.0, or later, and the Common Display System Block Point 15 update where this is required, to enable the outside air temperature crosscheck on all applicable Boeing 737 aircraft.

△ **Response Awaited – Open**

The electronic flight bag (EFB) used to calculate the takeoff data complied with the Canadian AMC document and was approved for use as a performance tool. However, there was no requirement to display the calculated N1, the parameter which defines each engine's thrust and, therefore, determines the aircraft's ability to meet takeoff performance requirements. Had N1 been displayed on the EFB, it would have allowed the pilots to crosscheck the value of N1 calculated by the FMC. Had they done so, they would have noticed the significant difference between the two calculated figures and investigated the discrepancy, and this would have probably prevented this serious incident. However, whilst the aircraft manufacturer required the crews to verify the N1, there was no specified procedure to do so.

An N1 crosscheck would also highlight other errors that have caused serious incidents and accidents, including selecting the wrong fixed derate and entering an incorrect assumed temperature. Such errors would not be picked up by the automated OAT crosscheck which would only identify erroneous OAT entries. However, the errors would lead to a discrepancy between the EFB and FMC-calculated N1 and, if the N1 figures were crosschecked by the crew, there would be an opportunity for these additional types of errors to be picked up and corrected before they led to an incident or accident. For aircraft not equipped with EFBs, a crosscheck of FMC-calculated N1 against an alternative, independently-calculated value would increase the likelihood of identifying the error.

Safety Recommendation 2018-013 made on 14 November 2018

It is recommended that the Boeing Commercial Airplanes give guidance to operators of Boeing 737 aircraft on how they might verify the FMC-calculated value of N1 against an independently-calculated value.

△ **Response Awaited – Open**

EUROCAE WG-94 concluded that it was not possible to develop standards and operational conditions for Takeoff Performance Monitoring Systems (TOPMS). Based on this, EASA responded to the Dutch Safety Board recommendation on TOPMS stating that, because the feasibility of TOPMS had not been demonstrated, no specifications could be developed. This report has demonstrated the feasibility of Takeoff Acceleration Monitoring Systems (TAMS), a simpler system than TOPMS which, nevertheless, has the potential to prevent potentially catastrophic accidents related to incorrectly-calculated takeoff performance.

Safety Recommendation 2018-014 made on 14 November 2018

It is recommended that the European Aviation Safety Agency, in conjunction with the Federal Aviation Administration, sponsor the development of technical specifications and, subsequently, develop certification standards for a Takeoff Acceleration Monitoring System which will alert the crew of an aircraft to abnormally low acceleration during takeoff.

△ **Response Awaited – Open**

The aviation industry has been concerned about aiding pilot decision-making during takeoff at least since the accident to a McDonnell Douglas DC-8 at Anchorage, USA in 1970. Following that accident the NTSB made a recommendation related to a crew's ability to 'appraise the aircraft's acceleration to V1 speed'. Following the accident to a McDonnell Douglas DC-10 at Boston, USA in 1982, the industry began actively considering an automated Takeoff Acceleration Monitoring System. Since then, there have been numerous incidents and accidents related to abnormal takoff performance leading to recommendations from the AAIB in the UK, the ATSB in Australia, the BEA in France, the NTSB in the USA, the TSB in Canada and the DSB in the Netherlands.

Safety Recommendation 2018-015 made on 14 November 2018

It is recommended that the International Civil Aviation Organization note the conclusions of this report and introduce provisions addressing Takeoff Acceleration Monitoring Systems.

△ **Response Awaited – Open**

Safety Actions from investigations reported on in 2018

Early in an investigation the AAIB will engage with authorities and organisations which are directly involved and have the ability to act upon any identified safety issues. The intention is to prevent recurrence and to that end to encourage proactive action whilst the investigation is ongoing and not for those involved to wait for the issue of official Safety Recommendations.

When safety action is taken, it may mean there is no need to raise a Safety Recommendation as the safety issue may have been addressed. However, if the issue remains then a Safety Recommendation will be raised. The published report details the safety issues and the safety action that has taken place, usually with a green highlight. In 2018 safety actions directly as a result of AAIB investigations were recorded on two formal investigations, two Special Bulletins, nineteen field investigations and sixteen correspondence investigations.

FORMAL INVESTIGATIONS

Sikorsky S-92A, G-WNSR on 28 December 2016

The details of this accident are shown under Recommendation 2018-006 and 2018-007 shown under Safety Recommendations Issued in 2018 of this Annual Safety Review.

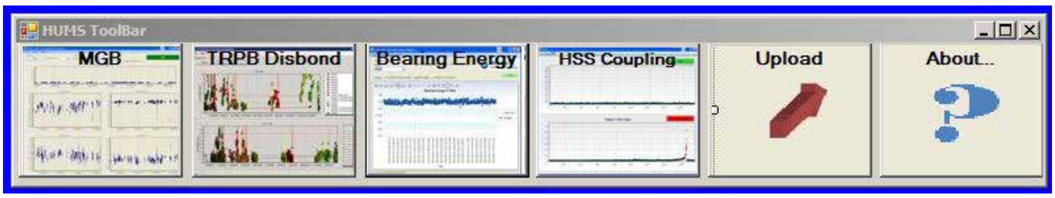
Safety issues – HUMS procedures, component failure, airworthiness

AAIB Special Bulletin

The AAIB published Special Bulletin S1-2017 which provided the initial facts of this investigation. The Special Bulletin presented the following safety actions:

Safety action by the helicopter operator

The operator subsequently introduced a number of measures to further strengthen the ability to detect impending bearing degradation. These included: a review of all HUMS data to ensure no anomalies, fleet-wide borescope inspections and a requirement for HUMS to be serviceable before flight. The operator also reviewed their HUMS processes and analytical procedures, correcting the omission in the documentation of the use of the IMDHUMS ToolBar analysis tools. They also introduced a requirement for an additional assurance check to be carried out by a second licensed engineer prior to releasing the helicopter to service.



Safety action by the helicopter manufacturer

On 31 December 2016 the helicopter manufacturer issued to all operators an 'All Operators Letter' (AOL), CCS-92-AOL-16-0019, which described the event. It emphasised the use of the HUMS Tail Gearbox Bearing Energy Tool, provided on the ground station, to detect a TRPCS bearing that is experiencing degradation, and recommended that this tool was utilised as often as reasonably possible.

Alert Service Bulletin 92-64-011 was issued by the manufacturer on 10 January 2017 and introduced a once-only inspection of the TRPCS and bearing assembly for ratcheting, binding, or rough turning. It also called for a review of the HUMS Tail Gearbox Bearing Energy Tool. The manufacturer recommended that compliance was essential and to be accomplished prior to the next flight from a maintenance facility; three flight hours are allowed in order to return directly to a maintenance facility. The once-only inspection was mandated by FAA Airworthiness Directive (FAA AD) 2017-02-51 issued on 13 January 2017 and added a requirement to carry out a 10-hourly borescope inspection of the bearing in situ until further notice.

Concurrent with the release of ASB 92-64-011, the manufacturer published Temporary Revision 45-03 to require operators to use S-92A HUMS ground station software to review Tail Rotor Gearbox energy analysis CIs for alert conditions on a reduced flight hour interval. CIs in excess of published alert levels required inspection of the pitch change shaft and bearing.

The manufacturer developed a temperature sensing plug which could be retrofitted to in-service TRPCSs to establish fleet-wide trends. The temperature sensing plug installation was carried out under the authority of ASB 92-64-012, issued on 9 March 2017 with a scheduled compliance date of 13 April 2017.

On 24 March 2017 the manufacture issued All Operators Letter CCS-ALL-AOL-17-0008 to remind users of the IMD software of the approved zoom and undo zoom commands for interrogating the HUMS CI data. It also informed users that the IMD software would be obsolete in the near future and that the maintenance manual revisions for the SGBA were now available.

The helicopter manufacturer has worked with the bearing manufacturer to identify and implement a number of improvements to the bearing manufacturing process. An improved end play measuring tool has been introduced in order to carry out more accurate measurement and bearing setting up during assembly. The grease is now drawn from sealed cartridges and injected into the races using a syringe to ensure a more consistent distribution. The bearing is also now weighed before and after grease application.

Safety action by the helideck operator

Since the accident the '*Helicopter Occurrence - Communication Process*' procedures for the helideck operator's UK operations have been revised to include a requirement to report an accident or serious incident to the AAIB.

Helideck certification safety action

The Helideck Certification Agency will bring this case to the attention of the CAA and the ICAO Heli Deck Working Group (HDWG) to consider whether the assumptions used in the regulations remain valid in the light of this accident.

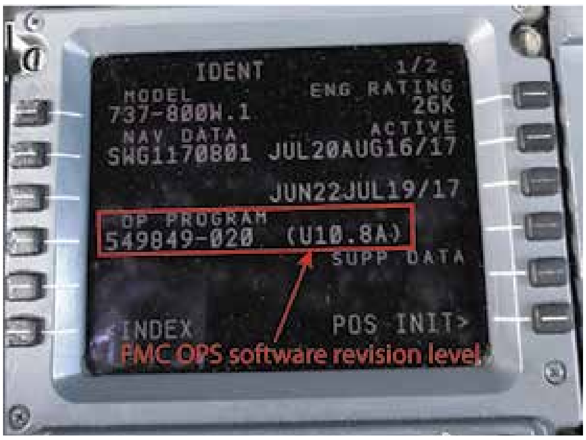
Boeing 737-86J, C-FWGH on 21 July 2017

The details of this accident are shown under Recommendation 2018-012 to 2018-015 shown under Safety Recommendations Issued in 2018 of this Annual Safety Review.

Safety issues – Flight management computer data input error, human factors

Safety Action by the aircraft operator

As a result of the initial findings of this investigation into this serious incident the aircraft operator began a programme of upgrading their fleet of B737s to FMC Update 13 and cockpit display unit (CDU) BP15 in order that the OAT alerting function would be available. They also updated their EFB software to display N_1 and included a crosscheck of this figure in their SOPs.



Safety Action by the UK CAA

After this serious incident, the CAA amended MATS Part 1 such that the senior controllers at ATSUs providing air traffic services at an aerodrome are required to notify the AAIB by telephone as part of their initial reporting actions following an aircraft accident or serious incident.

The CAA also amended Civil Aviation Publication (CAP) 797, *Flight Information Service Officer Manual,* to require air traffic services personnel to notify the AAIB by telephone as part of their initial reporting actions following an aircraft accident or serious incident.

In addition to the action above, a link to Regulation (EU) 996/2010 was put into MATS Part 1 and CAP 797 pointing to typical examples of what are likely to be classified as serious incidents.

SPECIAL BULLETINS

Agusta AW169, G-VSKP on 27 October 2018 S1/2018 and S2/2018

This accident is the subject of an ongoing AAIB investigation.

Between 1900 hrs and 1930 hrs the pilot and four passengers boarded the helicopter for a flight to London Stansted Airport. The helicopter started up at 1934 hrs and at 1937 hrs it lifted from the centre circle, yawed 15° left and moved forward a few metres. The helicopter then began a climb on a rearward flight path while maintaining a northerly heading. Gear retraction started as it passed through a height of approximately 320 ft. The climb then paused. Heading changes consistent with the direction of pedal movements were recorded initially, then the helicopter entered an increasing right yaw contrary to the pilot's left pedal command. The helicopter reached a radio height of approximately 430 ft before descending with a high rotation rate.

The helicopter struck the ground in an approximately upright position on a stepped concrete surface, with the landing gear retracted, and rolled onto its left side. The helicopter was rapidly engulfed in an intense post-impact fire.

Safety issue – Loss of yaw control in flight

Safety action by the manufacturer

The manufacturer of the helicopter has issued Alert Service Bulletin (ASB) 169120 for AW169 helicopters, giving instructions for a precautionary inspection of the tail rotor control assembly on all helicopters in the global fleet. The manufacturer also issued ASB 189-213 for AW189 helicopters, which have a similar tail rotor control system.

Safety action by EASA

These inspections have been mandated by the EASA, in its capacity as the regulator responsible for the type design approval of the AW169 and AW189. Airworthiness Directive 2018-0241-E has been issued to accomplish this.

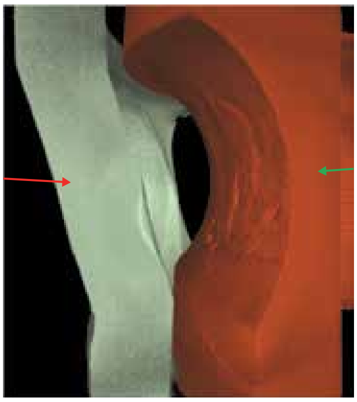
The second Special Bulletin S2/2018 provides information on the findings to date of a detailed examination of the helicopter's yaw control system.

Safety issue – component airworthiness

Safety actions by the manufacturer and EASA

On 19 November 2018 the EASA issued AD 2018-0250-E, superseding AD 2018-0241-E, to require a precautionary one-time inspection of the tail rotor duplex bearing and, depending on findings, applicable corrective actions.

On 21 November 2018 the helicopter manufacturer published Emergency Alert Service Bulletin ASB169-125 for AW169 helicopters, and ASB189-214 for AW189 helicopters, giving further instructions for a one-time inspection of the tail rotor duplex bearing. The EASA issued AD 2018-0252-E on 21 November 2018, superseding AD 2018-0250-E and mandating this inspection.



On 30 November 2018 the helicopter manufacturer published Emergency Alert Service Bulletin ASB 169-126 for AW169 helicopters, and ASB 189-217 for AW189 helicopters, introducing repetitive inspections of the castellated nut that secures the tail rotor actuator control shaft to the actuator lever mechanism, and the tail rotor duplex bearing. The EASA issued AD 2018 0261 E on 30 November 2018 mandating the repetitive inspections.

FIELD INVESTIGATIONS

Schleicher ASW 24, G-CFNG on 4 December 2016

During a glider winch launch in turbulent conditions the weak link parted. The pilot attempted to fly a circuit to land near the launch point but the glider encountered significant sink and had insufficient energy to complete the intended circuit. The pilot sustained fatal injuries in the impact with the ground.

Safety issues – HF, decision making, turn back

Safety action by the BGA

In February 2017 the BGA published a leaflet 'Safe Winch Launching – Land ahead if safe to do so' and this material was put on the BGA Website. It contained the following text:

'*The instructors' manual and the safe winch launch leaflet/booklet teach:*

> *After power loss in mid-launch, adopt the recovery attitude, wait until the glider regains a safe approach speed, and land ahead if it is safe to do so.*

Why not turn? The BGA has been teaching 'do not turn' because:

> *After a push-over the airspeed can be less than the attitude would suggest turning before the glider has accelerated to a safe speed after a launch failure can cause the glider to spin.*

After commencing a turn, although the glider may have sufficient airspeed to avoid a stall and spin, no landing area may be immediately available, and this can expose the glider to other hazards which can prevent a safe landing. Sink is one such hazard, often associated with strong winds and wave. A glider making a 360° turn in still air at a bank angle of 35° and 50kt typically descends by only 70ft. But with 15ft/second sink the height loss in a 360° turn is over 400ft. If the launch failure was at 300ft the glider would crash before completing a 360° turn.

The existence of additional hazards from a turn adds force to the advice:

LAND AHEAD IF IT IS SAFE TO DO SO.

If you are very experienced, you may sometimes be winch launching in challenging conditions. If you have a launch failure we would urge you to land ahead if it is safe to do so..'

In October 2017 the BGA updated and published the leaflet titled 'Safe Winch Launching', in its 6th edition.

Boeing 737-8AS, EI-EBW on 14 January 2017s

Whilst descending in to a high altitude jetstream, an associated rise in headwind caused the aircraft to overspeed. The commander disengaged the autopilot (AP) and used manual control inputs to stop the speed increasing, but in doing so applied a significant nose-up pitch input on the control column. The resulting manoeuvre caused two cabin crew members to fall, and one of them sustained a broken ankle. The operator has issued additional guidance to its pilots regarding overspeed recognition and recovery.

Safety issues – HF, atmospheric conditions, handling

Safety action by the operator

After this event, the operator released a memo to all pilots entitled 'Overspeed (Impending/Actual) Recognition and Recovery', dated 3 May 2017. This document reiterates the manufacturers FCTM guidance on overspeed, and provides supplementary guidance for use of the mode control panel (MCP), speed brake, autothrottle and autopilot in an overspeed condition. It states:

> *'…this guidance applies to all phases of flight. Crew, however, must recognize the difference between correcting an overspeed in level flight and correcting an overspeed when climbing or descending. Furthermore, when attempting to correct an overspeed condition, crew must also recognize the additional challenges associated with disengagement of (1) the auto throttle and (2) the autopilot.'*

The memo also provides guidance for use of the MCP, speed brake, autothrottle and autopilot during the different phases of flight, in relation to overspeed recovery.

In relation to descent it states:

> **'Autopilot: Monitor. Disengage ONLY if [the] autopilot [is] exacerbating the overspeed, or if required due to severe turbulence'**

The aircraft manufacturer stated that it is considering a revision to the overspeed guidance in the 737 Flight Crew Training Manual to state more explicitly that the preferred response to impending overspeed at high altitude is to leave the autopilot engaged and instead deploy partial speedbrakes slowly.

Let L-410 UVP-E, OK-LAZ on 23 February 2017

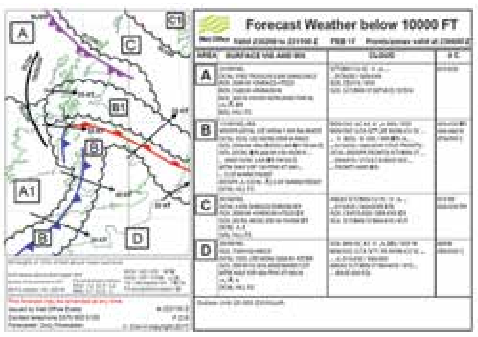
The details of this accident are shown under Recommendation 2018-005 shown under Safety Recommendations Issued in 2018 of this Annual Safety Review.

Safety issues – Weather, aircraft limitations, decision making

Safety actions by the Czech CAA

As a result of this serious incident the CAA of the Czech Republic stated that several safety actions have been completed, including:

1. The aircraft operator has increased the time allocated between crew report and the scheduled departure time to 60 minutes and incorporated this in Operations Manual (OM) Part A.
2. The aircraft operator has updated the crosswind limits in OM Part B. No details of the changes have been provided except a statement that the OM now offers guidance for taking off and landing in a crosswind, and that the EASA SIB 2014-20 has been taken into account.



3. The CAA of the Czech Republic has also stated that recent audits of the aircraft operator have focussed on hazard identification and safety risk management, with particular focus on operations in hazardous weather conditions.

Boeing 747-8R7F, LX-VCF on 30 March 2017

The details of this accident are shown under Recommendation 2018-011 shown under Safety Recommendations Issued in 2018 of this Annual Safety Review.

Safety issue – Air cargo preparation

Safety action by the operator

The operator has made a number of revisions to its procedures. It has also recommended that its contracted goods handling agency take steps to raise awareness among its staff about the possibility of dangerous goods in general cargo and to improve methods for detecting of undeclared dangerous goods.

[Boeing 787-9 Dreamliner, G-ZBKF] on 29 April 2017

The synopsis of this accident is shown under Recommendations 2018-008 to 2018-010 shown under Safety Recommendations Issued in 2018 of this Annual Safety Review.

The inability of the aircraft to maintain normal cabin pressure was found to be have been caused by the right lower recirculation fan becoming detached from the inner duct, which allowed air from the air conditioning unit to leak to atmosphere rather than provide the required cabin pressure on a sector where the left air conditioning system had been disabled before flight.

The right lower recirculation fan had been changed by the operator 11 days before the incident. Following the first flight after the fan had been changed, the operators engineering department was notified by the Aircraft Health Monitoring (AHM) system that it had detected a leak. A work request was raised to carry out a cabin pressure leak test, with an end date for completion set for 5 May 2017, in accordance with approved rectification periods.

For each subsequent flight, the AHM system notified the operator that a leak had been detected, but the cabin altitude remained normal for these flights and the end date for the inspection was not altered. When the aircraft was operated during the incident flight with only the right air conditioning system available, the system did not have sufficient capacity to overcome the effect of the leak.

It was concluded that the lower right recirculation fan had not been correctly attached to the inner duct when the fan had been installed on 18 April 2017.

Safety issues – Loss of pressurisation, MEL, technical fault

Safety actions by the manufacturer

- The aircraft manufacturer has revised the Aircraft Maintenance Manual (AMM) installation procedure for the lower recirculation fans.
- The aircraft manufacturer has made changes to its Fault Isolation Manual for Maintenance Message 21-34127, the message triggered by Maintenance Alert Message 21-0209-C740 from the AHM. This includes checking for recent maintenance activity on the cabin pressurisation system, including the lower recirculation fans.
- The aircraft manufacturer has made an update to the AHM 'maintenance alert' logic for message 21-0209-C740. This logic helps to filter out only those instances that are deemed valid and should be presented to the airline.
- The operator of G-ZBKF has revised its process for dealing with AHM 'maintenance alert' message 21-0209-C740.

Safety action by the operator

- The operator of G-ZBKF is updating the audio system software fitted to its fleet of Boeing 787 to prevent the volume of the cabin decompression PRA from being attenuated.

AS350 B3e Ecureuil, G-MATH on 5 May 2017

The accident occurred whilst the helicopter was engaged in hydraulic failure training. An instructor was in the left seat of the helicopter, a pilot under training in the right seat and another pilot under training, who was a passenger on this flight, was seated in the rear.

The right-seat pilot was performing a hydraulics-off approach, to finish in a run-on landing. The instructor became dissatisfied with the approach parameters and took control in the latter stages, performing a hydraulics-off go-around into a left-hand circuit, before lining up the helicopter on final approach for the pilot to make a second attempt. Once again, the instructor took control late in the approach and performed another go-around. On this occasion, the left turn onto the downwind was flown with a higher angle of bank (AOB). The instructor was unable to control the roll attitude and the helicopter rolled left, beyond 90° AOB, descended rapidly and struck the ground, coming to rest on its left side.

No technical issues were identified and a definitive reason why the instructor was unable to roll the helicopter back to a level attitude could not be determined.

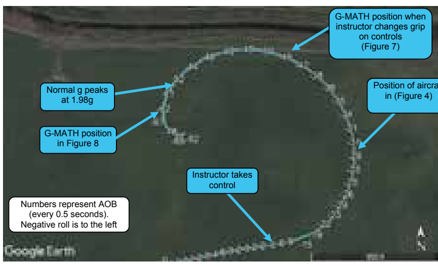
The investigation concluded that clearer instructions in the AS350 flight manual for hydraulics-off flight would help prevent similar accidents in future. In response to this accident, the helicopter manufacturer has taken safety actions including: amending the AS350 flight manual to limit the AOB to 30° during hydraulics-off flight and the inclusion of warnings not to conduct low speed manoeuvres with hydraulics off due to the danger of loss of control. It has also prepared a safety video describing how to perform hydraulics-off training.

Safety issues – helicopter systems management, flying training

Safety actions by the manufacturer

The AS350 flight manual has been amended to:

- Include a clear angle of bank limitation of 30° for hydraulics-off flight;
- Include warnings to clearly emphasize the risk of loss of control of the helicopter if the hydraulic failure or hydraulics-off training procedures are not complied with;



Safety Recommendation and Safety Action Overview

- ***State:*** *'In case of a go-around during hydraulic failure training procedure, it is recommended to abort the training and to reset the hydraulic cut-off switch to 'ON'*
- Include the note*: 'When resetting the hydraulic cut-off switch to* ON*, be prepared for a significant decrease of cyclic and collective control loads'.*

Airbus Helicopters has taken the further safety actions of publishing Safety Information Notice No. 3246-S-29 highlighting these flight manual changes and preparing a video[1] on how to conduct hydraulics-off training safely.

Silence Twister, G-JINX on 14 May 2017

During a formation aerobatics display of a pair of aircraft at MOD Abingdon the engine of the number 2 aircraft lost power and then stopped in flight. The subsequent attempted forced landing onto the runway at Abingdon was unsuccessful. The investigation found that the engine seized following the loss of its oil during the accident flight.

Safety issues – Loss of oil and lubrication, engine seizure, aircraft egress

Safety actions by engine manufacturer

The engine manufacturer advised the AAIB that it would introduce processes to monitor the condition of UL260iSA engines in regular aerobatic use, including:

- Installing additional temperature sensors in the cylinder walls.
- Regularly downloading and reviewing the data from the Dynon EMS-D10.
- The return of the engine to the manufacturer after a number of aerobatic displays for a full strip and examination.

The manufacturer stated that it intended to issue an amendment to the engine manuals recommending that:

- The engine oil level should be between 4 and 4.5 litres prior to the start of an aerobatic display.
- A Teflon based additive should be added to the oil.
- Maintenance activities such as removing cylinder heads and replacing cylinders should be carried out by technicians approved by the manufacturer.

Safety actions by the LAA

Following the accident to G-JINX, the LAA amended its Technical Leaflet 2.11 'Aircraft Placards, Labels and Registration Marks' to include the following:

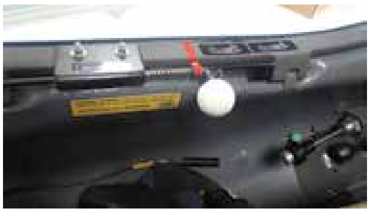
Footnote

1 A link to this video is at: https://dai.ly/k35kJCQ5f47SQcrffPU

'When not otherwise obvious, the external and internal latches on cockpit doors and canopies should be clearly identified by labels or markings sufficiently prominent to be seen in an emergency. In the event of an accident, even a few seconds saved by first responders in rescuing the crew may be critical to a positive outcome, especially where there is the threat of fire. Each normal and emergency exit operating control should be red in colour. Suitable placards should be near each control and should be designed to clearly indicate its method of operation, especially to a non-aviation person. Where any special procedure must be followed to gain entry, this should be described, for example 'to open canopy in an emergency, reach into cockpit through ventilator aperture and press red button. Canopy hinged on right hand side.'

Safety actions by the owner

Following the accident, the owner fixed labels to the outside of his other two Silence Twister aircraft explaining how the canopy is opened from the outside.



The aircraft owner stated he would consider enabling the EMS intercom audio alert function.

Piper PA-28R-201 Cherokee Arrow III, G-CEOF on 25 May 2017

During a flight from Oban to Carlisle, the aircraft flew into an area of low cloud, fog and mist that extended from the Irish Sea, around the Isle of Arran and into Loch Fyne. As the aircraft travelled down Loch Fyne it descended into the sea, approximately two miles north-east of Skipness on the Kintyre peninsula. The pilot and passenger were fatally injured in the accident.

Safety issues - Weather, HF, response

Safety actions by the DfT and RAF

Department for Transport and the Royal Air Force D&D Cell have initiated a number of safety actions to reduce duplication of effort and ensure that the required actions are carried out in a timely manner.

The Distress and Diversion (D&D) Cell undertook a broad review of their procedures for dealing with missing / overdue GA aircraft in order to reduce the timeframe during the uncertainty phase. They have introduced a standard checklist for their staff which has been shared with NATS and the Air Rescue Coordination Cell (ARCC). The D&D Cell have also reduced the time for requesting a radar replay for GA events and the request to NATS will

now be actioned no later than 30 minutes after an aircraft's Estimated Time of Arrival, or the start of tracing action. The new procedures will also help to reduce duplication of effort across the ANSPs, the D&D and the ARCC. The introduction of improved log keeping and data gathering will also help to better inform future decision making.

Review of the D&D Cell and ARCC processes

The Department of Transport has initiated a review of the processes and procedures carried out by the D&D Cell and ARCC. The intention is to map the roles and responsibilities of both organisations, identify any duplication and consider if processes can be streamlined.

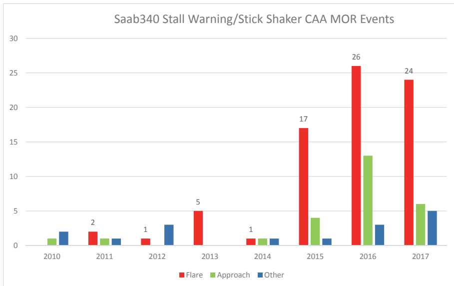
Saab-Scania SF340B, G-LGNB on 5 June 2017

During the climb after departure from Edinburgh Airport, the aircraft encountered severe icing and turbulence. During this period the stick shaker activated three times, before the aircraft descended to regain airspeed. After flying clear of the icing conditions and the area of turbulence, the aircraft continued to the destination without further incident.

Safety issues – Icing and turbulence

Safety Action by EASA

EASA, the operator and the manufacturer considered making deactivation of the ICE SPEED logic independent of the requirement to maintain the engine anti-ice system on for five minutes after leaving icing conditions. This change, considered feasible by the manufacturer, would address the concerns about repeated activation of the stick shaker in the latter stages of an approach and in the flare.



EASA expected to mandate the implementation of this improvement to address the safety concern.

HK36 TC Super Dimona, G-FMKA on 13 July 2017

The purpose of the flight was for the aircraft owner to undergo a biennial refresher training flight with an instructor to revalidate his class ratings. The aircraft was seen to be manoeuvring at low level shortly before it departed from controlled flight. It struck the ground in a near vertical attitude on farmland. Both pilots were fatally injured and the aircraft was destroyed. There was insufficient evidence available to determine conclusively the cause of the loss of control, but it was possibly as a result of a power-on stall.

Safety issue – Licence privileges

Safety action by the CAA

The CAA has agreed to issue advice to remind flying instructors of the requirement to hold a valid TMG class rating if they intend to exercise their flight instructor privileges on this class of aircraft.

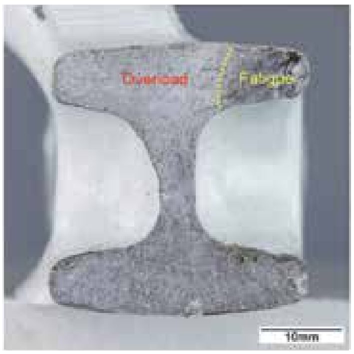
Rockwell Commander 114, G-TWIZ on 1 August 2017

The aircraft's left main landing gear (MLG) leg collapsed while landing at Lydd, following the fracture of the left MLG upper side-brace during retraction of the landing gear after takeoff. The upper side-brace had fractured under the application of landing gear retraction loads, due to the presence of a fatigue crack originating at a 'cold shut' casting defect. In response to this investigation the Type Certificate holder issued Service Bulletins applicable to the Rockwell Commander 112 and 114 aircraft models.

Safety issues – Landing gear, fatigue

Safety action by the manufacturer

In response to this investigation the Type Certificate holder, Commander Aircraft Corporation, issued Service Bulletins SB-112-75 and SB-11437, applicable to the Rockwell Commander 112 and 114 aircraft models respectively. These Service Bulletins require inspection of the upper sidebrace for cracking in the area of the retraction cylinder attachment and replacement of the upper side-brace if it is found to be cracked and not repairable.



HPH Glasflugel 304 eS, G-GSGS on 10 August 2017

During a normal touchdown following an uneventful flight, the glider's forward FES lithium polymer battery ignited due to an electrical arcing event. The pilot was unaware that the glider was on fire and the battery continued to burn, generating smoke and fumes which entered the cockpit during the latter stages of the landing roll. The pilot was not injured and the fire was extinguished using foam retardant, although the glider's fuselage battery box and surrounding structure were extensively damaged by the fire.

A comprehensive investigation of the failed battery did not identify the cause of the electrical arcing event. The AAIB published a Special Bulletin, S3/2017, in September 2017 that contained three safety recommendations relating to the provision of fire warning systems in FES-equipped sailplanes.

Safety issue – Battery fire mitigation

Safety actions

Battery and sailplane improvements

The HPH 304 eS sailplane manufacturer has replaced the composite battery compartment forward bulkhead with a stainless steel bulkhead to improve the fire-resistance of the bulkhead in the event of a battery compartment fire. The internal surfaces of the battery compartment are now painted in an intumescent fireproof paint finish.

The existing fleet of FES batteries was withdrawn from use and is currently being refurbished to a new design standard, to which new production batteries are also being produced. The new design standard includes replacement of the battery case with a stronger glass fibre case, constructed using high-temperature resin, that has been demonstrated in testing to remain structurally intact during a battery fire. The new battery case also features an impact label that permanently records if the battery has been subjected to a shock loading of 50g or more, to allow the battery to be withdrawn from use for inspection if subjected to abuse.

The new FES battery features additional nomex-mylar insulation between the cells and an increased quantity of silicone encapsulation of the battery cells to prevent foreign objects from falling between the cells. The edges of the battery cells pouches are covered in an electrically-insulating tape to prevent electrical discharge of the cell should the cell pouch seal fail. The stainless steel battery cell connector plates have been replaced with anodized aluminium plates which have been demonstrated not to eject machining swarf from screw threads when the connector screws are inserted during assembly.

Sailplanes equipped with the FES system also now feature a pressure-relief valve in the battery compartment cover, designed to allow the cover to remain attached to the sailplane in the event of over-pressurisation of the battery compartment should a battery fire occur.

FCU caution and warning system changes

The FCU caution and warning system has been redesigned such that red warnings are prioritised over lower-level yellow warning messages. Different audio warning tones now accompany red and yellow warning messages. All warning messages are recorded in the FCU's non-volatile memory for recall during operation and certain warning messages are recorded for subsequent fault investigation.

Battery certification requirements

An Electric Propulsion Working Group has been established including experts from the OSTIV[2] Sailplane Development Panel, EASA, certain sailplane manufacturers and the manufacturer of the FES system. This group will review the existing EASA battery certification requirements and to coordinate research activities in electric propulsion integration in powered sailplanes, including battery fire detection and containment.

Boeing 737-800, EI-DLV on 15 September 2017

As the aircraft was lining up on the runway to take off, the flight crew heard a noise similar to a nosewheel passing over a runway centre light; they did not consider the noise to be unusual. During the takeoff roll, the flight crew in an aircraft holding near the start of the runway noticed one of the nosewheels depart EI-DLV and be blown off the runway into the area behind the threshold. They informed ATC who informed the crew of EI-DLV, which was now in the climb. A diversion was carried out to East Midlands Airport where an uneventful landing was made.

The nosewheel was found to have separated from the aircraft because the nose landing gear axle had failed at the left inboard journal (the part of the axle that rests on bearings). This was the result of heat-induced cracking and material property changes due to abusive grinding of the chrome plate during the part's last overhaul almost three years earlier. The Maintenance and Repair Organisation (MRO) that performed the overhaul has introduced a new inspection for detecting abusive grinding.

Safety Issues – Overhaul processes, QA

Safety actions

To ensure that any abusive grinding is detected, the MRO of EI-DLV has introduced a new process to perform a Barkhausen inspection on all journals after grinding. The MRO has also introduced a Barkhausen inspection early in the overhaul process, prior to the Nital etch test.

In addition, the MRO is carrying out Barkhausen inspections on all 12 Boeing 737NG NLGs that were overhauled during the one-year period covering six months before and after the date of EI-DLV's NLG overhaul. These inspections are carried out on the aircraft, on the line, after removing the wheel and bearings. Out of these 12, nine have already been inspected and no evidence of abusive grinding was found.

Footnote

2 Organisation Scientifique et Technique International du Vol á Voile / International Scientific and Technical Soaring Organisation.

As some of the manufacturer's SOPM instructions, such as wheel dressing, are open to interpretation, the MRO is developing an internal protocol for grinding so that there is greater consistency among grinding operators.

North American P-51D, Mustang, G-SHWN and North American P-51D-20 (Modified), Mustang, G-BIXL on 23 September 2017

Two P-51 Mustangs were taking part in a display sequence at the Battle of Britain Air Show at Duxford, Cambridgeshire. The accident occurred as they were joining formation with a Boeing B 17G in preparation for the next part of the display. The pilots had briefed and agreed that the lead P-51 would join on the B-17's right side and the other on its left side. However, during the display both pilots tried to join on the B-17's right, resulting in the two P-51s colliding. They landed without further incident.

A number of human factors were contributory to the accident. Most significantly, although the P-51 pilots had performed a 'walk through' of their display, they did not include the part involving the B-17.

Safety Issues – Flying display preparation, guidance

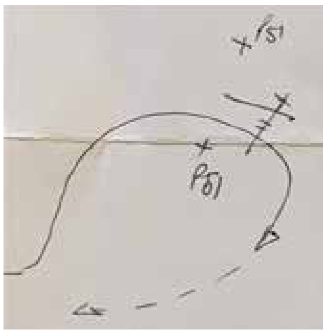
Safety actions

CAA has made the following addition to Appendix C of Edition 15 of CAP 403, Flying Displays and Special Events: Safety and Administrative Requirements and Guidance, that was published in March 2018:

'***Useful guidance for display pilots***

…

Briefings and walk throughs



C3 It is essential that in addition to the FDD's written and verbal briefings that all display items consisting of formations are thoroughly briefed. It is vital that every member of the formation has a clear picture of the objectives of the formation as a whole and of their individual positioning and responsibilities within it. Walk throughs are an integral part of this briefing process and it is strongly recommended that they are adopted as a standard part of all formation briefings.

C4 Walk throughs are not exclusive to formation briefs and can also be of benefit to the solo display pilot.'

Europa, G-MIME on 28 September 2017

The aircraft landed a significant distance down the runway at Grove Farm and was unable to stop before the end. The aircraft passed through a hedge and caught fire before coming to rest in the field beyond the end of the runway. Although both the pilot and passenger survived the accident, both subsequently died of the burns they sustained.

Safety issues – Certification, approvals, use of MOGAS

Safety actions

Although it could not be determined whether the type of fuel being used was a contributory factor, this is the second recent accident where there was no evidence of the correct procedures being followed to approve the use of E5 MOGAS[3].

The LAA agreed during discussions with the AAIB that it would remind all owners, via a Safety Spot article in their members magazine, of the importance of correctly following the published procedures to approve the use of E5 MOGAS in their aircraft.

This article was published in the January 2018 edition.

Cessna 152, G-WACG and Guimbal Cabri G2, G-JAMM on 17 November 2017

The Cessna 152 and the Cabri G2 helicopter collided in mid-air when both were engaged on training flights. They were operating in Class G airspace and neither aircraft was receiving an ATC service. The opportunity for the occupants of either aircraft to see the other was limited because, although they were in proximity for some time, they were both following a similar track and were not in each other's field of view.

Safety issues – Mid-air collision, conspicuity

Safety actions

By the regulator

Following previous Safety Recommendations, work is ongoing, led by the CAA, to promote the development and use of compatible Electronic Conspicuity (EC) aids to help mitigate the well-known limitations of 'see and avoid'.

By the operator

The flying club which operated G-WACG has issued an Instructor Notice to highlight the importance of maintaining an effective lookout throughout flight, and the need to carry out a regular change of heading during a prolonged descent, to check that the area ahead is clear.

Footnote

3 See report into the accident to Europa, G-NDOL in AAIB Bulletin 11/2017.

BAE Systems (Operations) Ltd ATP, SE-MHF on 14 December 2017

The aircraft was conducting an ILS approach to Runway 27 at East Midlands Airport (EMA). At around 800 ft agl (approximately 670 ft aal) the co-pilot attempted to disconnect the autopilot but it did not appear to disconnect. The crew made several further attempts to disconnect the autopilot before initiating a go-around at 230 ft aal. An uneventful, manually flown, circuit and landing was completed afterwards. Although the crew perceived that the autopilot disconnected while the aircraft was climbing during the go-around, recorded flight data indicated that it disconnected at approximately 425 ft aal during the approach. No defects or abnormalities were identified with any units associated with the autopilot.

Safety issue – Checklist procedures

Safety action

Following this incident (and two earlier similar events), the manufacturer decided to review the Emergency Checklist to see whether it should be amended to address the condition where crews are unable to disengage an autopilot.

DHC-8-402 Dash 8, G-ECOE on 11 January 2018

After takeoff from Belfast City Airport, shortly after the acceleration altitude and at a height of 1,350 ft, the autopilot was engaged. The aircraft continued to climb but pitched nose-down and then descended rapidly, activating both the “DON’T SINK’ and “PULL UP” TAWS (EGPWS) warnings. The commander disconnected the autopilot and recovered the aircraft into the climb from a height of 928 ft. The incorrect autopilot ‘altitude’ mode was active when the autopilot was engaged causing the aircraft to descend to a target altitude of 0 ft. As a result of this event the operator has taken several safety actions including revisions to simulator training and amendments to the taxi checklist.

Safety issues – Auto pilot settings, training

Safety actions

Actions by the operator

1) Issued an Operational Notice to flight crews in which it describes the incident and sets out the policy for the flight deck actions once ATC clearance has been obtained.

2) Amended the Taxi Checklist to include:

‘PF to review clearance including:
Confirming FMA selections (the heading bug should be adjusted for the expected drift).’

3) Updated the operator’s simulator training within the operator’s recurrent training and testing programme.

BAE Systems (Operations) Ltd ATP, SE-MHE on 14 February 2018

The aircraft was carrying out a cargo flight from East Midlands Airport to Guernsey Airport. As the aircraft commenced its descent from FL180, the ball in the slip indicator moved out to the left as normal and the pilot under training attempted to trim it back into the centre. He was unable to do so, and the autopilot disconnected automatically, causing a significant left bank and a nose-down attitude. The commander took control, closed the power levers and returned the aircraft to a safe flightpath. He had difficulty moving the flight controls and could not advance the power levers, believing both to have frozen due to ice. As the aircraft descended, the flight controls and power levers returned to normal and a safe landing was carried out. It is possible that the initial control upset was the result of the crew applying aileron trim instead of rudder trim whilst attempting to correct the yaw. Although the cause of the stuck power controls could not be established definitively, it is possible that the left power lever was restricted because of wear in the roll-over lever locking mechanism, although this would not explain the locking of the right power lever reported by the pilots.

Action was taken by the manufacturer to improve the effectiveness of both an existing Service Bulletin, relating to wear in the locking mechanism, and an electronic Service Information Leaflet, relating to the purging of moisture from engine control cables.

Safety issue – Mechanical wear

Safety action

The manufacturer stated that it:

- Would introduce a periodic wear check of the roll-over lever locking mechanism to supplement the previous one-off check that was introduced in Service Bulletin ATP-76-021.

- Would assess the effectiveness of eSIL 76-ATP-800-1 (to periodically purge moisture from the cables using low pressure nitrogen or air), consider possible options for long term corrective action, and would report to EASA on completion of the assessment.

CORRESPONDENCE INVESTIGATIONS

Sikorsky S-92A, G-CHHF on 29 January 2018

During a final approach to land at Scatsta the nose landing gear (NLG) failed to extend despite being recycled and the use of the emergency blowdown system. The crew declared a PAN and the decision was taken for ground crew to lever the NLG down manually. This was successfully carried out and the helicopter landed safely. It was found that the automatic nosewheel self-centring mechanism had not operated, causing the nosewheels to jam the nose leg in its bay. The exact cause of the failure of the NLG to centre the nosewheels could not be determined.

Safety issues – Maintenance, helicopter configuration and emergency procedures

Safety actions

To reduce the risk of nosewheels not self-centring during retraction, the operator is undertaking the following safety actions:

- The manufacturer's letter, '*S92A Nose Landing Gear – Improper Servicing*', dated 19 September 2017, will be re-iterated to the operator's engineering staff.
- S-92A crews will be reminded of the need to ensure the nosewheels are not canted off-centre after taxiing prior to takeoff (although this does not appear to have been a factor in this incident).
- The operator has also reviewed the EOPs and EOPs 8/2 and 8/3 have been amended and re formatted as EOP 13/2 and 13/4. EOP 13/2 now draws the crew's attention to EOP 13/4 and the actions to be taken to ensure a safe landing with the leading gear retracted, or in an asymmetric configuration.

Jetstream 4100, G-MAJW on 27 February 2018

On the approach to Sumburgh Airport, the primary and standby landing gear status indicators showed that the nose landing gear was not extended and downlocked. The crew aborted the approach, elected to return to Aberdeen and after unsuccessfully attempting to resolve the issue, declared a MAYDAY. The aircraft landed safely at 1235 hrs and the occupants evacuated via the overwing exits after the aircraft stopped on the runway.

A subsequent ground inspection of the aircraft confirmed that the nose landing gear was 'down and locked' but the primary indication wiring harness had failed and the standby indication microswitch was out of position. Safety actions have been taken by the manufacturer and the operator to improve the reliability of the system and the clarity of the Emergency and Abnormal Checklists.

Safety issues – Landing gear wiring and indication, checklists accuracy

Safety actions

The manufacturer has taken a Safety Action to amend the AMM and a further Safety Action to thoroughly review all Emergency and Abnormal Checklist cards to ensure that the correct card is actioned efficiently without confusion.

- Revision to AMM to clarify NLG down lock microswitch rigging procedure.
- Review the Emergency and Abnormal Checklists to improve clarity and efficiency of application.

Three Safety Actions have been taken by the operator to improve the reliability of the landing gear indication systems and to implement the latest revision of the Emergency and Abnormal Checklist cards.

- 'One-off' inspection - Nose landing gear standby micro switch check.
- 'One-off' inspection - NLG down lock and primary and standby microswitch inspection.
- Repeat inspection every 600 flight hours - Landing gear indication system check.

- Update all Emergency and Abnormal Checklists in accordance with manufacturers latest revision.

Hummerchute, G-CKTA on 14 April 2018

On becoming airborne on its maiden flight, the newly assembled powered parachute aircraft pitched steeply nose-up before falling backwards to the ground. A number of the lines securing the canopy to the 'trike' (accommodating the wheels, occupants and engine) were found to be of the wrong length. This caused the canopy to 'fly' in a different longitudinal position and attitude from normal, leading to loss of control of the aircraft.

Safety issues – Rigging, QA and flight test checks

The aircraft manufacturer has taken the safety actions of improving its quality checks during manufacture and flight testing aircraft prior to releasing them from the factory.

Safety actions

On establishing the nature of the problem, the pilot immediately informed the owner/customer of a Hummerchute he had recently supplied and had inspected at the same time as G-CKTA. He advised the customer not to attempt a flight. The customer confirmed shortly afterwards that the D lines on his parachute were about 8 inches shorter than those on the reference parachute. The parachute manufacturer was contacted and subsequently confirmed that they had identified a batch which had been manufactured with incorrect length D lines. They reported that only two of them had left the factory and both had been supplied to the UK.

The manufacturer has informed the importer that all future parachutes will come with a full factory trim check and will also be check flown prior to shipping to the UK.

Morane Saulnier MS.315E D2, G-BZNK on 5 May 2018

The aircraft made a successful forced landing on a beach following a loss of engine power. A spring in the fuel primer operating system had become disconnected, causing the primer to continue operating and resulting in the available fuel being consumed faster than expected.

Safety issue – Technical fault

Safety actions

The LAA stated that it will recommend priming installations of this type be configured so that normal operation of the fuel pressure regulator is restored if the primer operating mechanism fails.

Robinson R44 Raven, G-CTFL and Robinson R44 Raven, G-HYND on 5 May 2018

After lifting to a hover, the pilot of Robinson R44 G-CTFL reversed his helicopter, unaware that a second Robinson R44, G-HYND, had landed behind his position and was being shut down. One of G-HYND's rotor blades collided with G-CTFL's engine housing, startling the pilot of G-CTFL, with the result that he lost control, and the helicopter struck the ground several times before coming to rest in a tail-down attitude, next to a parked Robinson R22.

Safety issue – Helicopter movements in a confined area

Safety actions

As a result of the accident, the following safety actions have been taken by the helicopter operator:

- The northern helipad was extended eastwards by 12 m, so a parked helicopter is further from the apron, leaving space for other helicopters to move between the parked helicopter and the apron.

- The prepared grass area east of the helipads has been extended, to ensure helicopters parked there can remain well clear of the pads.
- A mirror has been placed at the corner of the hangar, to assist pilots using either helipad see any activity to their rear.
- The helicopter operator no longer permits helicopters to reverse from the helipads.
- The helicopter operator's safety team is due to review the procedure for turning off the avionics systems while a Robinson R44 is being shut down.
- A review of the Rescue and Firefighting Service (RFFS) response to this accident has led to several changes being instigated. These are intended to ensure that two appropriately trained employees are available, on the ground, at all times there is helicopter activity and that fire-fighting equipment can be readily accessed by these employees.

Piper J3C-65 Cub, G-CGIY on 12 May 2018

The aircraft was en route from Gamston Airport near Retford to Leeds East Airport when the pilot noticed a vibration on the rudder pedals. This was followed by an uncommanded yaw and a jolt through the pedals. Several seconds later the pilot heard a loud bang with a violent nose-down pitch. The pilot slowed the aircraft, regained control and, looking behind, observed that the rudder appeared to be displaced. He informed Leeds East of the problem and landed without further incident. The partial rudder detachment and the resultant handling difficulties were caused by the loss of the rudder upper hinge pin and bushes. It is not known how the pin and bushes worked loose but their loss would have been prevented had the specified upper washer been in place.

Safety issue – Correct component assembly

Safety actions

The CAA have been informed and are considering an appropriate safety action to inform owners and operators. In addition, the LAA has published a comprehensive article in the Safety Spot section in the association magazine with advice to Cub owners regarding the assembly and integrity of the rudder hinge pins.

Mainair Blade, G-CCZW on 20 May 2018

While attempting to land from an offset approach the pilot lost control, and the left wing struck a hedge which was adjacent to the runway.

Safety issues – Loss of control, obstructions near runways (1)

Safety actions

The airstrip owner states that since this accident occurred, the trees on the northern boundary have been removed and the recommended approach has been modified to reduce the offset angle to 20º or less. The website is to be amended accordingly and a new video added in due course.

The field to the south of Runway 14 belongs to the airstrip owner and he only grows a rapeseed crop there every third year. In future he will ensure the crop close to the narrowest section of the runway does not reach a height that is likely to distract pilots.

Jodel DR1050-M1 Sicile Record, G-CIYB on 8 June 2018 at 1045 hrs

The pilot lost control of the aircraft when it struck a hedge while approaching to land on a short runway at his private airstrip. The aircraft impacted the ground and incurred extensive damage.

Safety issues – Loss of control, obstructions near runways (2)

Safety action

The pilot intends to remove the hedge along the airstrip's southern boundary and will only operate a similar aircraft from here if he succeeds in lengthening the runway.

Robin DR400/180R Remorqueur, G-LGCC and Schleicher ASK 21, G-CFYF on 8 June 2018

During the recovery to Dunstable Downs Airfield (DDA) after conducting a successful aero-tow launch, the pilot of the tug aircraft, G-LGCC, became aware of a glider ahead of him at close range. The pilot bunted to pass underneath the glider but had insufficient time to avoid a collision. The top of G-LGCC's fin struck the outboard leading edge of the glider's right wing. Despite suffering major damage, both aircraft remained controllable and landed without further incident.

Safety issues – Gliding, mid-air collision, conspicuity and communication

Safety actions

To reduce the risk of mid-air collisions between aero-tugs and gliders, the gliding club decided to:

- Publicise and enforce the policy of using landing lights on their tug aircraft during normal towing operations.
- Resolve the issue of radio interference generated by LED landing lights on the Club's aero-tow aircraft.
- Review the policy on FLARM fitment for Club owned aircraft.
- Investigate the possibility of fitting extended life batteries to all Club aircraft with the aim of enabling radio use for all flights and supporting a growth path for wider use of electronic conspicuity systems.

Sky 220-24 hot air balloon, G-SPEL on 14 June 2017

The balloon was on commercial passenger flight with six passengers. After an uneventful flight the balloon landed firmly, at a horizontal speed relative to the ground of about 9 kt, and the basket tipped over on to its side, during which one passenger fell out. The passenger was seriously injured.

Safety issues – Pre-flight briefing, passenger actions for landing (1)

Safety actions

The operator stated that it is considering conducting the safety briefings before takeoff with only the passengers present, to avoid them being distracted. He will also give more emphasis on the need to hold onto the rope handles tight during the landing.

Groppo Trail, G-CIGR on 14 July 2018

The aircraft took off from a farm strip but did not climb sufficiently to clear a high hedge beyond the end of the runway.

Safety issues – Aircraft performance, obstructions near runways (3)

Safety actions

Following the accident, the following Safety Action was taken:

The operator of South Longwood airstrip decided to produce a briefing document for visiting pilots. A draft version, dated 18 July 2018, showed a diagram of the airstrip, runway and circuit information and warning text in a red box which included the following guidance:

> '*South Longwood is a challenging farm-strip suitable for experienced pilots flying aircraft of sufficient performance to safely negotiate the obstructions on approach and departure. It is unlikely that any aircraft that requires a landing or takeoff run of more than 300m will be suitable.'*

and

> 'Due to the valley location, the windsock does not always provide reliable indication of wind direction or strength.'

The airstrip operator had been negotiating for a landline to be installed prior to the accident and re-contacted the supplier to ask for the installation to be carried out as soon as possible.

The windsock was to be relocated to a position more central to the runway and would be set on a higher mast.

Boeing 767-300, D-ABUK on 21 July 2017

The aircraft was in the cruise on a positioning flight when the flight crew noticed an unusual smell, followed by smoke from the vicinity of the right windscreen. A MAYDAY was declared and the aircraft was diverted to Newcastle Airport where it landed without further incident. Investigation by the operator identified an anomaly with an electrical connection to the right windscreen heater.

Safety issue – Wiring fault

Safety actions

Following its investigation the operator took the following safety actions:

- Adopted a double inspection requirement for electrical terminal installation following windscreen replacement;
- Reduced the repeat inspection threshold for windscreen electrical terminals from 500 flight hours to 100 flight hours;
- Introduced an additional engineering condition inspection for all windscreens entering stores;
- Conducted a fleet check to ensure correct installation of windscreen terminal connections;
- Clarified Aircraft Maintenance Manual (AMM) task 56-11-01-404-017, No 1 Window Installation, so that the resistance test of the window heater element is performed before installation to prevent the J5 terminal block connection being made twice;

- Added advice to AMM task 30-41-00-765-046 to use a torque wrench when connecting the wiring to the window terminals;
- Evaluating a coordinated replacement of windscreens not using the later design pin and socket connections.

Boeing 737-8K5, G-FDZJ on 28 September 2017

G-FDZJ was operating a charter flight from Malta to Manchester on behalf of a cruise ship company. On takeoff the pilot flying found the aircraft required significantly more aft control column movement than normal to rotate. The available evidence indicates that the aircraft was out of trim due to an incorrect MACTOW on the load sheet. This occurred because passenger's actual seating positions were not passed to the handling agent. When producing the load sheet the handling agent assumed an even distribution of passengers within the cabin, when the actual distribution created a forward bias.

Safety issues – Weight and balance, pax distribution

Safety action

Following its review into this incident, the operator indicated it would take the following safety action:

1. Update the existing process to ensure the position of any empty seats on a cruise flight (or any flight where check in and seating is not completed by the handling agent) is communicated by the cruise line representative to the load controller.

2. Ensure all handling agents that deal with cruise flights (or any flight where they do not handle the check in themselves) have a method of determining the actual seating position of passengers on any partly loaded flight in order to produce an accurate load sheet.

Cameron Z-375 hot air balloon, G-VBFO on 9 October 2017

After an uneventful flight G-VBFO landed in a field near Royston. The basket landed firmly, bounced several times and was then dragged across the field eventually coming to rest approximately 60 m from the initial impact point. During the first impact, a passenger was ejected from the rear right compartment. Whilst it could not be determined why the passenger came out of the basket it is likely that he either let go prior to the landing or was unable to hold on tightly enough to keep himself in the landing position.

Post-accident interviews with the passengers confirmed that safety briefings were conducted in accordance with the company operations manual. However, passengers commented that the briefings were difficult to hear and did not prepare them for the dynamic nature of the landing. This may have contributed to the accident.

Safety issues – Pre-flight briefing, passenger actions for landing (2)

Safety actions

By the operator

Following this accident the operator indicated that it proposed to take the following safety actions;

1. The operator will explore ways to ensure passengers read and understand the safety information that is given to them before the flight.

2. The operator is considering the introduction of laminated passenger safety cards to be given to passengers to read between check in and boarding the flight to further emphasise the safety briefing.

3. The operator will continue to monitor safety briefings delivered by all pilots to ensure they are as clear as possible *and convey the potential dynamic nature of a balloon landing.*

By the regulator

The CAA has taken the following Safety Action:

The CAA will instruct all UK Balloon Flight Examiners and Type Rating Examiners to particularly check the content and quality of delivery of the passenger safety briefing and subsequent passenger landing position checks whilst undertaking LPCs and/or OPCs during the coming 12 months.

Jetstream 4100, G-MAJC on 16 October 2017

During a descent into Hawarden Airport, at around FL150, the flight crew noticed a burning smell. Oxygen masks were donned, a MAYDAY was declared and an expedited approach was carried out to land on Runway 22. The crew experienced some difficulty in communication, both internal and external, while using their oxygen masks. After landing the aircraft was taxied clear of the runway, brought to a stop, and an emergency evacuation was carried out. The burning smell was as a result of smoke and dust carried in the atmosphere from North Africa and Iberia.

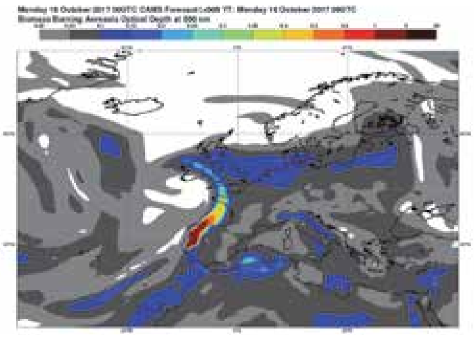
Safety issues – Meteorological circumstances, information promulgation

Safety actions

In December 2017 a review of the smoke and fume events on 16 and 17 October was held by the UK CAA together with representatives from NATS and the Met Office.

The Met Office advised that accurate forecasting of such phenomena is problematic because it is hard to forecast the extent and height at which the smoke is likely to be present due to the difficulty in accurately locating the fires.

Met Office systems allow a SIGMET to be issued that contains smoke related information and, although it is not compliant with the ICAO format or existing templates, a test showed that it was compatible with NATS's systems. In future a SIGMET will be issued when NATS informs the Met Office there is significant smoke in the atmosphere that is affecting aircraft operations.



ANSPs are responsible for notifying the Met Office of any pilot reports of unusual phenomena affecting flight, but not at present for notifying the UK CAA.

Work is being undertaken to see whether a 'Securité' message broadcast on 121.500 MHz could be used to promulgate a safety message concerning smoke in the UK FIR.

The participants agreed to ensure that suitable escalation and inter-agency coordination procedures are put in place to improve the promulgation of such unusual events in the future.

The operator conducted its own internal investigation into the event and identified safety recommendations and actions. The operator decided to:

Provide enhanced training on use of oxygen masks including a video of mask donning procedures.

Provide a list of approved headset types shown to be compatible with the aircraft communication systems.

Review and amend the passenger emergency briefing to include a warning about the danger of rotating propellers.

Incorporate a similar type of event into the company training programme.

Boeing 777-236, G-VIIJ on 3 November 2017

During descent into London Heathrow Airport a strong smell of fumes was apparent in the cockpit and the cabin. The crew actioned the appropriate checklist and the aircraft landed at Heathrow without further event. The aircraft was returned to service after engineering work.

On the next flight the aircraft returned to stand due to fumes in the cabin having taxied for takeoff. After further engineering work the aircraft was again returned to service.

The aircraft then flew once more without incident but on the return flight there were several indications of overheating in the left engine. The subsequent engineering work identified a hole in the left engine's combustor case, which resulted in the engine being changed. A replacement engine was installed and there were no further fume events.

Safety issues – Smoke and fumes, technical fault diagnosis

Safety actions

The engine manufacturer stated that this was the first reported event in the history of the GE90's approximately 24 million operating hours. The cause of the failure was not determined but the engine and airframe manufacturers have instigated the following safety actions:

As a precautionary measure, all swirler repair schemes will be deleted from the engine overhaul manuals.

The Fault Isolation Procedure for smoke or fumes in the cabin has been amended. If the engine is identified to be the source of fumes or smoke, the revised procedure includes a requirement to inspect the fuel nozzles irrespective of whether the fumes are believed to be associated with oil or fuel.

Appendix 1 - CICITT Occurrence Categories

CODE	DESCRIPTION
ARC	ABNORMAL RUNWAY CONTACT
AMAN	ABRUPT MANEUVER
ADRM	AERODROME
MAC	AIRPROX/TCAS ALERT/LOSS OF SEPARATION/NEAR MIDAIR COLLISIONS/MIDAIR COLLISIONS
ATM	ATM/CNS
BIRD	BIRD
CABIN	CABIN SAFETY EVENTS
CTOL	COLLISION WITH OBSTACLE(S) DURING TAKEOFF AND LANDING
CFIT	CONTROLLED FLIGHT INTO OR TOWARD TERRAIN
EVAC	EVACUATION
EXTL	EXTERNAL LOAD RELATED OCCURRENCES
F–NI	FIRE/SMOKE (NON-IMPACT)
F–POST	FIRE/SMOKE (POST-IMPACT)
FUEL	FUEL RELATED
GTOW	GLIDER TOWING RELATED EVENTS
GCOL	GROUND COLLISION
RAMP	GROUND HANDLING
ICE	ICING
LOC–G	LOSS OF CONTROL–GROUND
LOC–I	LOSS OF CONTROL–INFLIGHT
LOLI	LOSS OF LIFTING CONDITIONS EN ROUTE
LALT	LOW ALTITUDE OPERATIONS
MED	MEDICAL
NAV	NAVIGATION ERRORS
OTHR	OTHER
RE	RUNWAY EXCURSION
RI	RUNWAY INCURSION
SEC	SECURITY RELATED
SCF–NP	SYSTEM/COMPONENT FAILURE OR MALFUNCTION (NON-POWERPLANT)
SCF–PP	SYSTEM/COMPONENT FAILURE OR MALFUNCTION (POWERPLANT)
TURB	TURBULENCE ENCOUNTER
USOS	UNDERSHOOT/OVERSHOOT
UIMC	UNINTENDED FLIGHT IN IMC
UNK	UNKNOWN OR UNDETERMINED
WILD	WILDLIFE
WSTRW	WIND SHEAR OR THUNDERSTORM

GLOSSARY OF ABBREVIATIONS

aal	above airfield level
ACAS	Airborne Collision Avoidance System
ACARS	Automatic Communications And Reporting System
ADF	Automatic Direction Finding equipment
AFIS(O)	Aerodrome Flight Information Service (Officer)
agl	above ground level
AIC	Aeronautical Information Circular
amsl	above mean sea level
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASI	airspeed indicator
ATC(C)(O)	Air Traffic Control (Centre)(Officer)
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot's Licence
BMAA	British Microlight Aircraft Association
BGA	British Gliding Association
BBAC	British Balloon and Airship Club
BHPA	British Hang Gliding & Paragliding Association
CAA	Civil Aviation Authority
CAVOK	Ceiling And Visibility OK (for VFR flight)
CAS	calibrated airspeed
cc	cubic centimetres
CG	Centre of Gravity
cm	centimetre(s)
CPL	Commercial Pilot's Licence
°C,F,M,T	Celsius, Fahrenheit, magnetic, true
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)
kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
mb	millibar(s)
MDA	Minimum Descent Altitude
METAR	a timed aerodrome meteorological report
min	minutes
mm	millimetre(s)
mph	miles per hour
MTWA	Maximum Total Weight Authorised
N	Newtons
N_R	Main rotor rotation speed (rotorcraft)
N_g	Gas generator rotation speed (rotorcraft)
N_1	engine fan or LP compressor speed
NDB	Non-Directional radio Beacon
nm	nautical mile(s)
NOTAM	Notice to Airmen
OAT	Outside Air Temperature
OPC	Operator Proficiency Check
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POH	Pilot's Operating Handbook
PPL	Private Pilot's Licence
psi	pounds per square inch
QFE	altimeter pressure setting to indicate height above aerodrome
QNH	altimeter pressure setting to indicate elevation amsl
RA	Resolution Advisory
RFFS	Rescue and Fire Fighting Service
rpm	revolutions per minute
RTF	radiotelephony
RVR	Runway Visual Range
SAR	Search and Rescue
SB	Service Bulletin
SSR	Secondary Surveillance Radar
TA	Traffic Advisory
TAF	Terminal Aerodrome Forecast
TAS	true airspeed
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TODA	Takeoff Distance Available
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
USG	US gallons
UTC	Co-ordinated Universal Time (GMT)
V	Volt(s)
V_1	Takeoff decision speed
V_2	Takeoff safety speed
V_R	Rotation speed
V_{REF}	Reference airspeed (approach)
V_{NE}	Never Exceed airspeed
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional radio Range

Air Accidents Investigation Branch

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