Air Accidents Investigation Branch

Annual Safety Review 2020

Published: 24 June 2021.

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Annual Safety Review 2020

Foreword

I am pleased to introduce this Annual Safety Review which includes information on occurrences and the safety action taken or planned in response to AAIB investigations concluded in 2020.

Although the coronavirus pandemic had a profound effect on both commercial and general aviation activity in 2020, the AAIB still received 553 occurrence notifications (compared to 826 in 2019) and opened 20 field investigations, 4 of which were into fatal accidents in the UK resulting in 4 deaths. A further 108 investigations were opened by correspondence. In addition, the AAIB appointed an accredited representative to 31 overseas investigations (compared to 96 in 2019), and made a notable contribution to major event investigations in Iran and Indonesia.

The number of commercial air transport serious incidents was fewer than normal reflecting the reduction in air travel. However, several occurrences were attributed to factors associated with the return to flying, after a long pause which in some cases affected the aircraft or those that fly them.

Despite the coronavirus restrictions, there was a growth in the reporting of unmanned aircraft system (UAS) occurrences in 2020 reflecting a greater awareness among UAS operators of the need to report occurrences. The AAIB undertook several UAS investigations and identified safety issues related to the overflight of 3rd parties that have not been fully addressed by the new regulations and recommendations have been made to the relevant authorities.

The AAIB remained operational throughout the lockdowns, responding immediately to occurrences as they arose. Despite the many restrictions in place in the UK and around the world, the AAIB found effective ways to progress its investigations. This Review includes an article which describes how the AAIB adapted its working practices to continue to fulfil its important role.

The Review also includes an article on the new cloud-based Case Management System that the AAIB has introduced to manage investigations from notification to closure. Fortuitously, after 2 years of development, the system went live in March 2020, just as the UK went into its first lockdown, greatly enhancing our ability to work collaboratively and remotely as required.

Productivity remained high throughout the year and the branch published 30 Field and 199 Correspondence Investigation Reports. These included 30 Safety Recommendations covering diverse safety issues with commercial air transport, general aviation, unmanned air systems and glider flying. Full details of the recommendations and the responses received from the responsible authorities, are provided in this Review. There are also details of 159 significant safety actions taken proactively by the industry in response to our investigations, representing a wide array of actions taken to improve aviation safety.

I invite you to peruse this 2020 Annual Safety Review which I trust you will find interesting and useful.

Crispin Orr
Chief Inspector of Air Accidents

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Introduction

Whilst flying is the safest form of transport on the planet (per mile travelled), as a high technology industry it has always been an enterprise susceptible to a lack of attention to detail. However, few could have anticipated the devastation that the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) particle, as small as 60µm, would have on aviation globally.

One of the significant challenges for aviation has been how, after such a long hiatus, to safely get aircraft, pilots and passengers back flying. The statistics for the past year make interesting reading, and show that despite a disproportionate lack of flying, the amount of safety reporting has remained relatively high, at levels 86% of the year before. Despite huge efforts by regulators, operators and manufacturers to raise awareness of the potential hazards to enable a measured safe return to flying for all types of aviation there have inevitably been mishaps, serious incidents and, unfortunately, accidents. This article covers how the UK Air Accidents Investigation Branch (AAIB) has reacted to these events in the midst of a pandemic.

The global challenge

The global nature of Aviation is exposed in accidents. An aircraft accident in the UK could, for example, involve design organisations in the US, regulators from Canada and component manufacturers in Europe and could be of interest to operators of the type all over the world. Thus, Accident Investigation Authorities (AIAs) rely on relationships with other AIAs, manufacturers, operators and other government departments to conduct investigations. So, finding effective methods of sustaining these relationships in a pandemic has been key to sustaining operational viability of not just the AAIB, but every AIA. In response to these and many other types of challenge being encountered by investigators, AIAs had to establish codes of practice and recommendations of how to cope in a pandemic. These are comprehensive covering all phases of the accident investigation from notification of the accident, deployment, the post field phase through to the giving of evidence in an Inquest.

Maintaining operational readiness

Firstly, for the AAIB, it was critical to establish a safe and secure base from which to conduct operations. This required the AAIB Business Support team to overcome the challenge of rapidly implementing procedures and mitigations in accordance with UK Government and World Health Organisation guidelines to ensure that a covid-secure workplace was sustained. Communications and IT are a critical enabler and the AAIB has taken huge strides forward in enabling collaborative remote working whilst retaining its ability to manage sensitive and confidential information. Whilst the AAIB was well positioned in having the right type of Personal Protective Equipment (PPE), the same challenges were faced as with many other organisations of maintaining sufficient stocks in the face of overwhelming global demand for these products. Finally, we needed to protect the AAIB's most valuable assets – its people. Firstly, those within the organisation most at risk were identified and shielded; all unnecessary travel was avoided, particularly by public transport and access to healthcare resources facilitated. For the staff that needed to travel, the AAIB ensured they were designated as critical safety workers, with freedom to move around and operate as required.

A small accident in rural Britain will have multi-national interest

Notification and deployment

In taking the decision to activate an Investigative Team, AAIB Duty Coordinators (DCOs) assess an incident against a range of criteria and decide if it crosses a threshold which supports a deployment. Covid-19 has not changed those criteria, so in one regard the decision whether the AAIB should deploy has not changed. The more critical aspect has been if the team can deploy. Within the UK this was largely surmountable thanks to the skilled efforts of the AAIB Operations Centre team, who managed to resolve the logistics challenges such as availability of accommodation or flights during lockdown. However, overseas deployments presented more significant hurdles with the introduction of quarantine periods both on arrival and return. There was also the risk of contracting the virus whilst on deployment and having investigators stranded in far-off places. This potentially would impact on the wider AAIB capability if a major event occurred in the UK, as such events quickly consume the available resources of what is a capable but compact organisation.

The decisions on deployment are more straightforward when there are fatalities involved, but more nuanced with less severe incidents and near miss events. It is the latter scenarios where DCOs are having to carefully weigh the potential safety benefits with the risks involved in deploying. Despite these challenges the AAIB has continued to successfully deploy teams to a wide range of scenarios, attending fatal accidents and serious incidents in the UK and overseas whilst sustaining its capability to respond to a large scale incident.

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At the accident scene

In many ways conducting the physical investigation of the wreckage at the accident site posed the least challenge. With the numerous hazards inherent in aircraft accidents, of which inhalation hazards are often present, investigators were already well prepared from a PPE perspective for the hazards posed by SARS-CoV-2 (or Covid-19 as it more commonly known). The problems resided in the human side of the investigative process. Conducting interviews in-person with witnesses were made more difficult by the wearing of face masks, adding a barrier to the communication in which the ability of the investigator to build a rapport and gain trust is vital.

On the accident site the calibration of risk from Covid-19 can be difficult to maintain, the team are focussed on the hazards presented by the site and much care is taken to protect themselves and anyone else from harm. It can be a difficult mental adjustment to consider that each member of the team and other stakeholders present at the accident site could potentially be presenting a hazard to each others health as well. When an investigative team has spent hours in full body suits and masks combing over an accident site, the last thing they wish to do after getting out of the PPE is to put on another mask! But that is the discipline required to protect each other and keep the team operational. One of the challenging aspects of field investigations is managing stakeholders from different organisations who may have different perspectives on risk. On a small accident site this is relatively easy to control but ensuring consistent level of PPE on a larger scale accident can be more challenging. Covid-19 poses a similar problem, whilst the guidance on facemasks and social distancing is clear, it is common to observe lots of variance in adherence to these rules.

The impact of Covid-19 on the AAIB

An important dynamic from the investigative team is to be able to meet together in the evening to discuss the day's activities. Whilst the Engineering Inspectors will have spent most of the time on site, the Operations Inspectors will have been mobile, interviewing witnesses at varying locations. Similarly, the Recorded Data Group and Human Factors Inspectors may well have all spent time focussed on different areas. The opportunity to brief the investigator in charge and start to knit together the various strands of evidence and information into an initial concept of events is critical in enabling the investigation to focus its efforts in the right area.

This time is also important after an investigative team has undertaken the critically important task with the emergency services and Disaster Victim Identification (DVI) teams to carefully extract fatalities from the accident scene. Following exposure to what can be harrowing experiences, it is vital to have the opportunity for the team to talk and support one another.

Depending on the location of the accident this type of evening meeting was not always possible. On one deployment to the Channel Islands exemptions were granted from the quarantine with understandable strict conditions (given the Island had a zero incidence of Covid-19). Inspectors were required to go directly from the aircraft to their hotel rooms and only to leave to visit the aircraft. Technology can be used to try and overcome these issues, but there are some conversations that are not suited to the dynamics of video calls.

Post field phase

Whilst the actions taken at an accident site are often challenging, this element (known as the field phase) of the investigation tends also to be relatively short in duration. The post field phase, however, can last months, if not years and managing the investigation during this phase has raised its own challenges. Damaged or undamaged flight recorders have had to be transported to suitable laboratories, sometimes in a foreign state, to recover and analyse data.

With international interest in recorder downloads, arrangements had to be considered to enable Accredited Representatives to participate in briefings and observe proceedings remotelyusing live video links.

Similarly, novel techniques have had to be adopted to conduct detailed wreckage and component examinations. The AAIB was not able to travel to the United States with critical engine components from a Bell Helicopter, but were able to conduct the forensic examination with assistance from Rolls Royce (UK), with reach-back to the Type Certificate holder in the US who had the in-depth product knowledge.

The effect of Covid-19 protocols

So, as can be seen, the AAIB and other AIAs have introduced numerous protocols to sustain investigations through the pandemic, but what has been the cost of these? As is often the case in life, new challenges often re-present old problems in a different context. Some readers may be aware of the famous Prussian Military Officer Carl von Clausewitz and his writings on his experiences of war as France defeated Prussia at the twin battles of Jena and Auerstädt on October 14, 1806. It may seem odd to be drawing lessons from such a distant event. What relevance can the experience of a 19th century infantry officer hold for us today performing accident investigation? The central tenet of Clausewitz's writings are about the attritional effect of reality on ideas and intentions in war, for which he introduced the term 'friction'. In modern day air accident investigation, the investigative protocols are the embodiment of AIAs ideas and intentions to manage the risks associated with sustaining this important activity in a pandemic. Each mitigation, if applied correctly, is effective, but each brings its own friction in terms of a penalty of adding time, cost and increasing the energy needed to achieve the same level of effectiveness in an investigation. The effect of reality on all these protocols is that they also introduce delay, inertia and complexity at just about every step of an investigation.

And it is not just the protocols that have introduced friction. As mentioned earlier, aviation is a global business, and the business of investigating accidents relies on long established relationships with safety staff at operators, manufacturers and regulators. These safety teams have not been immune from the effects of the pandemic on industry. The hollowing out of industrial resources has meant that some company's ability to respond to incidents has been significantly diminished, and their own investigations have taken longer than normal, or not been possible at all because the company has ceased to operate.

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As well as the impact on investigations there has been the impact of the pandemic on individual's health and wellbeing. There are the obvious first order consequences of personnel who have been unfortunate enough to contract Covid-19, both in its short and longer term effects. But more insidious has been the indirect effects of the pandemic on people's sense of wellbeing. The effects of social distancing and the impediments to the mobility of people has the potential to affect people's mental and physical health and undermine the morale and cohesion of the workforce. It is interesting to note that Clausewitz recognised the morale and will of a soldier as the most important component in warfare. For AIAs, which tend to be small organisations comprised of highly motivated individuals, maintaining these components is equally important.

Unexpected side effects

But what AIAs are also recognising is that the pandemic has expedited new ways of working and innovation that may have taken decades to progress otherwise. Home working is not a new concept, in fact it was common prior to the Industrial Revolution (and even sustained through it). However, the huge experiment in home working conducted over the past several months, has despite the understandable initial concerns of some, delivered surprising results.

It has generated a resilience by significantly reducing the risk of losing a cohort of investigators to an outbreak of Covid-19. By exploiting the advantages technology can offer it has strengthened the ability of AIAs to conduct remote investigations, particularly overseas. Whilst undoubtedly certain aspects of business, particularly networking, are better conducted face to face, the innovative ways of working adopted through the pandemic have shown that many routine aspects can be conducted remotely. AIAs have had an advantage in that the provisions of *Annex 13 to the convention on civil aviation - aircraft accident and incident investigation* provide the statutory enabling framework for AIAs to assist one another. The working practices adopted under the pandemic have merely further exploited the co-operation this enables.

The impact of Covid-19 on the AAIB

Glimmers of light in the darkness

The importance of management and leadership, at all levels, in guiding the AAIB through this pandemic cannot be overstated. This demand is twofold. Firstly, there is the challenging task of trying to understand the cumulative effect of the friction generated by the Covid-19 protocols on the output of an AIA and the health and wellbeing of the workforce. The CIAA and the management team have gone to great lengths to sustain communication with their teams. As importantly, the wider AAIB team have needed to work to support each other across the psychological divides and barriers that can be created by social distancing protocols and remote working.

Secondly, there is the responsibility to exploit the opportunities that have been presented by the pandemic to enhance the way the AIA works. If there is one certainty during these very unpredictable times it is that SARS Cov-2 will not be the last virus with which the world will wrestle. The AAIB management team are focussed on learning the lessons from this pandemic. Finding the right blend of traditional and distributed working models and building on the technological capabilities and investigation techniques developed during Covid-19 will be key to the AAIB's ability to sustain operations in the next pandemic.

Conclusion

The AAIB has responded effectively to the pandemic; it has remained operational and continued to fulfil its important role of improving aviation safety. It has deployed personnel throughout the pandemic and sustained the currency of its experienced cadre. It has also effectively recruited and trained new inspectors and support staff. It has achieved all this by employing innovative ways of working, exploiting technology and working with its extensive network of fellow AIAs to develop safe protocols for investigations. If there is a truism in the field of accident investigation it is that every accident is different and presents unique challenges. It is in the DNA of the AAIB to overcome challenge and to solve problems and this attitude can be seen at every level and discipline in the AAIB. Ultimately, it has been the harnessing of this corporate attitude that has enabled the AAIB to successfully overcome the challenges and continue to operate during the SARS Cov-2 pandemic.

AAIB's Case Management System

As an investigative body there is a need to store appropriate records securely and to manage the investigation process from event notification to assessment of responses to recommendations. The legacy system was proving to be outdated and was not flexible enough to keep pace with changes in accident investigation regulations.

In March 2020 AAIB went live with a new cloud-based Case Management System (CMS). This was fortuitous timing as it was the week before the UK went into lockdown due to Covid-19 and our legacy database system did not provide good remote access.

The CMS programme was the result of two years of development and testing. It replaced the previous bespoke database, and importantly brought tracked emails and investigation evidence, such as images, into one cloud-based system. The system can be accessed from most mobile devices giving significant improvements for staff working remotely, which is routinely encountered during deployments, as well as during enforced home working during the Covid-19 pandemic.

Agile project techniques were used to develop the system, and much of the core functionality was developed in conjunction with the UK Rail and Marine Accident Investigation Branches to reduce costs. Importantly AAIB case records from legacy systems have been migrated into CMS to provide a database of events spanning several decades.

Managing the Investigation

The case management process starts with a notification to the AAIB. This might be from a pilot, an airport, an operator, the police or from a member of the public. The AAIB accident line is active at all times. During UK office hours the accident line is staffed by the AAIB's Operations Centre, whilst out of hours the accident line is transferred to the DfT's Duty Office who then contacts the AAIB's Duty Coordinator.

Information, gathered from the notification, such as contacts, event description, damage to the aircraft, is entered into CMS. Previously this info would have been recorded on an electronic form, however it is now input directly into CMS by whoever takes the call and is immediately available for the AAIB's Duty Coordinator to make their assessment as to the AAIB's response.

Event notifications are triaged by the AAIB Duty Coordinator, who is an experienced investigator. This includes an assessment of the severity of the event according to international standards set out in Annex 13 to the Convention on International Civil Aviation and regulations, as well as an assessment of the appropriate response from AAIB. In a typical year AAIB receives just under 1,000 notifications and AAIB are very keen that they achieve an element on over-reporting so that all events from which safety lessons can be learned are captured. AAIB responses include:

- Deploying a team for a Field investigation
- Assigning an inspector for a correspondence investigation
- Conducting a wide-ranging Safety Study
- Completing a short (few lines of text) Record Only investigation
- Assisting a foreign state by appointing an Accredited Representative or "Expert"
- Referring the investigation to a UK sport aviation body
- No Further AAIB Action.

Having captured the assessment in CMS the AAIB Operations Centre Team then support the investigation process with various activities such as sending formal notification emails to organisations such as State Investigation Authorities. The team assigned to the investigation are entered in CMS and thereafter automated alerts notify the case team of key milestones in the investigation process.

Managing the Investigation

A dedicated SharePoint site has been created as part of CMS where case information, such as documents, images and email attachments, are stored. This allows the case team to share case information throughout the investigation, including during the field phase where the deployed team are often not working at the same location. There is also functionality in CMS to record notes on investigation progress to assist management oversight.

A key part of the investigation is report creation. AAIB publish several report types such Formal Reports, Field Investigation Reports, Correspondence Investigation Reports, Special Bulletins and Record Only Reports; these are all managed from CMS and the linked SharePoint site. This includes managing the email process for formally requesting comments on draft reports in accordance with the ICAO Annex 13 standards.

Managing Safety Recommendations

Making Safety Recommendations is a key part of AAIB's activities in improving aviation safety. The formal transmittal of Safety Recommendations, and the responses from the addressees to Safety Recommendations, is managed and monitored from CMS. This includes managing both the email process with external addressees as well as managing the internal assessment of responses.

Evidence Management

The tracking of evidence has been incorporated within CMS. Evidence can be logged into CMS during a field deployment using mobile devices and can be tracked as the investigation progresses. CMS has the functionality to manage 'child' evidence that is generated from 'parent' evidence during a component teardown for example. The system has the option to use barcode readers available on mobile phones.

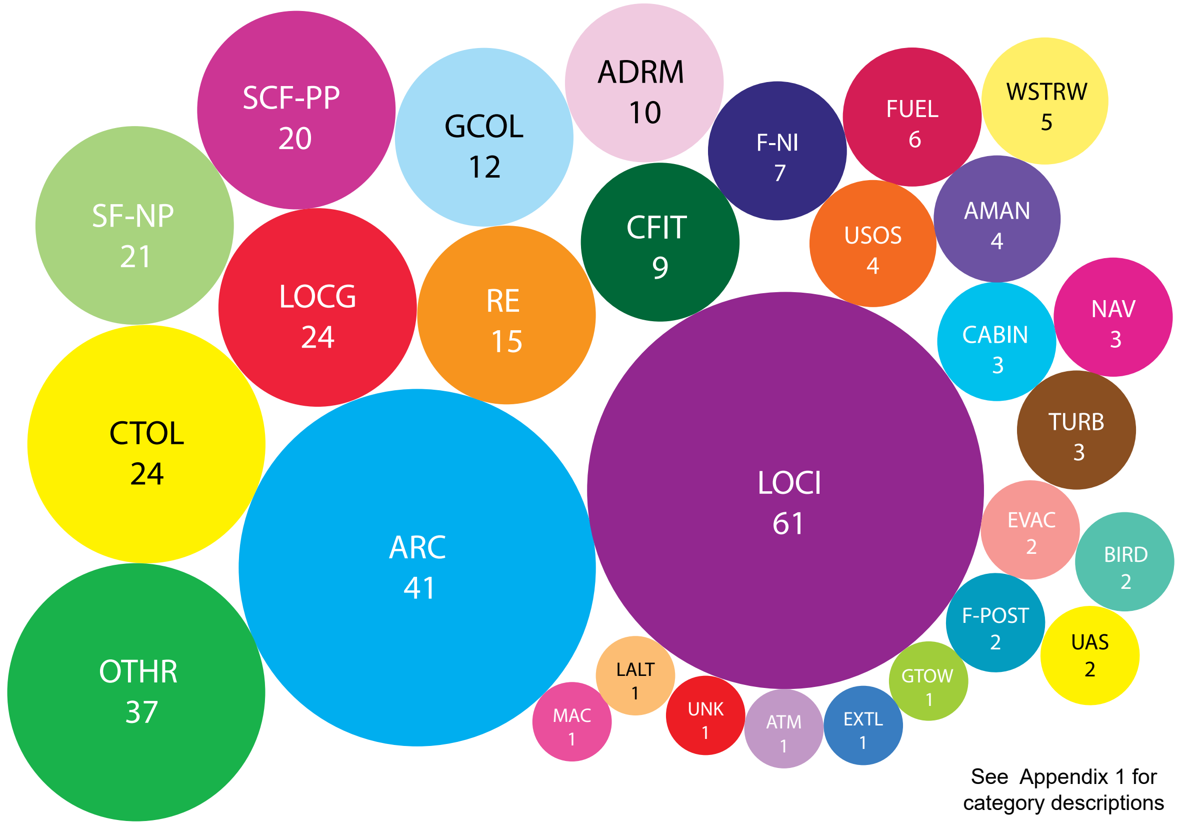
Management data

The system has powerful search capabilities and the ability to tailor data presentation to various user needs using bespoke views. This is particularly useful for providing automated management information for example weekly event logs, inspector workload allocation and managing responses to Safety Recommendations.

The Deputy Chief Inspector at AAIB, has been very pleased with the results, "not only has this been a real enabler to AAIB during lock down with the extended periods of home working, but it has also provided AAIB with the flexibility to evolve our business processes. The latter is particularly important for our key outputs and Safety Recommendations, as we are now required to monitor the responses and actions taken by organisations".

CICTT factors on investigations by the AAIB in 2020

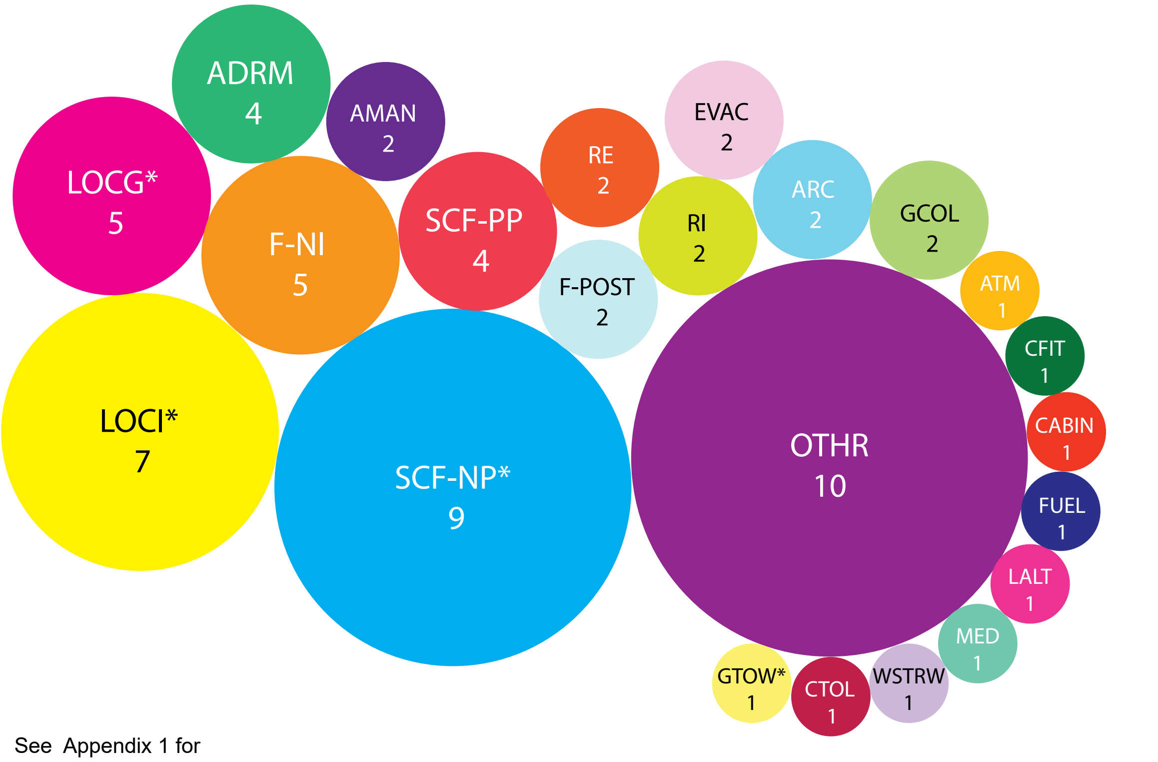
Every occurrence in the UK is recorded and coded using the occurrence taxonomy defined by the CAST/ICAO Common Taxonomy Team (CICTT). This is a worldwide standard taxonomy to permit analysis of data in support of safety initiatives. It should be noted that they are recorded as multiple factors, for example turbulence (TURB) leading to loss of control in flight (LOC-I). Similarly, other (OTHR) is also used and may include aspects that do not have specific classifications.



See Appendix 1 for category descriptions

Factors for all investigations reported on by AAIB in 2020

Field investigations



See Appendix 1 for category descriptions

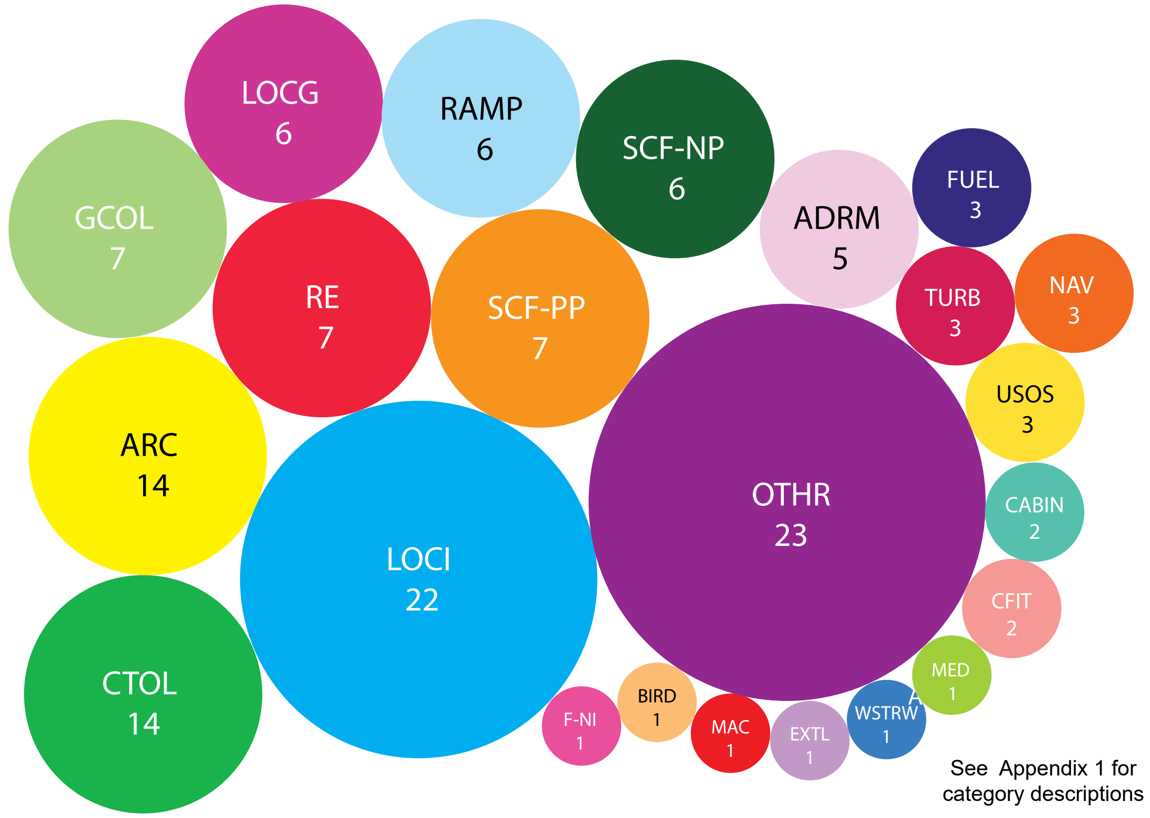
* - Categories connected with fatal accident

Factors for field investigations reported on by AAIB in 2020

In 2020 the AAIB published 30 field investigation reports, one of which was an investigation into a fatal accident and 29 were into non-fatal accidents or serious incidents.

The 29 investigation reports published during 2020 into non-fatal events were balanced between commercial air transport (CAT) and general aviation (GA).

Correspondence investigations

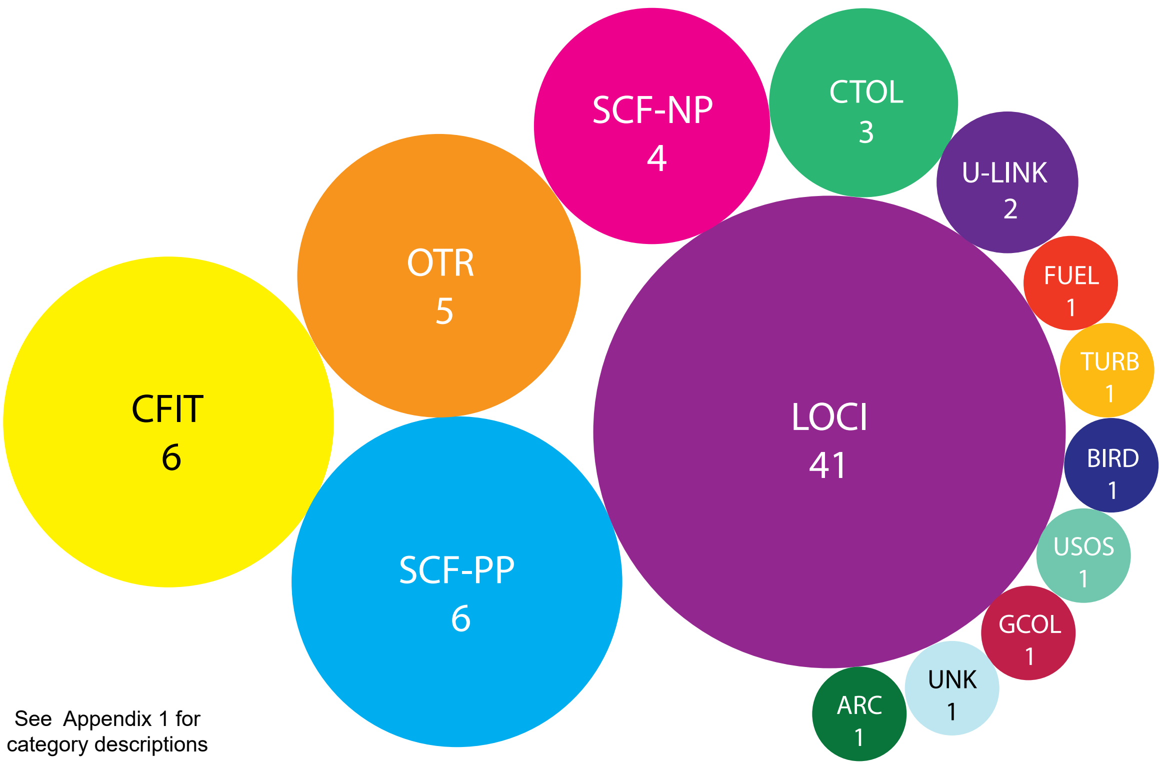


See Appendix 1 for category descriptions

Factors for correspondence investigations reported on by AAIB in 2020

Correspondence investigations are usually conducted into non-fatal accidents on GA aircraft and to some serious incidents on CAT aircraft.

UAS investigations



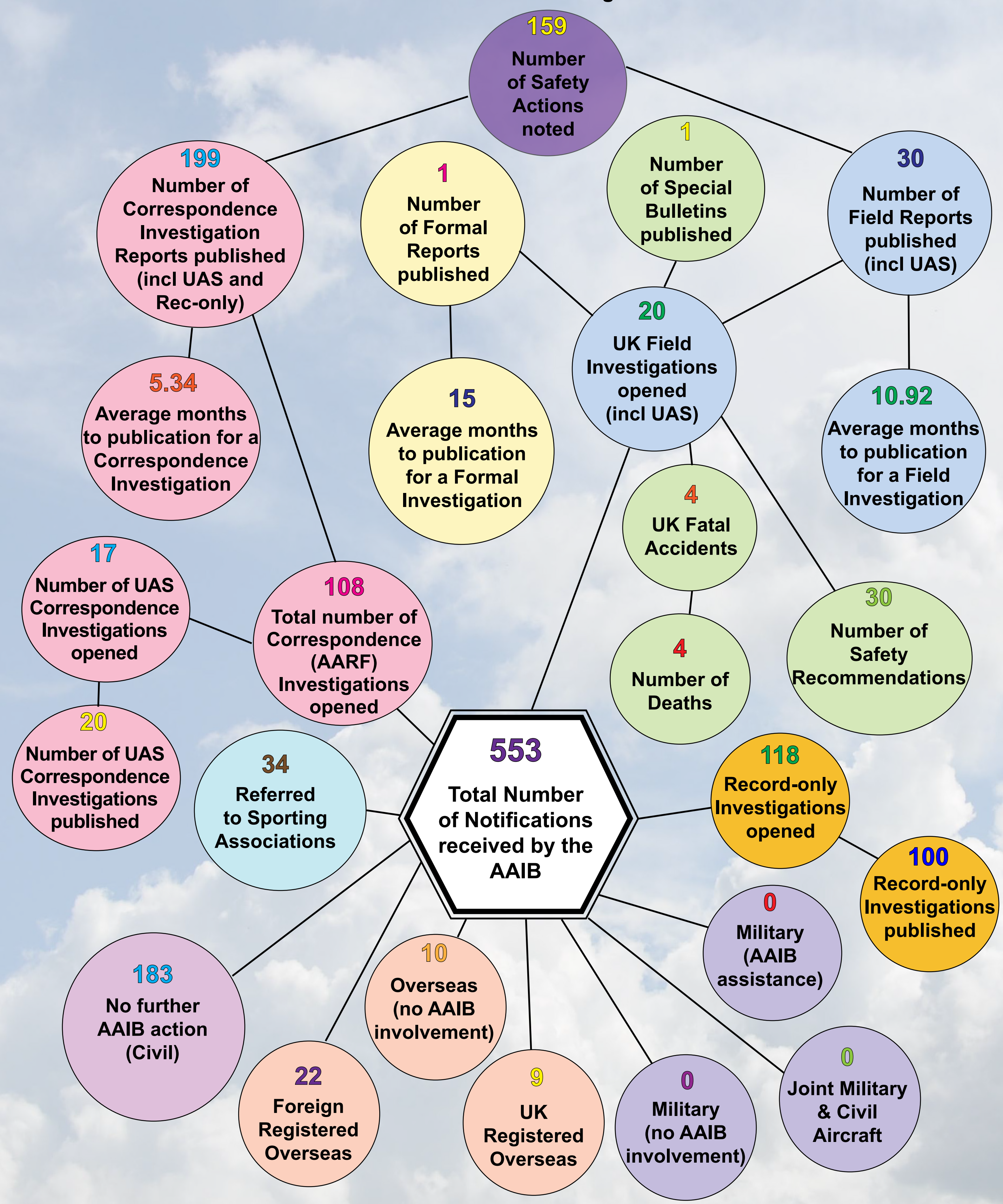
See Appendix 1 for category descriptions

Factors for UAS investigations reported on by AAIB in 2020

The predominant cause of UAS accidents, was LOCI usually resulting from a sudden complete electrical power failure or loss of thrust from one or more lift propellors. In most of these cases failures such as this results in the machine rapidly becoming unflyable and unrecoverable. There is no resort to aerodynamic recovery techniques such as can be carried out in a conventional helicopter. Although the parachute recovery systems are becoming available, the AAIB has no data on the effectiveness or otherwise of these systems.

Statistics for 2020

An overview of what we were involved with during 2020 can be seen below:



Introduction

The following pages provide the statistics for 2019, 2018 and 2017 for accidents and serious incidents notified to the Air Accidents Investigation Branch.

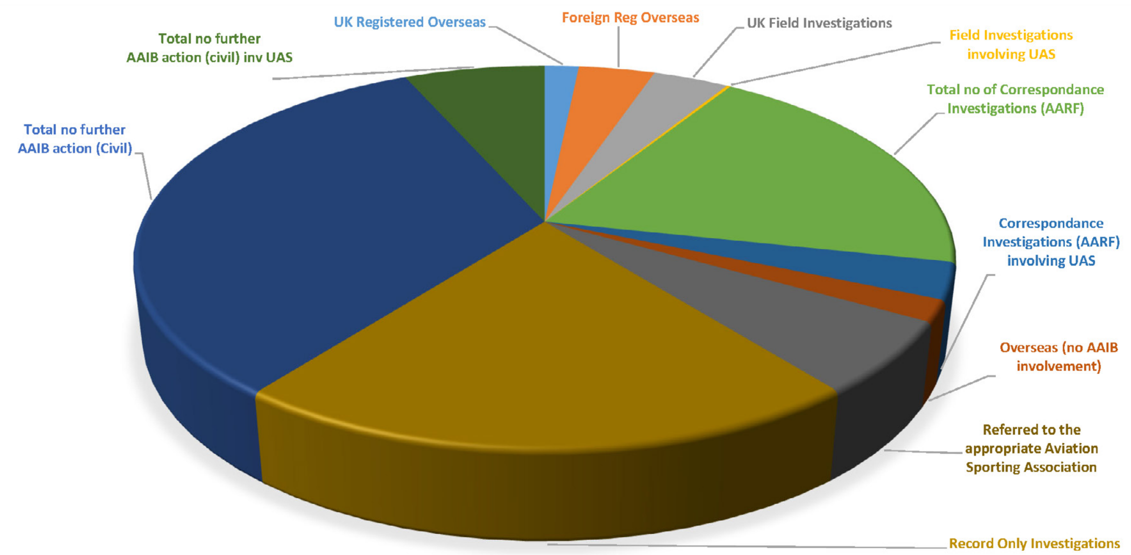
An explanation of the categories is as follows:

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 of 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 of 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)	Accidents and serious incident investigations to UAS where they are operated under a CAA permission, or are privately operated with mass greater than 20 kg.
Military with AAIB Assistance / Observer	Where an MoD aircraft accident, serious incident Service Inquiry may be convened, an AAIB Inspector is appointed to assist or observe.
AARF Investigations	Investigations conducted by correspondence only using an Aircraft Accident Report Form (AARF) completed by the aircraft commander.
Overseas (no AAIB involvement)	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 involvement)	Notifications to the AAIB concerning Military aircraft with no AAIB involvement.
Record-Only Investigations	An occurrence that if investigated fully has little likelihood of identifying new safety lessons that will advance aviation safety.

Notifications 2020

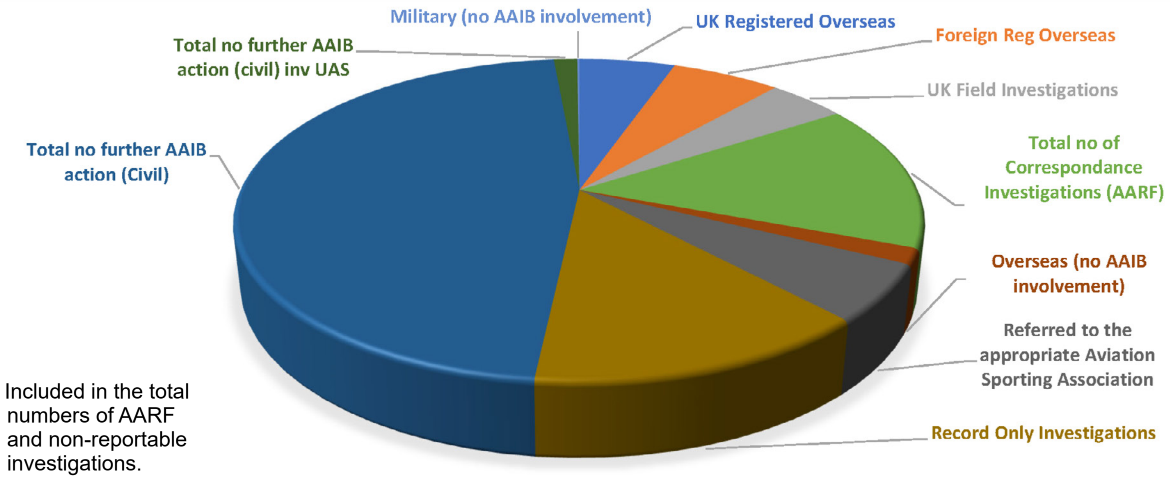
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	1	0	2	1	0	1	0	1	1	1	1	0	**9**
Foreign Reg Overseas	5	3	1	0	2	0	2	1	2	3	2	1	**22**
UK Field Investigations	0	1	1	0	3	1	0	4	4	3	2	1	**20**
Military (AAIB Assistance)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total no of Correspondence Investigations (AARF)	4	5	8	2	9	13	18	15	15	6	4	9	**108**
Correspondence Investigations (AARF) involving UAS	0	0	3	3	1	2	1	0	0	0	0	0	**10**
Overseas (no AAIB involvement)	0	0	3	1	0	1	2	0	0	1	1	1	**10**
Referred to the appropriate Aviation Sporting Association	1	0	1	1	2	7	10	5	4	2	1	0	**34**
Record Only Investigations	7	7	9	4	10	4	17	18	20	3	9	10	**118**
Total no further AAIB action (civil)	32	31	8	5	3	8	15	22	28	12	8	11	**183**
Total no further AAIB action (civil) inv UAS	3	0	1	4	7	4	7	6	7	0	0	0	**39**
Military (no AAIB involvement)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**53**	**47**	**37**	**21**	**37**	**41**	**72**	**72**	**81**	**31**	**28**	**33**	**553**
UK Fatal accidents	0	0	0	0	0	0	0	2	0	1	1	0	4
Number of deaths	0	0	0	0	0	0	0	2	0	1	1	0	4



Investigation Statistics

Notifications 2019

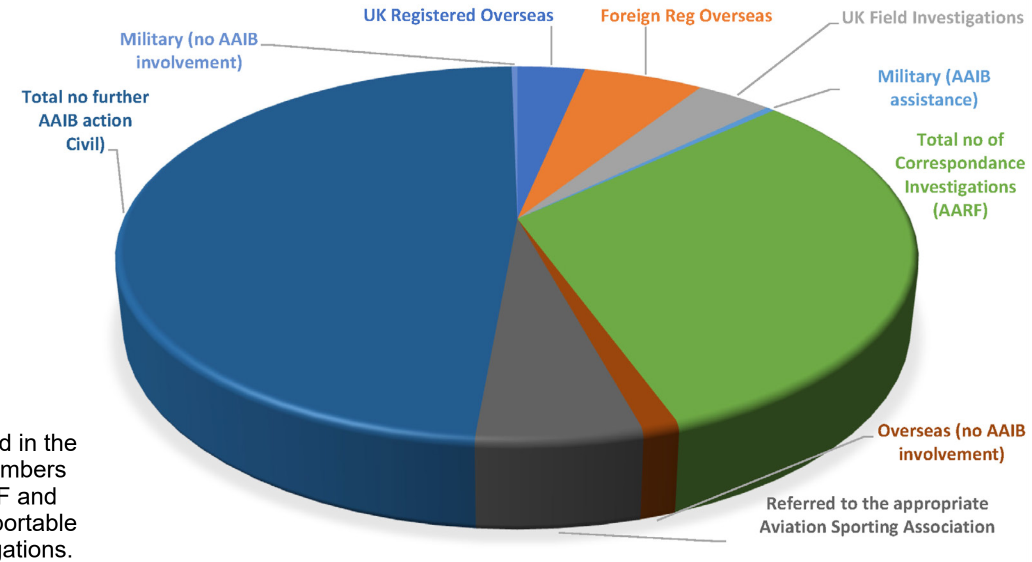
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	3	1	5	1	8	6	8	6	4	2	0	1	45
Foreign Reg Overseas	3	1	5	4	7	4	5	6	1	6	4	5	51
UK Field Investigations	2	3	2	3	3	4	4	4	4	2	2	4	37
Military (AAIB Assistance)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total no of Correspondence Investigations (AARF)	11	20	11	14	11	10	14	13	6	6	5	3	124
Correspondence Investigations (AARF) involving UAS	3	3	3	2	0	2	1	0	4	2	2	1	23*
Overseas (no AAIB involvement)	2	0	2	1	1	1	0	1	2	2	0	1	13
Referred to the appropriate Aviation Sporting Association	3	1	3	5	6	5	8	7	6	1	2	1	48
Record Only Investigations	1	1	1	7	11	15	22	16	14	7	6	14	115
Total no further AAIB action (civil)	22	23	26	26	23	45	49	33	44	40	36	25	392
Total no further AAIB action (civil) inv UAS	0	0	0	0	0	0	0	0	1	2	1	7	11*
Military (no AAIB involvement)	0	0	1	0	0	0	0	0	0	0	0	0	1
Total	**47**	**50**	**56**	**61**	**70**	**90**	**110**	**86**	**81**	**66**	**55**	**54**	**826**
UK Fatal accidents	**1**	**1**	**0**	**0**	**1**	**0**	**2**	**1**	**0**	**0**	**1**	**1**	**8**
Number of deaths	**2**	**1**	**0**	**0**	**1**	**0**	**2**	**2**	**0**	**0**	**1**	**1**	**10**



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

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**

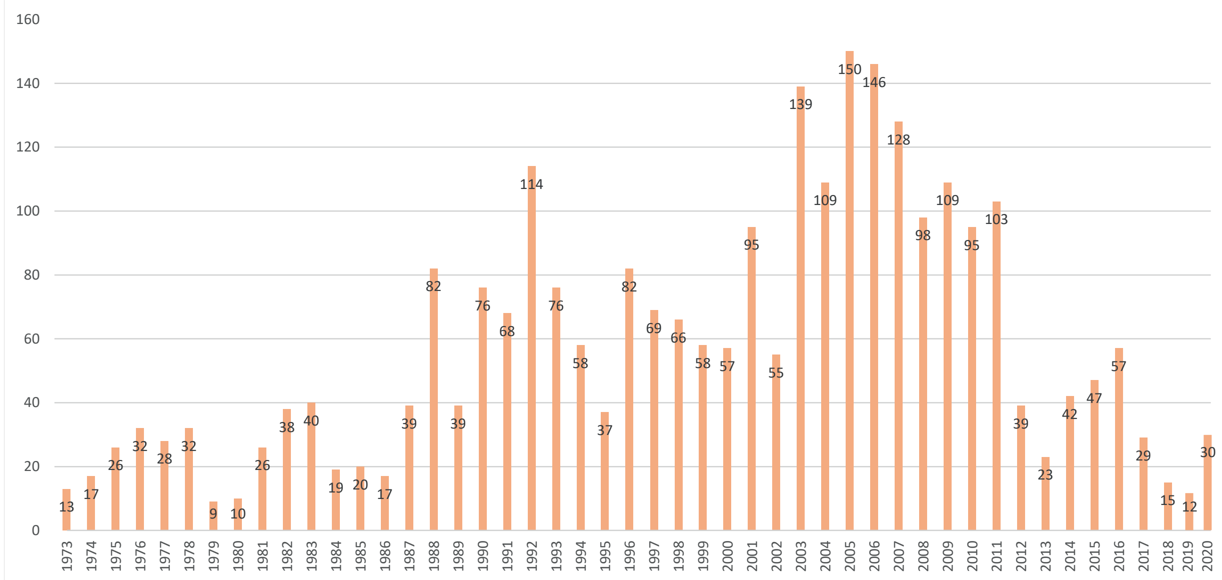


* Included in the total numbers of AARF and non-reportable investigations.

Investigation Statistics

Safety Recommendations in 2020

In 2020 the AAIB issued 30 Safety Recommendations from 12 investigations.



Recommendation numbers made in previous years

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

Monitoring of Safety Recommendations

The AAIB is responsible for monitoring the action addressee responses to Safety Recommendations. This is in accordance with the amendment that was made to ICAO Annex 13 in November 2018. The specific Paragraph 6.12 requires that; '*A State that receives a safety recommendation shall implement procedures to monitor the progress of the action taken in response to that safety recommendation'*.

The AAIB carries out this function for the UK, its Overseas Territories and Crown Dependencies.

It is important to note that this is to monitor the progress of actions taken in response to a Safety Recommendation, it is not to undertake the role of the regulator nor to provide opinion on the efficacy of the action. The AAIB monitors the progress of actions being taken by the addressees and reports regularly to the Board of Accident Investigation Branches (BAIB) and the State Safety Board (SSB) on progress toward completion. It is for the SSB to decide whether any further intervention is needed.

This monitoring of actions is not only for Safety Recommendations issued by the AAIB but also those that have been issued to addresses in the UK from other Accident Investigation Authorities.

When the AAIB receives a response to a recommendation from the addressee it is assessed as to its adequacy under the requirements of Article 18 of retained Regulation (EU) 996/2010 (as amended). The AAIB applies the following assessment criteria to the Safety Recommendation responses;

- **Adequate** means that the response fully meets the intent of the Safety Recommendation and the action is expected to address the safety issue.
- **Partially Adequate** 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.
- **Not Adequate** means that the response does not address the intent of the Safety Recommendation nor does it address the safety issue concerned. The AAIB will apply an open or closed status depending on the expectation of whether the addressee will reassess their response.
  - **Not Adequate - OPEN** The status of 'open' implies that AAIB still has concerns regarding the identified safety deficiency and that there is an expectation that the addressee will provide further responses.
  - **Not Adequate - CLOSED** The status 'closed' implies that there is a low likelihood that the addressee will act on the recommendation or provide any further responses.
- **Superseded** means the Safety Recommendation has been 'Superseded' either by a 'newer' and more comprehensive Safety Recommendation or actions have subsequently been taken by the addressee that have superseded the recommendation.

In reporting on the monitoring of the actions taken to a Safety Recommendation these are reported as meeting one of the following:

ACTION STATUS	Meaning	Status
• **Planned actions complete**	All planned actions are completed.	CLOSED
• **Planned actions partially completed**	Some of the planned actions have been completed and the addressee is not intending on doing any further action.	CLOSED
• **Planned actions not completed**	The planned actions have not been completed and the addressee now has no intention of doing any further action.	CLOSED
• **Planned actions ongoing update due (XX/XX/XXXX)**	Planned actions are still ongoing and further updates will be provided.	OPEN
• **Not enough information**	The update is not detailed enough to assess. A request will be made for a further update.	OPEN
• **No planned actions**	There are no planned actions.	REFER TO NOT ADEQUATE

A Safety Recommendation issued after 1 January 2019 therefore remains OPEN until such time as the addressee has completed its activity in relation to that recommendation. It is therefore possible for a Safety Recommendation to be assessed as "adequate" but will remain OPEN until the planned actions are completed.

Of the 30 Safety Recommendations issued in 2020, as of the of 31 March 2021, responses have been received for 29 Safety Recommendations. The AAIB response assessment has classified those responses as follows:

- Eight are **Adequate**, with planned actions completed and are **Closed.**
- Five are **Adequate**, with planned actions ongoing and remain **Open**.
- Ten are **Partially Adequate** with planned actions ongoing and remain **Open.**
- Four are **Partially Adequate,** with planned actions completed and are **Closed.**
- Two are **Not Adequate** and are **Open.**
- One is awaiting a response from the addressee.

Summary table

Number	Response Assessment	Action Status	Status
2020-001	Adequate	Planned actions completed	Closed
2020-002	Adequate	Planned actions completed	Closed
2020-003	Adequate	Planned action ongoing, update due 28 February 2021	Open
2020-004	Adequate	Planned actions completed	Closed
2020-005	Adequate	Planned action ongoing, update due 30 June 2021	Open
2020-006	Partially adequate	Planned action ongoing, update due 31 December 2020	Open
2020-007	Partially adequate	Planned action ongoing, update due 31 March 2021	Open
2020-008	Not adequate	Not enough information	Open
2020-009	Adequate	Planned action ongoing, update due 31 December 2020	Open
2020-010	Partially adequate	Planned action completed	Closed
2020-011	Adequate	Planned action ongoing, update due 28 February 2021	Open
2020-012	Adequate	Planed action ongoing, update due 02 April 2021	Open
2020-013	Adequate	Planned action completed	Closed
2020-014	Adequate	Planned action completed	Closed
2020-015	Adequate	Planned action completed	Closed
2020-016	Partially adequate	Planned action completed	Closed
2020-017	Adequate	Planned action completed	Closed
2020-018	Partially adequate	Planned action ongoing, update due 21 June 2021	Open
2020-019	Partially adequate	Planned action completed	Closed
2020-020	Partially adequate	Planned action ongoing, update due 19 July 2021	Open
2020-021	Partially adequate	Planned action ongoing, update due 31 January 2022	Open
2020-022	Partially adequate	Planned action ongoing, update due 19 July 2021	Open
2020-023	Partially adequate	Planned action ongoing, update due 14 September 2021	Open
2020-024	Partially adequate	Planned action ongoing, update due 31 August 2021	Open
2020-025	Partially adequate	Planned action ongoing, update due 24 May 2021	Open
2020-026	Partially adequate	Planned action ongoing, update due 31 December 2021	Open
2020-027	Partially adequate	Planned action completed	Closed
2020-028	Adequate	Planned action completed	Closed
2020-029	Not adequate	Not enough information	Open
2020-030	Awaiting response		Open

On 31 December 2020 the transition period for the UK exit ended. Thereafter the AAIB was unable to update details of its Safety Recommendations on the European Central Repository Safety Recommendation Information System (SRIS). In addition, SRIS was updated to SRIS 2. The UK Safety Recommendation issued up to the end of 2020 were entered onto SRIS and can be found on the public SRIS.

Air Accidents Investigation Branch
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These can be found under Safety Recommendations on the aviationreporting.eu portal:

https://sris.aviationreporting.eu/safety-recommendations

Each Safety Recommendation is also assessed as to whether it is a Safety Recommendation of European Union Wide Relevance (SRUR) or a Safety Recommendation of Global Concern (SRGC).

A SRUR is defined as meeting one or more of the following criteria:

- The deficiency underlying the safety recommendation is systemic, not related to a specific aircraft type, operator, manufacturer component, maintenance organisation, air navigation service and/or approved training organisation, and is not solely a national issue, or
- There is a history of recurrence across Europe of the relevant deficiency.

ICAO Annex 13 was amended in November 2020 to the 12th Edition, this included an amendment to the definition of a SRGC to:

> A safety recommendation regarding a systemic deficiency having a probability of recurrence, with significant consequences at a global level, and requiring timely action to improve safety.

SRGC provided to ICAO can be found on their website:

https://www.icao.int/safety/airnavigation/AIG/Pages/Safety-Recommendations-of-Global-Concern-(SRGC).aspx

Safety Recommendations issued to ICAO are also available on their website:

https://www.icao.int/safety/airnavigation/AIG/Lists/Safety%20recommendations%20to%20ICAO/Search1.aspx

Of Safety Recommendations issued by the AAIB in 2020, 5 were both a SRUR and a SRGC.

Note: The regulations and a link to ICAO Annex 13 can be found on the AAIB website:

https://www.gov.uk/government/collections/aaib-regulations-and-mous

Safety Recommednation and Safety Action Overview

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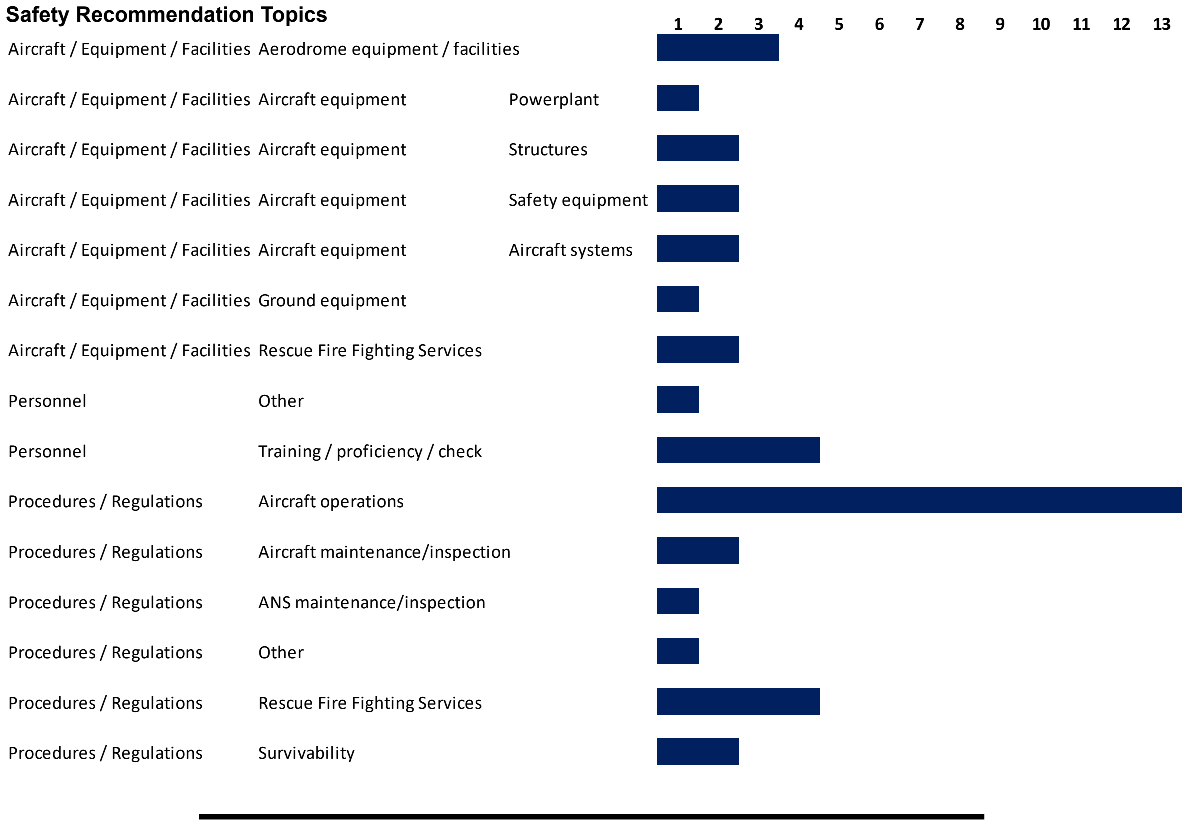

Safety Recommendations issued in 2020

Notes: Safety Recommendation classification correct at time of publication.

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

Reflects the situation with Safety Recommendations at 31 March 2021.

Index of Safety Recommendations 2020

DJI Matrice 210, (UAS registration n/a)
16 March 2019 at Temple Newsam, Leeds, Yorkshire

Synopsis

Footage captured one minute before the accident

The DJI Matrice 210 small unmanned aircraft was being operated commercially to record video footage of an outdoor athletics event. The pilot started to position the aircraft back towards the landing site due to an increase in the rainfall. The pilot then saw the aircraft "wobble" slightly and as it neared the landing site it flipped over before descending rapidly to the gound from a height of about 3 m (10 ft). No one was injured. During the accident flight the aircraft had been operating at heights of up to about 30 m (100 ft) near to, and above people on the ground. This investigation reviewed other similar accidents and the risk of injury to people on the ground. Two Safety Recommendations were made to the UK CAA.

Safety Recommendation 2020-001

Justification

Although it was not confirmed if moisture ingress caused this accident, information shows that other Matrice 200 series accidents have been caused by moisture entering the aircraft. The manufacturer's analysis also showed that 27% of accidents were attributed to a loss of propeller motor propulsion that were for reasons other than a fault with the ESC. The manufacturer did not provide guidance on ascertaining if the rainfall exceeded limitations, or the duration that the IP 43 protection may remain in place. It is therefore possible that pilots of the Matrice 200 series could operate the aircraft in rain without knowing that it could result in the loss of control of the aircraft due to moisture ingress.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-001**
>
> It is recommended that the Civil Aviation Authority notify users of the DJI Matrice 200 series of the possibility of moisture entering the aircraft when operating in rain and that this could result in a sudden loss of control of the aircraft.

Date Safety Recommendation made: 2 January 2020

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LATEST RESPONSE

Response received: 25 February 2020

The publication of CAA Safety Notice SN-2020/001 "Small Unmanned Aircraft – Water Ingress" highlights the issue of water ingress to all types of Unmanned Aircraft Systems and not just specifically for the DJI Matrice 200 series

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Safety Recommendation 2020-002

Justification

In accordance with the ANO, a person must not 'permit an aircraft to endanger any person' and may only fly the aircraft 'if reasonably satisfied that the flight can safely be made'. It is therefore up to the operator or remote pilot to decide if flying a UA over people will endanger them. However, there is no guidance available from the CAA on how to make that assessment. This could include consideration of standards of safety, reliability, UA mass and type, the operational environment and whether any secondary safety systems are fitted.

IR (EU) 2019/947 is due to come into force in July 2020 and will require that a UA operating in the open category with a mass of more than 250 grams must not be flown over 'uninvolved persons'. If operating a UA in the specific category, the operator will need to comply with mitigating safety actions to prevent injury to people. However, these actions are not due to be published by the EC until 2021 which leaves an unresolved hazard prior to publication.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-002**
>
> It is recommended that the Civil Aviation Authority specify the conditions that must be met for an unmanned aircraft to be flown safely over people.

Date Safety Recommendation made: 2 January 2020

LATEST RESPONSE

Response received: 1 December 2020

The CAA believes that this recommendation is met through the introduction of the European Commission's new regulations pertaining to UAS that will be implemented in the UK on 31 Dec 20. With the extant regulations, there are no specific requirements that must be met for UAS to be flown over people; the existing rule set specifies that uninvolved third parties must be avoided by a 50m 'bubble,' which allows for overflight. Advice on the requirements to achieve this safely were covered through the release of Safety Notices and assessment of individual Operational Authorisations, but it was not within our remit to change the legislation directly to disallow overflight or enforce these requirements.

The new regulations specify that the 50m 'bubble' will be replaced by a 'cylinder,' meaning that UAS cannot fly within a 50m horizontal distance of uninvolved 3rd parties when operating in the A2 and A3 categories. The A2 category also demands extra requirements in terms of pilot competence and product standards. Overflight in the A1 category is permitted and mitigated by the mass limit of 250g and additional product standards.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Air Accidents Investigation Branch
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Airbus A320-214, G-EZTD
24 April 2019 at Lisbon Airport, Portugal

Synopsis

Under international protocols, this investigation was delegated to the AAIB by the Gabinete de Prevenção e Investigação de Acidentes com Aeronaves e de Acidentes Ferroviários (GPIAAF) in Portugal.

Image of Lisbon Airport showing the calculated and actual takeoff points

During pre-flight preparations, both pilots completed a takeoff performance calculation for a takeoff from the runway intersection with Taxiway U5. During subsequent re-planning, the crew thought they had recalculated performance information from Taxiway S1 but had, in fact, used S4 (runway full length). The aircraft took off from Taxiway U5 with performance calculated for the full runway length. The takeoff distance available from U5 was 1,395 m less than that used for the performance calculation, and the aircraft passed the upwind end of the runway at 100 ft aal. The operator had another identical event 14 days later.

Following this event, the operator acted to raise awareness of the issue with its crews and engaged with the aircraft manufacturer to review possible technical developments which might prevent a recurrence of these type of events.

One Safety Recommendation is made to mitigate the risk of further confusion relating to takeoff positions.

Safety Recommendation 2020-003

Justification

Lisbon Airport uses takeoff 'Positions' to reference takeoff points rather than the more usual taxiway/runway intersections. This led to confusion with two crews when entering the takeoff position into their electronic flight bags as part of their takeoff performance calculations. This led to takeoff thrust being calculated for the full length of the runway while the actual takeoff was from an intersection from which there was 1,395 m less runway available.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-003**
>
> It is recommended that ANA Aeroportos de Portugal discontinue the use of takeoff 'Positions' at Lison Airport to minimise confusion in relation to takeoff points.

Date Safety Recommendation made: 9 January 2020

LATEST RESPONSE

Response received: 6 May 2020

ANA Aeroportos de Portugal is still waiting for approval from the Civil Aviation Authority, ANAC, to promote the AIP Amendment proposed in its letter to ANAC dated 9 March 20.

It is thought that there are some delays due to the COVID-19 lockdown, but ANA Aeroportos de Portugal will contact ANAC for an update.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Ongoing Update Due 28 February 2021**

Recommendation Status: **Open**

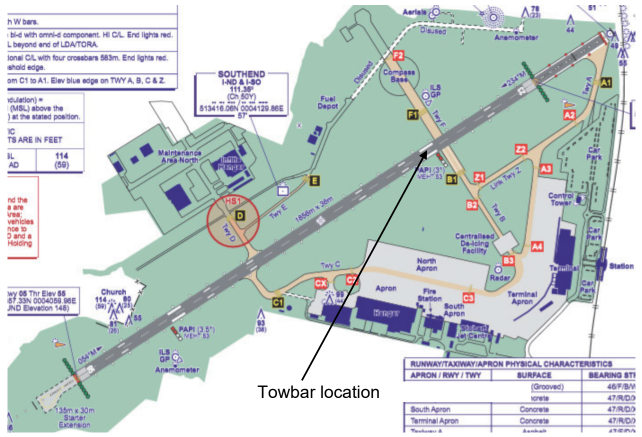
Feedback rationale

The AAIB requests an update by February 2021 on the progress made to discontinue the use of takeoff Positions at Lisbon Airport.

EMB-145EP, G-SAJK
7 August 2019 at London Southend Airport

Synopsis

An Embraer 145 landing at London Southend Airport ran over a general aviation towbar which had been dropped on the runway. No damage was caused to the aircraft. The investigation found that the towbar had fallen from a Cessna 210 which departed Southend Airport 30 minutes before. The Cessna pilot had likely been distracted during his pre-flight checks by an earlier road traffic incident in which he was involved, and had inadvertently left the towbar attached.



London Southend Airport Chart showing approximate location the towbar was found

One Safety Recommendation has been made to the CAA to improve the visibility of general aviation ground equipment.

Safety Recommendation 2020-004

Justification

Increasing ground equipment visibility.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-004

It is recommended that the Civil Aviation Authority communicate to the general aviation community the importance of increasing the visibility of ground equipment.

Date Safety Recommendation made: 16 January 2020

LATEST RESPONSE

Response received: 26 March 2020

The General Aviation Unit within the CAA have created a communications campaign on the risk and mitigation actions surrounding the Southend serious incident and made a clear call to action to pilots to consider painting their tow bars in bright colours. Firstly, the AAIB report was highlighted to the community via Skywise with a request for pilots to consider painting their tow bars in bright colours. This was followed by a call on social media for pilots to show and tell the CAA what colour they had painted their own tow bars and to encourage those that haven't, to follow suit. An article was written about the Southend incident and shared via Skywise, highlighting the factors that led to the event; lack of visibility of the tow bar and inadequate checks due to distraction. Again, a call to action was made to pilots to paint their tow bars in highly visible colours and for them to consider if they are fit to fly. On behalf of the CAA, GASCo have also contributed to the campaign with a slide on external checks as part of covering the incident within their March and April 2021 safety webinars. Once these presentations have commenced the CAA hope to have further reduced the risk of this incident re-occurring and will have fulfilled the above recommendation.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Air Accidents Investigation Branch
Annual Safety Review 2020

Piper PA-46-310P, N264DB
21 January 2019 at 22nm north-north-west of Guernsey

Synopsis

The accident occurred on 21 January 2019 at 2016 hrs. The wreckage was located on 3 February 2019 on the seabed approximately 22 nm north-north-west of Guernsey, within 100 m of the last secondary radar point recorded by the radar at Guernsey and at a depth of 68 m. There was one body present in the wreckage, which was recovered. The body was subsequently identified as that of the passenger.


View looking at remains of inner wing

The AAIB published Special Bulletin S1/2019 on 25 February 2019 to give preliminary information on the investigation and general information about how aircraft registered in the USA may be operated between the UK and France.

This Special Bulletin contains medical information relevant to the accident to highlight the implications of that information to the General Aviation community.

Safety Recommendation 2020-005

Justification

The CAA maintains a database of the licence details and qualifications of all pilots who hold a UK-issued flying licence as required under EASA Part ARA.GEN.220. It became clear during this investigation, however, that the CAA database for the pilot of N264DB was incomplete and contained numerous errors. The pilot had scanned a copy of his licence onto his laptop, which the investigation was able to access, but without this copy erroneous conclusions might have been reached about the pilot's qualifications and entitlements. This mismatch between database records and a pilot's licence is not unique, and previous AAIB investigations have encountered similar discrepancies. Although the authoritative document is the licence, the competent authority, in this case the CAA, should maintain accurate information as required by EASA regulation.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-005

It is recommended that the Civil Aviation Authority ensure that the system in place to meet the requirements of EASA Part ARA.GEN.220 is effective in maintaining accurate and up-to-date records related to personnel licenses, certificates and ratings.

Date Safety Recommendation made: 14 March 2020

Safety Recommednation and Safety Action Overview

LATEST RESPONSE

Response received: 1 December 2020

Our review of the current licensing system delivered several options to allow us to meet the intent of this recommendation by maintaining accurate and up-to-date records related to personnel licences, certificates and ratings. In the current climate with resource heavily involved in both Covid-19 and BREXIT activities a two-stage solution was deemed appropriate.

In the short to mid-term, the practice of attaching a scanned copy of the examiner report forms to the Pilots record in the Pilot Information Management System (PIMS) will continue, but where we receive Freedom of Information requests or requests for information from official bodies additional checks will be added to ensure all data contained in the scanned documentation is manually entered on the pilot record as well.

The longer-term solution is for the 'Aviation Licensing Discovery' activity, which has been paused due to Covid-19 and BREXIT activities, to restart in February 2021. Where engagement with internal and external stakeholders will help clarify the end-to-end licensing requirements, enabling a solution to be created to meet all stakeholder needs and removing the additional burden of managing paper examiner report forms.

The discovery phase will take 8 to 12 weeks with the solution passing through Alpha and Beta testing prior to going live approximately 18 months later.

We will provide a further update when the discovery phase reports its findings and the solution has been shaped in June 2021. With additional updates at key stages of development to ensure we remain on track for implementation in December 2022.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Ongoing Update Due 30 June 2021**

Recommendation Status: **Open**

Feedback rationale

The AAIB notes the update from 1 December 2020 and requests a further update on progress in June 2021.

Safety Recommendation 2020-006

Justification

CO poisoning is known in the UK as the 'silent killer' as the gas cannot be seen, smelt or tasted and its effects can lead to a reduction in performance, permanent injury or death. Even the minor effects of CO poisoning can have a fatal consequence when operating an aircraft. As the existing two barriers to prevent CO poisoning (design and inspections) are not always effective, there is a need for a third barrier to alert pilots to the presence of CO in the cabin in time to take effective action. Low cost warning devices are readily available, and their carriage is actively encouraged by the regulators. Regulators have also produced specifications for CO detectors with active warnings. Although the carriage of a CO detector is at the owner's and pilot's discretion, it is unlikely that passengers, pilots under training and individuals who use cost sharing websites understand the risk.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-006

It is recommended that the Federal Aviation Administration require piston engine aircraft which may have a risk of carbon monoxide poisoning to have a CO detector with an active warning to alert pilots to the presence of elevated levels of carbon monoxide.

Date Safety Recommendation made: 2 March 2020

LATEST RESPONSE

Response received: 19 July 2020

The FAA is evaluating this recommendation and reviewing information related to carbon monoxide detectors that have been addressed in past issues for small airplanes.

We anticipate providing an updated response by December 31, 2020.

The FAA would like to thank the UK AAIB for submitting FAA Safety Recommendation 20.028 and its continued interest in aviation safety.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 31 December 2020**

Recommendation Status: **Open**

Safety Recommendation 2020-007

Justification

As for Safety Recommendation 2020-006, the following Safety Recommendation was made:

> **Safety Recommendation 2020-007**
>
> It is recommended that the European Union Aviation Safety Agency require piston engine aircraft which may have a risk of carbon monoxide poisoning to have a CO detector with an active warning to alert pilots to the presence of elevated levels of carbon monoxide.

Date Safety Recommendation made: 13 March 2020

LATEST RESPONSE

Response received: 11 December 2020

Prompted by the preliminary results of the Air Accidents Investigation Branch (AAIB) investigation, the European Union Aviation Safety Agency (EASA) has published the Safety Information Bulletin (SIB) No. 2020-01 'Carbon Monoxide (CO) Risk in Small Aeroplanes and Helicopters' on 27 January 2020.

The aim of the SIB is to inform Type Certificate and Supplemental Type Certificate holders, maintenance personnel, owners and operators of small aeroplanes (CS-LSA, CS-VLA and CS-23) and light helicopters (CS-27) with internal combustion engines or combustion heaters about the dangers of exposure to CO and to provide recommendations relating to the prevention, the detection and the reactions against CO exposure.

The SIB also refers to several related publications from the AAIB, the UK Civil Aviation Authority (CAA) and EASA.

In addition, the European Plan for Aviation Safety (EPAS 2020-2024) includes a regular update of the air operational rules (rulemaking task RMT.0392) to ensure efficiency and proportionality of the regulatory framework of Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations. The associated Terms of Reference (ToR) were published on the EASA website on 07 October 2020, and, as stated on page 2 of the ToR, this safety recommendation will be considered within the framework of this RMT. See the following link to the ToR:

> https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0392

The EPAS 2020-2024 indicates a planning milestone of 2021 Q1 for the associated Notice of Proposed Amendment (NPA). It should be noted that, depending on the complexity of the topics, several NPAs may be published in steps towards that target date.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 31 March 2021**

Recommendation Status: **Open**

Feedback rationale

The AAIB requests an update in 2021 Q1 on the progress of this Safety Recommendation within the RMT, corresponding to the EPAS 2020-2024 planning milestone.

Safety Recommendation 2020-008

Justification

As for Safety Recommendation 2020-006, the following Safety Recommendation was made:

> **Safety Recommendation 2020-008**
>
> It is recommended that the Civil Aviation Authority require piston engine aircraft which may have a risk of carbon monoxide poisoning to have a CO detector with an active warning to alert pilots to the presence of elevated levels of carbon monoxide.

Date Safety Recommendation made: 14 March 2020

LATEST RESPONSE

Response received: 14 May 2020

The Civil Aviation Authority does not currently accept this Recommendation but will revisit this position at the conclusion of an operational trial of carbon monoxide detectors.

The Authority is considering what barriers in addition to good design and maintenance practice will be both effective in further minimising the likelihood of critical CO contamination in the UK GA fleet, whilst acknowledging that any such additional measures should be both practical and proportionate.

On 3 March 2020, Safety Notice CAA SN 2020/003 was published which highlights the potential benefits of carrying low cost available commercial/domestic active detectors, as well as conventionally installed, approved aviation units. This Safety Notice will be advertised further through communication to all pilots when the current restrictions on recreational flying due to COVID-19 are lifted, to reduce the risk of this announcement being overlooked.

Importantly, the Safety Notice includes reference to a CAA-sponsored carriage trial of low-cost, widely available units which is intended to facilitate informed decisions in the future regarding recommending (or possibly mandating) specific categories of devices. This trial will establish if there are any negative safety implications (such as loose article hazard or distraction) associated with the carriage of carbon monoxide detectors. However, given the implications of COVID-19 on the 2020 flying season and stakeholder events, the timing for this trial is currently under review.

CAA Status – Open

AAIB Assessment: **Not Adequate**

Action Status: **Not Enough Infomation**

Recommendation Status: **Open**

Feedback rationale

The AAIB will await an update from the CAA on the results of its carriage trial of CO detectors including whether it intends to change its position on Recommendation 2020-008.

Safety Recommendation 2020-009

Justification

While the engine manufacturer produced guidance on how to examine its exhaust system, this guidance was not included or directly referenced in the aircraft manufacturer's 100-hour / Annual maintenance schedule. There was a warning in the introduction of the aircraft maintenance manual about consulting vendor publications, but there was no specific requirement in the 100-hour / Annual maintenance schedule for the PA-46-310P to pressurise the exhaust system to check for leaks. CO poisoning is known in the UK as the 'silent killer' as the gas cannot be seen, smelt or tasted and its effects can lead to a reduction in performance, permanent injury or death. Even the minor effects of CO poisoning can have a fatal consequence when operating an aircraft. As the existing two barriers to prevent CO poisoning (design and inspections) are not always effective, there is a need for a third barrier to alert pilots to the presence of CO in the cabin in time to take effective action. Low cost warning devices are readily available, and their carriage is actively encouraged by the regulators. Regulators have also produced specifications for CO detectors with active warnings. Although the carriage of a CO detector is at the owner's and pilot's discretion, it is unlikely that passengers, pilots under training and individuals who use cost sharing websites understand the risk.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-009**
>
> It is recommended that Piper Aircraft Inc. ensure that the 100-hour / Annual maintenance schedule for the PA-46 variants references the engine manufacturer's guidance, where available, on inspecting and testing the exhaust system.

Date Safety Recommendation made: 2 March 2020

LATEST RESPONSE

Response received: 30 June 2020

Piper Aircraft, Inc. acknowledges and agrees with Safety Recommendation 2020-009: "It is recommended that Piper Aircraft Inc. ensure that the 100-hour / Annual maintenance schedule for the PA-46 variants references the engine manufacturer's guidance, where available, on inspecting and testing the exhaust system."

In furtherance of and to accomplish the above safety recommendation, Piper Aircraft commits to the following:

1. Work with Original Equipment Manufacturers to determine the best way to convey the importance of thorough exhaust system inspections.
2. Review its maintenance and overhaul manuals to determine whether additional elaboration would increase the chance of a qualified mechanic finding a potentially un-airworthy condition. Piper will endeavour to complete this review to have any amplifications implemented in the aircraft maintenance manual in as timely a manner practical given the business constraints such as COVID-19, etc.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Ongoing Update Due 31 December 2020**

Recommendation Status: **Open**

Feedback rationale

Piper Aircraft's proposed actions allow their response to the Safety Recommendation to be classified as Adequate, Open. An update is requested when the proposed actions have been completed or by the end of 2020, whichever is earlier.

Bell 429, G-WLTS
2 January 2019 at Melksham Airbase, Wiltshire

Synopsis

The report considers two events which occurred while the pilot was conducting a Power Assurance Check. In one, an un-commanded yaw pedal movement caused a rapid rotation of the helicopter through two and a half complete rotations; in the other, a trim runaway was contained by the pilot. The trim runaway was found to be an unknown feature of the Automatic Flight Control System logic.

Autopilot control panel

Following these events, safety action was taken by the helicopter manufacturer and Transport Canada to help crews respond to a yaw trim runaway and to address the underlying causal factor. Also, the flight recorder manufacturer improved the way it reported the results of CVR recording inspections.

Two Safety Recommendations are made: one to Transport Canada in relation to conduct of the Power Assurance Check; and one to the European Union Aviation Safety Agency to ensure that the installation of new equipment on aircraft does not have a detrimental effect on existing equipment.

Safety Recommendation 2020-010

Justification

The Power Assurance Check (PAC is not mentioned in Rotorcraft Flight Manual (RFM) Normal Procedures for normal operations. The description of the PAC is in the Performance section of the manual, where it states that the PAC should be completed daily. However, it does not define the required configuration for the APs and AFCS and does not specify whether the PAC should be carried out pre- or post-flight. The operator conducted the PAC out of sequence with the RFM Category A Supplement, where the intent is to carry it out as part of the pre-flight procedures for every flight. The main body of the RFM, however, does not require the PAC to be conducted on the first start of a day, only that it should be achieved on a daily basis. The PAC is a normal procedure but is not reflected in the Normal Procedures section of the RFM. The inclusion of a defined procedure in Section 2 of the RFM, including starting parameters before the procedure such as AP status, would reduce ambiguity and allow flexibility in the timing of the procedure.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-010**
>
> It is recommended that Transport Canada require Bell Textron Canada Limited to amend Section 2 of the Bell 429 GlobalRanger Rotorcraft Flight Manual to include a Normal Procedure for the conduct of the daily Power Assurance Check.

Date Safety Recommendation made: 23 April 2020

LATEST RESPONSE

Response received: 6 January 2021

Regarding AAIB Safety Recommendation(s) No 2020-010

The RFM for the Bell 429 has been revised. The revision concerns the AAIB Safety Recommendation.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Feedback rationale

Although Transport Canada (TC) declined to accept the Safety Recommendation, the RFM revision goes some way to address its intent. Following publication of the RFM revision, therefore, this Safety Recommendation is closed.

Safety Recommendation 2020-011

Justification

If newly installed equipment interfaces (and shares information) with other existing equipment on an aircraft, tests must be conducted to ensure the installation has not had a detrimental effect on the existing equipment (these tests are in addition to any electromagnetic compatibility/interference testing). EASA specifically reminds Minor Change applicants of this in guidance contained in their 'Minor Change Certificate Document'. The document is aimed at applicants making changes to GA aircraft, and especially those who are not Design Organisation Approval holders and who may have limited experience in the change process. There is, however, no equivalent guidance or reminder to organisations qualified and practised in carrying out changes or repairs to Commercial Air Transport aircraft, leaving the potential for these tests to be overlooked and the continued airworthiness of the aircraft to be compromised.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-011**
>
> It is recommended that the European Union Aviation Safety Agency remind Minor Change applicants of the importance of verifying that new equipment does not have a detrimental effect on existing equipment with which it has a direct interface.

Date Safety Recommendation made: 21 April 2020

LATEST RESPONSE

Response received: 26 July 2020

The European Union Aviation Safety Agency (EASA) will undertake both corrective and preventive actions.

First, a dedicated inspection will be performed on the relevant Design Organisation Approval (DOA) holder, with particular attention given to the aspects pertinent to this serious incident.

Second, a safety-promotion article will be published in EASA's Certification & Design Newsletter, to highlight that the installation of certain equipment needs an electromagnetic and audio interference test, as part of the compliance demonstration, before the approval change.

An update will be sent to the Air Accidents Investigation Branch once these actions have been performed.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Ongoing Update Due 28 February 2021**

Recommendation Status: **Open**

Feedback rationale

EASA is requested to provide an update when the actions are complete or by the end of February 2021, whichever is sooner.

Standard Cirrus 75, G-DDGX
27 July 2019 at Gwernesney Airfield, Monmouthshire

Synopsis

Rear tailplane mechanism partially engaged, front fitting disengaged

The glider was undertaking an aerotow launch to the west at Gwernesney Airfield which was operated by the resident gliding club. During the early stages of the ground roll the horizontal tailplane (tailplane) detached from G-DDGX and fell to the ground. Club members assisting with the launch signalled for the takeoff to be aborted but the message did not reach the aerotow tug pilot; the accident pilot did not appear to hear or see the stop signals either. The glider became airborne and climbed rapidly, before the tow cable released and the aircraft's nose dropped. The glider descended steeply and struck the ground nose first. It came to rest inverted pointing in an easterly direction. First responders extricated the pilot from the aircraft before he was airlifted to hospital. He died five days later from complications related to injuries sustained in the accident.

The investigation determined that the tailplane had not been correctly attached when the glider was rigged and this condition was not detected prior to the flight. Several possible mis-rigging scenarios were identified during the investigation, but the precise manner in which the tailplane had been mis-rigged could not be determined.

Two Safety Recommendations are made relating to communication for glider launching and detecting incorrect alignment of tailplane locking features. In addition, the gliding club has undertaken several safety actions regarding launch signalling and detection of incorrect tailplane locking on other Standard Cirrus gliders.

Safety Recommendation 2020-012

Justification

The BGA's guidance notes highlight the limitations of hand signals and 'strongly' recommend that radios are used during aerotows. While pilot-to-pilot communications would not have prevented this accident, intervention by a radio-equipped launch observer, as occurred in the Ventus glider incident, may have influenced the outcome.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-012

It is recommended that the British Gliding Association specifies in its Operational Regulations the minimum requirements for an 'adequate system of communication' for glider launching.

Date Safety Recommendation made: 20 May 2020

LATEST RESPONSE

Response received: 2 October 2020

The BGA accepts that its Operational Regulations regarding signalling should be reviewed and updated. BGA Operational Regulations are high level BGA requirements which are periodically reviewed and can only be significantly modified following a general meeting. Supporting detail is generally published elsewhere to facilitate change.

As a result of this accident, several BGA Operational Regulations have been redrafted and will be approved by the membership in their next general meeting. In addition, Managing Flying risk has been updated.

The following text describes the proposed changes:

PLANNED NEW OPERATIONAL REGULATION REPLACING OP REGS 34, 35 AND 36:

Op Reg XX. Launch signalling. A reliable and unambiguous signalling system shall be used for all launches.

PLANNED NEW OPERATIONAL REGULATION REPLACING OP REGS 37, 38 AND 39

Op Reg XX. Emergency signals – aerotow.

The following emergency signals shall apply:

Aerotow Release. The tug pilot orders the glider pilot to release immediately by rocking the tug laterally.

Unable to Release on Aerotow. The glider pilot either communicates the problem to the tug pilot by radio, or alternatively signals 'unable to release' by flying out to the left side of the tug as far as is practicable and rocking the glider laterally.

Excessive Drag on Aerotow. The tug pilot either communicates the problem to the glider pilot by radio, or alternatively signals that the glider is producing excessive drag (for example the glider airbrakes are open or the drogue parachute is deployed) by waggling the rudder.

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RECENTLY UPDATED MANAGING FLYING RISK TEXT

Launch signalling

Launch signalling from the ground does not remove the responsibility for the safe conduct of the launch from the pilot in command.

Recognised methods of launch signalling

The recognised methods of launch signalling include radio and other wireless transmission, lights, and hand/bat signals. Release of the tow rope or cable by the glider or tug pilot on the ground signals the pilots intent not to launch.

Terminology

To minimise the risk of a misunderstanding during launch signalling, which is a safety critical activity, 'take-up slack', 'all out' and 'stop' are the standard terms where verbal commands are used during launches.

Use of signalling lights and signalling by hand - limitations

Light or hand signalling can result in a delayed response, can be difficult to see (even when using bats for hand signalling) or interpret in poor visibility or against bright sunlight, and may not be seen once the launch progresses, for example when a tug pilot is focussed on starting the take-off.

Where signalling lights are utilised, they should not be red or green in colour.
Use of signalling lights and signalling by hand/bat - protocol

Lights:

a. Take up slack: light dashes of one second duration and three seconds interval.
b. All out: light dots at one second interval.
c. Stop: steady light.

By hand:

a. Take up slack: arm swung underarm.
b. All out: arm swung from side to side above the head.
c. Stop: arm held stationary vertically above the head.

Signalling – aerotow

Radio communication should be established between the launching operation and the towing aircraft. Where radio communication is not possible, another of the recognised methods of signalling to stop the launch should be available.

Safety Recommendation and Safety Action Overview

Signalling – wire launches

The method of communication used between the launch point and winch (or tow car) should result in reliable signalling for the duration of each launch and may be visual or audible. It is highly desirable for the signalling system to reliably allow an immediate audible and visual STOP command to be sent to the winch driver. Wireless signalling can provide near-instant communication to audible and visual indicators in the winch cab. Please note that a short period at the start of a personal management radios (PMR) radio transmission can be lost during channel identification. This shortcoming can be addressed by repeating the launch command, eg. "All out. All out" or "Stop. Stop".

AAIB Assessment: **Adequate**

Action Status: **Planned Action Ongoing Update Due 02 April 2021**

Recommendation Status: **Open**

Feedback rationale

Whilst the AAIB accept that the BGA have met the intent of the recommendation, the AAIB request that following the next BGA General Meeting, the BGA confirm that the redrafted regulations have been approved.

Safety Recommendation 2020-013

Justification

Following this accident, for gliders with similar tailplane locking features to that of the Standard Cirrus 75, the gliding club introduced tell-tale markings to show the approximate required position of the locking lever and make it easier to detect incorrect alignment. The EASA recommended that such markings indicating the correct position for locking levers should be green in colour. Similar tailplane attachment mechanisms are known to be used on other types of glider.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-013**
>
> It is recommended that the European Union Aviation Safety Agency require a means to detect incorrect alignment of the tailplane locking lever on gliders with locking features similar to the Standard Cirrus 75.

Date Safety Recommendation made: 20 May 2020

LATEST RESPONSE

Response received: 26 April 2021

AAIB acknowledge that the EASA needs to consult with the manufacturer, and expect an update is March 2021.

Following the European Union Aviation Safety Agency (EASA)'s investigation of this issue in cooperation with the sailplane Type Certificate Holder, Schempp-Hirth, an Airworthiness Directive (AD) AD-2020-0260 has been issued in order to address this issue linked to elevator attachment. Furthermore, Safety Information Bulletin (SIB) SIB-2019-07 addressing sailplane rigging is being revised to add more examples. A further update will follow.

The AD specifies:

1) Within 90 days after the effective date of the AD, to modify the (powered) sailplane by installing an optical indicator in accordance with the instructions of the TN.

2) Concurrently with the modification of the (powered) sailplane amend the AFM of that (powered) sailplane in accordance with the instructions of the TN, inform all pilots and, thereafter, operate the (powered) sailplane accordingly.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Britten-Norman Islander BN-2A-27, VP-MNI

23 September 2019 at John A Osborne Airport, Montserrat

Synopsis

The aircraft was flying from Antigua to Montserrat, which was experiencing a heavy rain shower. After the shower had passed the aircraft made a normal approach in a light tailwind to Runway 10, which was still wet from the rain. The pilot made a positive touchdown and applied appropriate braking but was unable to stop the aircraft. The pilot steered the aircraft to the right but it skidded through 180° and departed the level surface of the airfield backwards, down a steep incline at the end of the runway, before coming to a stop when the tail caught in the airport security fence. The pilot and passengers were able to exit the aircraft and the airport rescue and firefighting service responded promptly.

VP-MNI at the point of touchdown on Runway 10

No aircraft defects were found that would have contributed to the outcome. The touchdown groundspeed was 79 kt, which was higher than appropriate, either because the approach was flown at an airspeed greater than the normal 65 kt, or because of a significant change in windspeed and direction during the approach. This, combined with a wet runway and skidding, resulted in the aircraft requiring more distance to stop than was available on the runway. Three Safety Recommendations are made regarding aircraft operation, access for rescue and firefighting vehicles, and a means of arresting aircraft that overrun the runway.

Safety Recommendation 2020-014

Justification

Local wind variations specific to this aerodrome affect landings.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-014**
>
> It is recommended that Air Safety Support International Ltd ensure that pilots and operators intending to use John A Osborne Airport take account of local wind variations, and require operators to demonstrate how they will achieve this.

Date Safety Recommendation made: 13 May 2020

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LATEST RESPONSE

Response received: 14 May 2020

The runway itself and the associated operating conditions at Montserrat have been the subject of an ongoing monitoring programme by ASSI over a significant period of time. In the past, NOTAMSs have also been issued to advise operators of the adverse runway conditions when wet. A runway refurbishment programme is well underway and this is planned for completion by the end of 2020.

Furthermore, and enhanced Governor's Instruction (MON 004) was issued on 24th February 2020 which required Commercial Air Transport operators to complete safety risk assessments, paying particular attention to the awareness of potential local wind variations including possible significant turbulence, windshear and downdraft during approach and climb out. The Safety Risk Assessment is aimed at mitigating any residual risk and providing flight crew with sufficient guidance to operate at the Aerodrome. We consider that the combination of runway refurbishment programme and the Governor's Instruction, a copy of which is attached for reference, satisfies the requirements of Safety Recommendation 2020-014.

AAIB Assessmen: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Safety Recommendation 2020-015

Justification

Difficult terrain in the aerodrome surroundings prevents ready access to emergency services.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-015**
>
> It is recommended that the operator of John A Osborne Airport provide adequate access to the Difficult Environs at the east end of Runway 10 to ensure that emergency services can reach expeditiously the location of an aircraft which has overrun the end of the runway.

Date Safety Recommendation made: 13 May 2020

LATEST RESPONSE

Response received: 5 November 2020

The government received written permission to access the land to ensure that emergency services can reach expeditiously to the location of an aircraft which has overrun the end of the runway. Picture evidence of the four completed trails was sent via email on Tuesday 13th October 2020 for the possible closure of this safety recommendation.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Safety Recommendation 2020-016

Justification

Terrain adjacent to the runway ends is hazardous to aircraft that overrun, and prevents ready access by emergency services.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-016**
>
> It is recommended that the operator of John A Osborne Airport install a means of arresting the progress of an aircraft that has overrun either end of the runway in order to minimise the risk injury to those onboard and to ensure that emergency services can reach them expeditiously.

Date Safety Recommendation made: 13 May 2020

LATEST RESPONSE

Response received: 19 February 2021

With the support of ASSI we have conducted further, extensive research into addressing the recommendation. Our intention was to ascertain the availability and practicalities of installing such a system however, the second review supported our original stance that a suitable, approved system is not available and the environment at the John A. Osborne Airport would not allow for effective installation and efficient operations due to the length of the runway and difficulties with the surrounding environs.

John A. Osborne Airport is located on what is, effectively, a small plateau and as such, there is insufficient space to install any type of barrier / net or an 'EMAS-type' system which could provide any appreciable deceleration or restraint in the event of a runway excursion. For example, approved barriers come with large hydraulic systems and robust stanchions which are simply too large for the available area. The adoption of an ad-hoc, untried 'fence' is, in our opinion fraught with uncertainty and could actually introduce more risk than currently exists. Any locally installed catch-fencing would likely be supported by non-frangible posts, set into concrete with all the dangers of airframe and undercarriage damage and the potential risk of ruptured fuel tanks and uncontrolled fires that represents.

That said, we fully support the view that the risks of injury to those on board an aircraft which has overrun either end of the runway must be minimised to As Low As Reasonably Practicable (ALARP) and therefore, it may be helpful to make you aware of the additional mitigations which we are putting in place. New markings on the edge of the runway are intended as aiming point markers or (more simply put) 'throw-away' indicators. Their purpose is self-explanatory in that pilots who have not positively touched down by those points must execute a missed approach. Thus far, the feedback from the pilots has been very supportive. Secondly, the runway re-surfacing project has been approved and the work to provide a new, grooved surface with a significantly improved friction level, will be completed during the first quarter of 2021 which should significantly reduce the risk of hydroplaning.

The additional measures which both the Airport and ASSI have put in place (including a revised Governors instruction ensuring competent and current pilots who take account of wind variations) are robust, pragmatic, and proportionate for an operation of this size and with this level of traffic. They will provide significant safety enhancements in the longer term whilst we continue our search for an arrestor system and ensure that the runway remains complaint with accepted international standards.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Feedback rationale

The AAIB acknowledges the Airport operator's response to the Safety Recommendation and the action it has taken to explore suitable mitigations. It has not installed a means of arresting the progress of an aircraft that has overrun the runway, and the associated hazards remain, but the response includes other action to reduce the likelihood of overruns and to improve access for emergency services.

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DJI M600 PRO, (UAS registration n/a)
13 December 2019 at Wallsend, Tyne and Wear

Synopsis

The UAS, a DJI M600 Pro, was being operated in an automated flight mode to survey a construction site when a GPS-compass error caused the aircraft to revert to a flight mode that required manual control. By the time that the pilot and observer realised that it was not responding to the return-to-home (RTH) function, visual line of sight was lost when the aircraft drifted with the wind beyond a line of trees. It subsequently collided with the roof of a house before falling into the property's rear garden. No persons were injured.

M600 series aircraft
The accident aircraft was fitted with three GPS antenna

The pilot, and the observer who was also a pilot, had operated UASs since 2018 and had the required permissions from the UK CAA. Both pilots had relied predominantly on the automated flight capability of their aircraft and had not, nor were required to have, practised for emergencies since completing their flying training in 2018. One Safety Recommendation is made to the UK CAA.

Safety Recommendation 2020-017

Justification

The CAA required that any person or organisation operating a UAS with a mass of no more than 20 kg for commercial work in the UK required permission, which was commonly referred to as Permissions for Commercial Operations (PfCO). A PfCO was renewed annually but the CAA did not require, nor provide guidance on, practising for emergencies or maintaining manual flying skills as part of the PfCO renewal. However, manual flying is a perishable skill that UAS operators may need to rely on in the event of an emergency.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-017

It is recommended that the Civil Aviation Authority require that operators issued with a Permissions for Commercial Operations (PfCO) include in their operations manuals the need to practise routinely the actions to take in the event of emergencies, and specify how pilots will remain competent at maintaining manual control of their aircraft in the event that automated flight modes are lost.

Date Safety Recommendation made: 19 June 2020

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LATEST RESPONSE

Response received: 30 July 2020

The CAA accepts this Recommendation. CAA Safety Notice SN-2020/10 was issued on 22 June 2020, detailing recommendations to all Remote Pilots (RPs), National Qualified Entities and Recognised Assessment Entities. It strongly recommends that all Remote Pilots ensure they are confident in their abilities to recognise and react to likely emergencies and are familiar with the warnings generated by their UAS. It also strongly recommends that RPs regularly practice identifying and responding to emergencies, and maintain competence in reversionary flying modes.

The Safety Notice also advises that Operations Manuals will need to assure the CAA that an operation is safe enough by describing complete and effective emergency procedures, and providing schedules for RP practice of emergencies. The same advice was given to NQEs/RAEs, to ensure that they reinforce the content of the Safety Notice to their customers.

The UAS Sector Team Surveyors and Inspectors have been briefed to pay particular attention to emergency handling and pilot training currency sections of Operating Safety Cases. Additionally, checks will be made to incoming applications and renewals for Permissions for Commercial Operations for the same. RAE paperwork will be checked for the advice given to their customers when received.

AAIB Assessment: **Adequate**

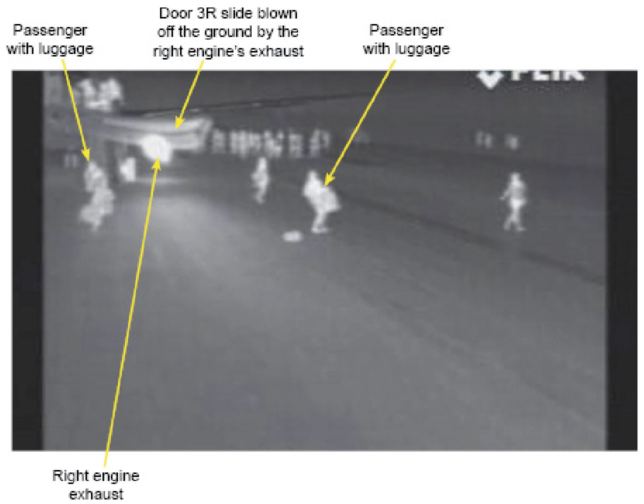
Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

[Airbus A320-214, OE-LOA](#)

1 March 2019 at London Stansted Airport

Synopsis



RFFS infrared CCTV showing some passengers leaving with baggage

The aircraft was on a scheduled flight from London Stansted Airport to Vienna International Airport, Austria. Shortly after the takeoff roll was commenced it was rejected, due to a contained failure of the left engine, and the aircraft was brought to a stop on the runway. Just as the flight crew were about to taxi the aircraft off the runway, an evacuation was commanded by the Senior Flight Attendant. The investigation identified several factors that contributed to this decision. Ten passengers were treated for minor injuries that occurred during the evacuation and there was a risk of serious injury due to one of the engines running during the evacuation. The operator has taken several safety actions, principally based around the training of its flight attendants. Two Safety Recommendations regarding passenger evacuation have been made in this report.

The left engine experienced a contained failure following the rupture and release of several blades from the first stage of the high-pressure compressor. The investigation found that the blades fractured as a result of high-cycle fatigue loading which initiated in the dovetail (part of the blade root), due to a once-per-revolution aerodynamic excitation. An inlet guide vane lever arm had been improperly assembled which led to aerodynamic excitation of the passing blades and the resulting forces exceeded the design loads of the blades.

Safety Recommendation 2020-018

Justification

The evidence from this accident, in combination with the collated evidence from previous cases shows that, even despite recent improvements, it remains the case that passenger briefing, safety cards and FA instructions are insufficient to stop passengers retrieving cabin baggage during an evacuation. This hazard will still exist in future emergencies unless additional measures are taken to either reduce the impact of that behaviour on the safety and speed of an evacuation or to prevent passengers evacuating with baggage.

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Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-018**
>
> It is recommended that the European Union Aviation Safety Agency commission research to determine how to prevent passengers from obstructing aircraft evacuations by retrieving carry-on baggage.

Date Safety Recommendation made: 20 August 2020

LATEST RESPONSE

Response received: 15 November 2020

The safety issue "Emergency Evacuation" is included in the Safety Risk Portfolio (SRP) for large aeroplanes, as part of the European Union Aviation Safety Agency (EASA) Safety Risk Management (SRM) process (see the Annual Safety Review 2020, published on the EASA web site at: https://www.easa.europa.eu/newsroom-and-events/news/easapublishes-annual-safety-review-asr-2020). The SRP is used to trigger the assessment of safety issues, to target analysis activities over key risk areas and to prioritise safety actions. This includes consideration of the exposure to the hazard and its predicted evolution in the coming years, the expected safety benefit of the mitigation recently implemented or committed, or recommended, and reprioritisation of actions where appropriate.

Passengers taking hand luggage preventing or slowing down the evacuation is one of the identified sub-set of associated risks.

The Emergency Evacuation safety issue is currently under development of recommendations for actions in accordance with the Best Intervention Strategy (BIS) process, with potential inclusion of the mitigating actions in the European Plan for Aviation Safety (EPAS). The recommendation, for EASA to commission research to determine how to prevent passengers from obstructing aircraft evacuations by retrieving carry-on baggage, will be considered within this process.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 21 June 2021**

Recommendation Status: **Open**

Feedback rationale

The European Union Aviation Safety Agency has confirmed that the recommendation to commission research into preventing passengers from obstructing aircraft evacuations by retrieving carry-on baggage will be considered for inclusion under the European Union Aviation Safety Agency Safety Risk Management process. The AAIB requests an update by 21 June 2021.

Safety Recommendation and Safety Action Overview

Safety Recommendation 2020-019

Justification

During an emergency evacuation, a proportion of passengers will attempt to leave the aircraft with their carry-on baggage slowing the evacuation process. The emergency evacuation demonstrations conducted to show compliance with CS-25 do not include a realistic simulation of this aspect of passenger behaviour which will slow down the evacuation and increase the risk of injury. Therefore, the following Safety Recommendation is made:

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-019**
>
> It is recommended that the European Union Aviation Safety Agency consider including a more realistic simulation of passenger behaviour in regard to carry-on baggage in the test criteria and procedures for the emergency demonstration in CS-25.

Date Safety Recommendation made: 20 August 2020

LATEST RESPONSE

Response received: 15 November 2020

The aeroplane evacuation demonstration requirement in Certification Specification (CS) CS 25.803(c) and the test criteria and procedures in Appendix J to CS-25 are not intended to investigate all possible emergency evacuation scenarios that may occur in service. In particular, the emergency demonstration does not intend to take into account the impact from unruly passengers. The emergency demonstration provides a standard method for assessing the evacuation capability of the aeroplane and to demonstrate the effectiveness of crew emergency procedures and training.

The related test conditions and pass/fail criteria (e.g. the 90 seconds limit to the evacuation time) demonstrate that the aircraft design provides an acceptable level of performance in a standard evacuation scenario.

The simulation of passenger behaviour with regards to carry-on baggage would not provide appreciable added value in the evaluation of the aircraft design, and would result in an increased risk of injury for certification test participants.

The European Union Aviation Safety Agency (EASA) therefore does not deem it is appropriate to amend CS 25.803(c) and Appendix J to CS-25 as suggested by this safety recommendation.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Feedback rationale

The European Union Aviation Safety Agency have considered the Safety Recommendation and stated that the test criteria and procedure in Appendix J of CS-25 are not intended to investigate all possible emergency evacuation scenarios and provide a standard method for assessing the evacuation capability of the aeroplane and to demonstrate the effectiveness of crew emergency procedures and training.

The European Union Aviation Safety Agency does not consider that the simulation of passenger evacuation with carry-on baggage would not improve the certification process and would result in an increased risk of injury for certification test participants.

ERJ 190-200 LR, G-FBEJ

28 February 2019 at Exeter Airport, Devon

Synopsis

As the thrust levers were advanced for takeoff, on an early morning scheduled passenger flight, the flight crew detected an unusual odour and observed smoke entering the cockpit. They then moved the thrust levers to the idle position and applied the parking brake. The cabin crew subsequently reported that there were smoke and fumes in the cabin. Following an assessment of the situation, the commander initiated an emergency evacuation. During the evacuation, passengers who evacuated via the overwing exits reported being unsure of how to get down from the wing to the ground and several re-entered the cabin and exited via one of the escape slides.

The smoke and fumes were subsequently attributed to an incorrectly performed engine compressor wash procedure, which was carried out by maintenance personnel the night before the occurrence flight.

Overwing exit escape route markings on E195 (view towards wing trailing edge)

As a result of the findings of this investigation, the European Union Aviation Safety Agency (EASA) has undertaken two safety actions relating to the certification requirements for overwing emergency exits. The operator has also undertaken several safety actions relating to passenger safety briefings, processes for maintenance planning, engineer training, competency and welfare and monitoring of ground equipment.

Four Safety Recommendations are made relating to the certification requirements for overwing exit markings and the height requirement for overwing exits to be equipped with an assisted means of escape.

Safety Recommendation 2020-020

Justification

Despite the presence of a marked exit route on the wing with a non-slip surface, many passengers who exited via the overwing exits reported being uncertain where to go once out of the aircraft. Overwing exit route markings are not always readily identifiable and may be even less so in darkness. Poor weather conditions or the presence of smoke could also hinder identification of an exit route. It is apparent that the issue of ambiguous overwing escape route markings that resulted in previous AAIB Safety Recommendations 2002-42 and 2010-007 still exists.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-020**
>
> It is recommended that the European Union Aviation Safety Agency amends the certification requirements relating to the design, contrast and conspicuity of overwing exit escape route markings on commercial air transport aircraft, to ensure that the route to be taken from wing to ground is immediately apparent to evacuating passengers, in a range of emergency scenarios.

Date Safety Recommendation made: 10 September 2020

LATEST RESPONSE

Response received: 11 December 2020

The European Union Aviation Safety Agency (EASA) will assess this recommendation within the frame of the Best Intervention Strategy (BIS) for Emergency Evacuation. BIS are fundamental components of the Safety Risk Management (SRM) programming cycle used to assess the criticality of an issue, and identify the relevant actions for the European Plan for Aviation Safety (EPAS). A BIS report contains the assessment and rationale to determine relevant and proportionate actions.

The first draft of this BIS is planned for Q1/2021. The BIS will identify the need for action(s) and, if necessary, will define the adequate relevant one(s) to be included in the EPAS after consultation with the Advisory Bodies.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 19 July 2021**

Recommendation Status: **Open**

Feedback rationale

The EASA has confirmed that it will assess this recommendation within the frame of the Best Intervention Strategy (BIS) for Emergency Evacuation. The first draft of this BIS is planned for Q1 of 2021. The AAIB request an update by 19 July 2021.

Safety Recommendation 2020-021

Justification

As for Safety Recommendation 2020-020, the following Safety Recommendation was made:

> **Safety Recommendation 2020-021**
>
> It is recommended that the Federal Aviation Administration amends the certification requirements relating to the design, contrast and conspicuity of overwing exit escape route markings on commercial air transport aircraft, to ensure that the route to be taken from wing to ground is immediately apparent to evacuating passengers, in a range of emergency scenarios.

Date Safety Recommendation made: 10 September 2020

LATEST RESPONSE

Response received: 22 February 2021

The FAA chartered the Emergency Evacuation Standards Aviation Rulemaking Committee (ARC) to review various regulatory standards, and in-service events, that apply to emergency evacuations. The ARC also evaluated several issues cited by the National Transportation Safety Board, the United States Congress, and from public inquiries to the FAA, 2 related to recent emergency evacuations. This review included the emergency evacuation of the Embraer ERJ 190-200 LR (E195) aircraft on February 28, 2019, that led the UK AAIB to issue these safety recommendations.

Based on a review of the evacuation events through overwing exits, the ARC determined that some evacuees do not understand how or where to egress from a wing when no escape slide is provided. A review of the applicable regulations and guidance reveals potential for improvement, recognizing escape route markings alone do not always appear to provide enough instructions to guide evacuees to the location where they should exit from the wing.

The FAA will review the ARC recommendations upon their completion and determine what actions may be warranted by the safety benefit to be gained in relation to the cost of implementing any recommendations.

In conjunction with other aviation authorities, the FAA will review the requirements in Title 14, Code of Federal Regulations § 25.810, Emergency Egress Assist Means and Escape Routes for Marking the Escape Routes, from overwing exits.

We will determine what actions may be effective to improve passenger recognition and enable safe transition from the wing to the ground. This action will include reassessing the 6 foot (1.8 meter) threshold for assist means cited in §§ 25.810 (a) and (d). We will provide a follow-on response updating you on our actions no later than January 31, 2022.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 31 January 2022**

Recommendation Status: **Open**

Feedback rationale

The AAIB acknowledges the FAA's response and requests an update on the outcome of the review of the Emergency Evacuation Standards Aviation Rulemaking Committee (ARC) recommendations by 31 January 2022.

Safety Recommendation 2020-022

Justification

Emergency exits that do not meet the 1.8 m maximum height criteria of FAR/CS 25.810 are not required to be equipped with an evacuation slide. This applies equally to overwing and non-overwing exits. Jumping from heights of up to 1.8 m can be challenging for many passengers and has the potential to cause injury. Similar findings were documented in a 2009 EASA study and prior to that, an NTSB safety study, which made a Safety Recommendation to the FAA on this subject.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-022**
>
> It is recommended that the European Union Aviation Safety Agency, re-evaluate and reduce the 1.8 m height criteria in CS 25.810(a) and (d), for the provision of an assisted means of escape at emergency exits, to minimise passenger injuries and reduce egress time during emergency evacuations.

Date Safety Recommendation made: 10 September 2020

LATEST RESPONSE

Response received: 11 December 2020

The European Union Aviation Safety Agency (EASA) will assess this recommendation within the frame of the Best Intervention Strategy (BIS) for Emergency Evacuation. BIS are fundamental components of the Safety Risk Management (SRM) programming cycle used to assess the criticality of an issue, and identify the relevant actions for the European Plan for Aviation Safety (EPAS). A BIS report contains the assessment and rationale to determine relevant and proportionate actions.

The first draft of this BIS is planned for Q1/2021. The BIS will identify the need for action(s) and, if necessary, will define the adequate relevant one(s) to be included in the EPAS after consultation with the Advisory Bodies.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 19 July 2021**

Recommendation Status: **Open**

Feedback rationale

The EASA has confirmed that it will assess this recommendation within the frame of the Best Intervention Strategy (BIS) for Emergency Evacuation. The first draft of this BIS is planned for Q1 of 2021. The AAIB request an update by 19 July 2021

Safety Recommendation 2020-023

Justification

As for Safety Recommendation 2020-022, the following Safety Recommendation was made:

> **Safety Recommendation 2020-023**
>
> It is recommended that the Federal Aviation Administration, re-evaluate and reduce the 1.8 m height criteria in FAR 25.810(a) and (d), for the provision of an assisted means of escape at emergency exits, to minimise passenger injuries and reduce egress time during emergency evacuations.

Date Safety Recommendation made: 10 September 2020

LATEST RESPONSE

Response received: 22 February 2021

The FAA chartered the Emergency Evacuation Standards Aviation Rulemaking Committee (ARC) to review various regulatory standards, and in-service events, that apply to emergency evacuations. The ARC also evaluated several issues cited by the National Transportation Safety Board, the United States Congress, and from public inquiries to the FAA, 2 related to recent emergency evacuations. This review included the emergency evacuation of the Embraer ERJ 190-200 LR (E195) aircraft on February 28, 2019, that led the UK AAIB to issue these safety recommendations.

Based on a review of the evacuation events through overwing exits, the ARC determined that some evacuees do not understand how or where to egress from a wing when no escape slide is provided. A review of the applicable regulations and guidance reveals potential for improvement, recognizing escape route markings alone do not always appear to provide enough instructions to guide evacuees to the location where they should exit from the wing.

The FAA will review the ARC recommendations upon their completion and determine what actions may be warranted by the safety benefit to be gained in relation to the cost of implementing any recommendations.

In conjunction with other aviation authorities, the FAA will review the requirements in Title 14, Code of Federal Regulations § 25.810, Emergency Egress Assist Means and Escape Routes for Marking the Escape Routes, from overwing exits.

We will determine what actions may be effective to improve passenger recognition and enable safe transition from the wing to the ground. This action will include reassessing the 6 foot (1.8 meter) threshold for assist means cited in §§ 25.810 (a) and (d). We will provide a follow-on response updating you on our actions no later than January 31, 2022.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 14 September 2021**

Recommendation Status: **Open**

Feedback rationale

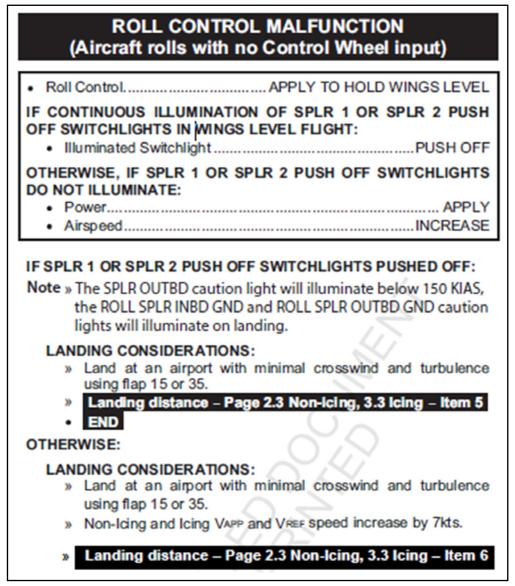
The AAIB acknowledges the FAA's response and requests an update on the outcome of the review of the Emergency Evacuation Standards Aviation Rulemaking Committee (ARC) recommendations by 31 January 2022.

[DHC-8-402, G-FLBE](#)

14 November 2019 at In flight from Newquay Airport to London Heathrow Airport

Synopsis

Shortly after takeoff in a strong crosswind, the pilots noticed that both handwheels were offset to the right in order to maintain wings level flight. The aircraft diverted to Exeter Airport where it made an uneventful landing.



ROLL CONTROL MALFUNCTION
(Aircraft rolls with no Control Wheel input)

- Roll Control.......................APPLY TO HOLD WINGS LEVEL

IF CONTINUOUS ILLUMINATION OF SPLR 1 OR SPLR 2 PUSH OFF SWITCHLIGHTS IN WINGS LEVEL FLIGHT:

- Illuminated Switchlight.......................PUSH OFF

OTHERWISE, IF SPLR 1 OR SPLR 2 PUSH OFF SWITCHLIGHTS DO NOT ILLUMINATE:

- Power.......................APPLY
- Airspeed.......................INCREASE

IF SPLR 1 OR SPLR 2 PUSH OFF SWITCHLIGHTS PUSHED OFF:

Note » The SPLR OUTBD caution light will illuminate below 150 KIAS, the ROLL SPLR INBD GND and ROLL SPLR OUTBD GND caution lights will illuminate on landing.

LANDING CONSIDERATIONS:

» Land at an airport with minimal crosswind and turbulence using flap 15 or 35.

» **Landing distance – Page 2.3 Non-Icing, 3.3 Icing – Item 5**

- **END**

OTHERWISE:

LANDING CONSIDERATIONS:

» Land at an airport with minimal crosswind and turbulence using flap 15 or 35.

» Non-Icing and Icing V_{APP} and V_{REF} speed increase by 7kts.

» **Landing distance – Page 2.3 Non-Icing, 3.3 Icing – Item 6**

QRH Roll Control Malfunction checklist

The handwheel offset was the result of a break in a left aileron cable that ran along the wing rear spar. In the course of this investigation it was discovered that the right aileron on G-FLBE, and other aircraft in the operator's fleet, would occasionally not respond to the movement of the handwheels. Non-reversible filters were also fitted to the operator's aircraft that meant that it was not always possible to reconstruct the actual positions of the control wheel, column or rudder pedals recorded by the Flight Data Recorder.

The aircraft manufacturer initiated safety actions to improve the maintenance of control cables and to determine the extent of the unresponsive ailerons across the fleet. Three Safety Recommendations are made in this report for the unresponsive aileron and filtering of the control position data.

Safety Recommendation 2020-024

Justification

The investigation discovered that aileron control surfaces on some DHC-8-400 aircraft were freezing in flight. This SR requires TC to investigate further.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-024**
>
> It is recommended that Transport Canada require De Havilland Canada to determine why the aileron control surfaces on the DHC-8-400 series of aircraft can become unresponsive to handwheel movements and ensure that the findings and any rectification action is promulgated to operators.

Date Safety Recommendation made: 8 October 2020

LATEST RESPONSE

Response received: 17 December 2020

The United Kingdom Air Accidents Investigation Branch (AAIB) has determined that the aileron became unresponsive due to aileron cable failure.

Transport Canada (TC) National Aircraft Certification (NAC) accepts the recommendation and is working with the manufacturer to collect data necessary to determine what corrective action is appropriate to ensure the integrity of the aileron control system and the usability of Flight Data Recorder (FDR) for the ailerons.

Any corrective action that is determined to be mandatory will be promulgated to operators as part of NAC's Continuing Airworthiness program.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 31 August 2021**

Recommendation Status: **Open**

Feedback rationale

The AAIB thanks the Transport Canada for their response and would request an update on the plans to address this Safety Recommendation by 31 August 2021.

Safety Recommendation 2020-025

Justification

Recording filtered parameters for primary flight controls makes it difficult to reproduce the flight from the stored data.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-025**
>
> It is recommended that the European Union Aviation Safety Agency require that the flight data recorder system fitted to DHC-8-400 series of aircraft registered in the United Kingdom record unfiltered data for the parameters representing primary flight control input positions and input forces, so that their original sensor signal values can be reliably established.

Date Safety Recommendation made: 8 October 2020

LATEST RESPONSE

Response received: 11 December 2020

The European Union Aviation Safety Agency is analysing this safety recommendation in cooperation with the Type Certificate Holder - De Havilland Aircraft of Canada.

An update will be provided once a decision has been reached on the orientation to be given to this topic.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 24 May 2021**

Recommendation Status: **Open**

Feedback rationale

The AAIB thanks the EASA for their response and would request an update on the plans to address this Safety Recommendation by 24 May 2021.

Safety Recommendation 2020-026

Justification

Filtering parameters by the Flight Data Recorder makes it difficult to reconstitute the flight.

Therefore, the following Safety Recommendation was made:

Safety Recommendation 2020-026

It is recommended that the International Civil Aviation Organisation provide guidance on the recording of filtered parameters by the flight data recorder system. The guidance should address as a minimum:

1) Definitions for filtered and unfiltered parameters.
2) Parameters on the FDR for which filtering is not permitted.
3) The need to be able to reconstruct the original sensor signal values from filtered data recorded during extremely dynamic conditions and that the information to achieve this is a permanent part of the aircraft specific FDR system documentation package.

Date Safety Recommendation made: 8 October 2020

LATEST RESPONSE

Response received: 8 January 2021

With respect to the above-mentioned safety recommendation, the proposal for providing guidance material on the recording of filtered and unfiltered parameters by the FDR system will be referred to the Flight Recorder Specific Working Group (FLIRECSWG) of the Flight Operations Panel (FLTOPSP) for further study. The next FLIRECSWG meeting is scheduled for February 2021.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Ongoing Update Due 31 December 2021**

Recommendation Status: **Open**

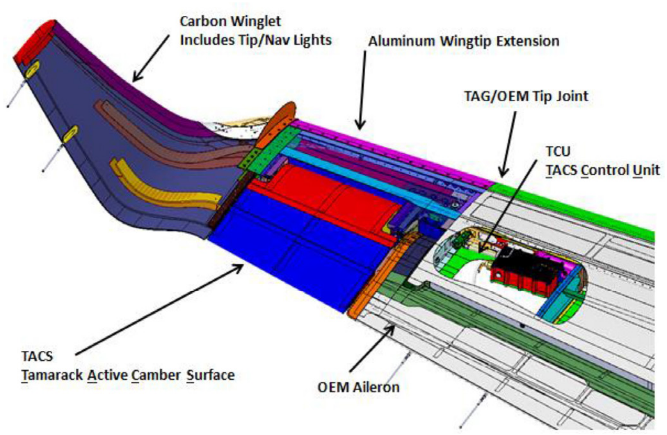
Feedback rationale

The AAIB thanks ICAO for their response and looks forward to the update from FLIRECSWG on the response to this Safety Recommendation.

[Cessna Citation CJ1, N680KH](#)
13 April 2019 at Bournemouth Airport

Synopsis

The aircraft had been modified with a system intended to enhance its performance, which included supplementary control surfaces designed to deflect symmetrically and automatically to alleviate gust loads. Shortly after takeoff, an electrical failure in this system caused one of these control surfaces to deploy separately, causing an uncommanded roll. The resulting aircraft upset caused the pilot significant surprise and difficulty in controlling the aircraft.



Cessna 525 wing with ATLAS installed

The pilot was not aware of supplementary procedures associated with the modification. The procedures did not adequately characterise the significance of the system failure, nor address the failure in all anticipated flight conditions. Certification flight tests of the system did not reveal the severity of possible outcomes. The 'Aircraft Safety and Certification Reform Act 2020' underway in the USA will review existing assumptions on pilot recognition and response.

Four Safety Recommendations are made, and safety action has been taken or is intended in the areas of training and the information to be provided, both for this system and for other supplementary systems capable of influencing the flight path of an aircraft.

Safety Recommendation 2020-027

Justification

The ATLAS inoperative in flight procedure currently specified is not relevant to all anticipated flight conditions.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-027**
>
> It is recommended that Tamarack Aerospace Group amend the ATLAS inoperative in flight procedure to ensure actions are specified that are relevant in all anticipated flight conditions.

Date Safety Recommendation made: 26 November 2020

LATEST RESPONSE

Response received: 3 March 2021

Tamarack worked closely with EASA to develop the procedure, which was then validated by other aviation authorities in other countries, including FAA, ANAC, TCCA, and others. During certification, EASA flight test personnel flew simulated emergency conditions, and contributed directly to the process of writing the procedures to address them. This process included a variety of critical and less-critical flight conditions, initially to confirm which flight conditions were critical to begin with, and later to confirm that the procedures were appropriate for all.

Tamarack is concerned, as was EASA during certification, that the AIIFP must be written explicitly and simply, to give pilots the necessary safety information for responding to the most critical condition identified during the certification process. While it is true that certain steps in the procedure are more critical in some flight conditions than others, the AIIFP was developed to ensure that executing the full procedure in accordance with good pilot judgement and aviation best practices is safe for all anticipated flight conditions.

As an example, step three of the AIIFP to disconnect the autopilot and the subsequent procedural step to maintain lateral control would apply to an ATLAS fault event which does not introduce an asymmetric deployment. Likewise, the immediate reduction in power would apply to flight conditions slower than maximum cruise. In both instances, however, the less critical flight conditions allow the AIIFP to be executed quickly, either by the lack of induced roll to address in non-deployment fault conditions or by the relative increase of aileron roll authority relative to the TACS at lower speeds. The overwhelmingly favourable flight characteristics inherent to the 525 series continues to support this conclusion, as do confirmed reports of ATLAS asymmetries and subsequently uneventful executions of the AIIFP in a variety of flight conditions.

Flight conditions for abnormal and emergency procedures should be carefully considered. However, the primary contributing factor to the incident described in the AAIB report was pilot lack of familiarity with the AIIFP itself, rather than ambiguity of the procedure in a particular flight condition. Tamarack has received no other feedback from subject matter experts, pilots, or certification authorities to suggest that the procedures are not appropriate to all flight conditions as currently approved. Therefore, no major changes are planned for the ATLAS Inoperative In Flight Procedure.

AAIB Assessment: **Partially Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Feedback rationale

The AAIB notes that the addressee has considered the Safety Recommendation and that it does not intend to amend the ATLAS inoperative in flight procedure.

Safety Recommendation 2020-028

Justification

The information currently provided may be inadequate for pilots to understand the significant and potentially escalating nature of TACS failures.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-028**
>
> It is recommended that Tamarack Aerospace Group expand the information within the ATLAS inoperative in flight procedure to provide a level of detail consistent with other AFM procedures and to enable pilots to understand the significant and potentially escalating nature of TACS failures.

Date Safety Recommendation made: 26 November 2020

LATEST RESPONSE

Response received: 3 March 2021

Tamarack agrees that emergency procedures must balance the need for short, concise steps that are easy to remember and follow with the need to provide pilots with sufficient information to understand the intent of the procedures and the conditions for which they are written. In the case of the AIIFP, Tamarack agrees that there is an opportunity to add potentially useful additional information.

The AAIB report indicated that the pilot perceived that the control forces during the recovery were higher than expected, and that these control forces diminished as the airspeed was reduced. This is exactly in line with the original intent of the procedure, which specifies a reduction in airspeed to reduce control forces and minimize pilot exertion during execution of the AIIFP in the event of an asymmetric deployment.

To that end, the approved procedures at the time of the incident included a warning preceding the memory items: “Large aileron input may be required if an ATLAS failure at high indicated airspeed includes a TACS runaway. Speed reduction is the first priority in these failure conditions.”

Tamarack has amended the wording of the warning to more clearly indicate the intent behind prioritizing speed reduction as follows: “Large aileron input may be required if an ATLAS failure at high indicated airspeed includes a TACS runaway. Speed reduction to reduce control forces is the first priority in these failure conditions at high indicated airspeed.”

This change makes the intent of the warning and procedure sequence more explicit without dramatically changing the look of the procedure with which current pilots are already familiar. Further, adding this note is in line with conventional pilot training, which stresses from the earliest stages that speed reduction reduces control forces. Tamarack hopes that better

Safety Recommendation and Safety Action Overview

comprehension of the procedure and associated critical flight condition will assist other pilots familiarizing themselves with the AIIFP.

Tamarack is also committed to addressing questions and feedback from current and prospective pilots and owners and will continue to review these procedures if feedback or questions indicate that there are further opportunities for improvement.

AAIB Assessment: **Adequate**

Action Status: **Planned Action Completed**

Recommendation Status: **Closed**

Safety Recommendation 2020-029

Justification

The operation of supplementary systems fitted to an aircraft may require pilot behaviours different to those for which pilots are trained on the unmodified aircraft.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-029**
>
> It is recommended that the European Union Aviation Safety Agency determine the additional training it requires pilots to undertake in order to operate aircraft fitted with supplementary systems that influence flight path, where training on the original aircraft would not adequately prepare pilots for operating the modified aircraft in normal, abnormal or emergency situations.

Date Safety Recommendation made: 26 November 2020

LATEST RESPONSE

Response received: 2 March 2021

The following provisions of Commission Regulation (EU) No 965/2012 on air operations ensure that flight crew are suitably trained for the aircraft type operated (including those with supplementary systems installed), and cover the availability and use of relevant checklists:

- NCC.GEN.106(a)(4)(viii) which requires the flight crew to be properly rated and meet competency and recency requirements;

Safety Recommednation and Safety Action Overview

- ORO.FC.100(c) on ratings, i.e. type-specific training;
- ORO.FC.125 on differences and familiarisation training;
- ORO.GEN.110(h) on checklists per aircraft type in normal, abnormal and emergency procedures in accordance with the latest relevant documentation from the design approval holder.

Furthermore, in accordance with Article 11 of Regulation (EU) 2018/1139, operational suitability data (OSD) associated with a type design must be approved, when the applicant has demonstrated that the design of the product meets the applicable certification basis, and this approval must be include in the type certificate (TC) (or supplemental type certificate - STC).

This provision is further detailed in Commission Regulation (EU) No 748/2012, which in its Article 7a requires aircraft that are newly certified or delivered as new to an EU operator after February 2014 to have OSD, including for flight crew (FC) approved as part of the TC, covering type specific training associated with the aircraft design.

Further to that, point 21.A.93 of Annex I (Part-21) to Commission Regulation (EU) No 748/2012, as amended by Commission Regulation (EU) No 69/2014 and applicable from 19 December 2016, requires an applicant for a change to a TC or for an STC to consider the effects of the change to the OSD certification basis, and include the necessary changes to the OSD FC, when applicable, in their application for approval. Guidance to assess the impact of design changes on the OSD are provided in GM No 1 to 21.A.93(b)(1)(iii). Part of the resulting approval covers the pilot training elements associated with a specific design, when such elements are identified in the certification process and captured in the OSD FC associated with the TC or STC.

In turn, approved training organisations (ATOs) and operators have an obligation to use the mandatory elements of the OSD FC in developing initial, differences and recurrent training programmes and courses (cf. points FCL.710(a) and FCL.725(a) of Annex I (Part-FCL) to Regulation (EU) 1178/2011; point ORO.FC.145(b) of Annex III (Part-ORO) to Commission Regulation (EU) No 965/2012.).

The process embedded in the relevant regulations as described above provides a high level of confidence that, when training elements are necessary to support a specific aircraft design, these are properly identified, approved as part of the TC, change to a TC or STC, and delivered to pilot, reinforcing the principle of them receiving the appropriate training to ensure safe operation of the aircraft and its modifications

AAIB Assessment: **Not Adequate**

Action Status: **Not enough information**

Recommendation Status: **Open**

Feedback rationale

The EASA response describes the regulatory framework that existed at the time of this serious incident. These regulations demonstrably were not adequate to address the circumstances of this occurrence. It is not clear what additional training the EASA has now determined it requires pilots to undertake (to operate aircraft fitted with supplementary systems that influence flight path) to improve on the situation that existed at the time of this serious incident and thus help to avoid those circumstances.

Safety Recommendation 2020-030

Justification

The operation of supplementary systems fitted to an aircraft may require pilot behaviours different to those for which pilots are trained on the unmodified aircraft.

Therefore, the following Safety Recommendation was made:

> **Safety Recommendation 2020-030**
>
> It is recommended that the Federal Aviation Administration determine the additional training it requires pilots to undertake in order to operate aircraft fitted with supplementary systems that influence flight path, where training on the original aircraft would not adequately prepare pilots for operating the modified aircraft in normal, abnormal or emergency situations.

Date Safety Recommendation made: 26 November 2020

LATEST RESPONSE

Response received: **Awaiting Response**

Recommendation Status: **Open**

Air Accidents Investigation Branch
Annual Safety Review 2020

Safety Actions from investigations reported on in 2020

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 means there is no need to raise a Safety Recommendation as the safety issue has 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 2020, 159 safety actions directly resulted from AAIB investigations. These arose from one Formal Investigation, one Special Bulletin, 26 Field Investigations and 23 Correspondence Investigations.

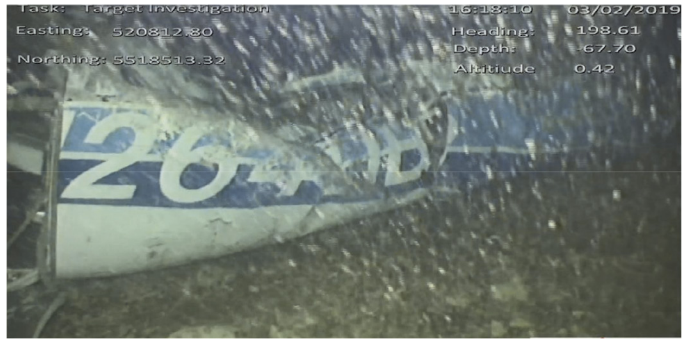
Index of Safety Actions (by aircraft weight)

Index of Safety Actions (by aircraft weight)

Air Accidents Investigation Branch
Annual Safety Review 2020

FORMAL INVESTIGATIONS

Piper PA-46-310P Malibu, N264DB
21 January 2019 at 22 nm north-north-west of Guernsey



The investigation established that the aircraft departed from Nantes Airport, France, at 1906 hrs on 21 January 2019 carrying a passenger on a commercial basis to Cardiff Airport in the UK. At 2016 hrs, probably while manoeuvring to avoid poor weather, the aircraft was lost from radar and struck the sea 22 nm north-north-west of Guernsey. Neither the pilot nor aircraft had the required licences or permissions to operate commercially.

The investigation identified the following causal factors:

> The pilot lost control of the aircraft during a manually-flown turn, which was probably initiated to remain in or regain Visual Meteorological Conditions (VMC).
>
> The aircraft subsequently suffered an in-flight break-up while manoeuvring at an airspeed significantly in excess of its design manoeuvring speed.
>
> The pilot was probably affected by carbon monoxide (CO) poisoning.

The investigation identified the following contributory factors:

> A loss of control was made more likely because the flight was not conducted in accordance with safety standards applicable to commercial operations. This manifested itself in the flight being operated under Visual Flight Rules (VFR) at night in poor weather conditions despite the pilot having no training in night flying and a lack of recent practice in instrument flying.
>
> In-service inspections of exhaust systems do not eliminate the risk of CO poisoning.
>
> There was no CO detector with an active warning in the aircraft which might have alerted the pilot to the presence of CO in time for him to take mitigating action.

Safety Recommendation and Safety Action Overview

Following this accident, the following safety actions were taken:

Safety action taken by the CAA

- The CAA developed a campaign to raise awareness of unlicensed charters, including publishing a Leaflet, *Legal to Fly*, to inform passengers about flying safely in light aircraft and business jets.

Safety action taken by the engine manufacturer

The engine manufacturer stated that it would:

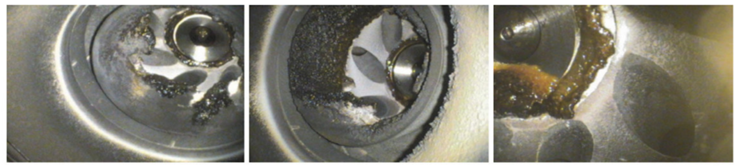
- Work with Original Equipment Manufacturers to determine the best way to convey the importance of thorough exhaust system inspections.

- Review its maintenance and overhaul manuals to determine whether additional elaboration would increase the chance of a qualified mechanic finding a potentially unairworthy condition. It undertook to complete this review in order to have any amplifications implemented in the next FAA approved version of its Standard Practice Manual (M-0).

SPECIAL BULLETIN

Airbus A321-211, G-POWN
26 February 2020 at London Gatwick Airport

At 0009 hrs on 26 February 2020, G-POWN took off from London Gatwick Airport for a flight to London Stansted Airport. At approximately 500 ft agl in the climb, there was a loud noise and flames were seen coming from the tailpipe of the No 1 engine as it surged. The crew made a MAYDAY call and turned right to return to the airport. Two minutes later, parameters relating to the No 2 engine began to fluctuate and the crew received an indication that the engine had stalled. The aircraft landed at 0020 hrs.



Brown material deposits in No 2 engine combustion chamber swirl cups

Before the incident flight, there were start-up difficulties with the No 1 engine and momentary 'Eng 2 Stall' messages associated with the No 2 engine on descent into Gatwick. An engineer was tasked with troubleshooting the engine stall messages. This intervention was a potential opportunity to detect the abnormal deposits on the high pressure and low pressure turbine blades. It is considered likely that a borescope inspection would have detected these deposits and, had it done so, it is unlikely that the aircraft would have been released to service. The engineer was not tasked with investigating any issues with the No 1 engine. The symptoms presented by each engine were different and no one considered there to be a possible common cause.

Safety action by EASA and the FAA:

- The EASA issued Safety Information Bulletin SIB 2020-061 on 20 March 2020, to notify affected stakeholders of recent air safety-related events involving Kathon biocide and to remind aircraft owners and operators to ensure that the correct method and dosage is used for approved biocide treatment of aircraft fuel systems. The FAA issued Special Airworthiness Information Bulletin SAIB NE-20-042 on 25 March 2020 that contained similar regulatory guidance.

Safety actions taken by the manufacturers of the biocide and engines:

- The manufacturer of Kathon discontinued the use of its product for aviation fuel applications on 10 March 2020.

- On 16 March 2020, CFM, the manufacturer of the G-POWN's engines, issued Alert Service Bulletin 73-A0296 recommending that operators of CFM56-5B engines suspend the use of Kathon during aircraft fuel system biocide treatments. Similar instructions were issued for other variants of the CFM56 engine family, as well as all General Electric turbofan engines. Note: the discontinuation of Kathon for aviation applications, combined with the inability to use Biobor within the EU presently, leaves aircraft operators in the EU without an approved biocide treatment.

Safety action by the AMO that performed the biocide treatment:

- The AMO that performed the biocide treatment on G-POWN has introduced a new role of 'technical engineer'. The technical engineer will be an EASA Part-66 B1 licensed engineer, outside of the management chain within the organisation, who will be available to assist other licensed engineers and mechanics with technical queries, such as calculations.
- The AMO will also introduce usage limits in stores so that staff will not be able to withdraw chemicals in quantities that significantly exceed the maximum permitted.

Safety action by the Operator and the AMO at London Gatwick Airport:

- In consultation with the manufacturer, the operator granted the Gatwick AMO access to the airnav$_x$ system.
- The Gatwick AMO issued a safety and compliance notice highlighting the importance of filtering maintenance data to the specific aircraft.

FIELD INVESTGATIONS

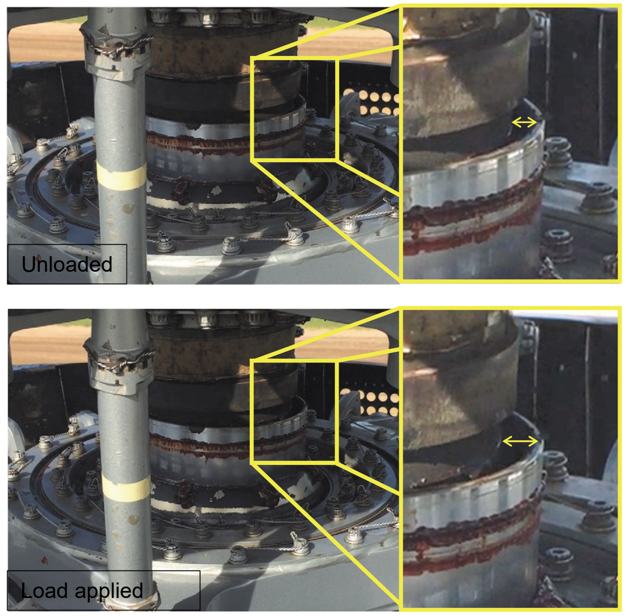
Sikorsky S-61N Sea King, G-ATBJ
1 February 2018 in Marchwood, Hampshire

The helicopter was being transferred from Marchwood, Hampshire, to a maintenance base having been transported, by sea, from the Falkland Islands. As the helicopter took off for a hover check it pitched nose-down. The commander promptly lowered the collective and the helicopter struck the ground on its nose, before coming to rest on its landing gear.

The investigation found that the spherical bearing within the swashplate had seized as a result of corrosion, compounded by inactivity during the voyage from the Falkland Islands. The checks prior to the flight did not identify the control restriction.

Safety action has been taken by the helicopter manufacturer to highlight the correct preflight procedures to follow after prolonged aircraft inactivity, and by the operator to remind flight crews to conduct flight control servo system checks to the maximum extents of control movement.

The cyclic control restriction was found to be as a result of seizure of the spherical bearing with the swashplate. The seizure was determined to be as a result of corrosion build-up within the bearing sockets. Prolonged inactivity during the transportation of the helicopter from the Falkland Islands allowed corrosion to develop sufficiently to cause the bearing to seize. Following the helicopter's arrival in the UK, Safety Inspection checks detailed in the S-61N Equalized Inspection and Maintenance Program, SA 4047-13 were not carried out; it is likely that the seized swashplate would have been identified if they had.



Stills from video of another S-61 showing levels of guide tube deflection when cyclic was applied to a seized swashplate

Despite the seizure, the investigation determined that full fore/aft travel of the cyclic control could still be achieved which indicates that this is not a reliable indication that the swashplate is free to move. During pre-flight checks by maintenance engineers and the flight crew, the flight control servo system checks were not completed to the full extremes of travel. With a seized swashplate, the rotor blades changed pitch due to flexing of the guide tube and the blade movement was incorrectly identified as a positive confirmation of control authority. There was no confirmation by external observation of the main rotor and swashplate operation during the limited range pre-flight checks.

The perceived limitations of the hydraulic system when pressuring the hydraulics from the battery powered DC motor (motorising) compounded by the restrictions of using an external battery for starting were identified as contributory factors because control movements were not made to the full extremes of the cyclic envelop during the pre-flight checks.

Safety actions taken by the operator:

- On 20 June 2018, the operator issued Flying Staff Instruction (FSI) 2018-35 to remind all crews to conduct the flight control servo system check, which includes a full and free check, as required in Appendix 2 of the Operations Manual Part B S61 Section 02. This FSI contained the detailed check as an Appendix.
- The operator has continued to monitor that its pilots perform the check, to the extremities, through routine simulator checks and, through its flight data monitoring programme, during operational flying.
- The operator has incorporated the assessment of the ball ring socket for freedom of movement in the Daily inspections. In addition, it has made the decision that, in the future, helicopters that have been transported by sea will be road transported from their port of entry to the maintenance facility.
- The operator has also undertaken to investigate increased environmental protection for its helicopters during sea voyages.
- On 22 July 2019, the helicopter manufacturer issued a Safety Advisory to highlight to operators the necessity of performing the prescribed Safety Inspections after long-term storage of the aircraft, specifically regarding the inspection/check of the swashplate.

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Bell 429 GlobalRanger, G-WLTS
2 January 2019 at Melksham Airbase, Wiltshire

The report considers two events which occurred while the pilot was conducting a Power Assurance Check. In one, an un-commanded yaw pedal movement caused a rapid rotation of the helicopter through two and a half complete rotations; in the other, a trim runaway was contained by the pilot. The trim runaway was found to be an unknown feature of the Automatic Flight Control System logic.

Following these events, safety action was taken by the helicopter manufacturer and Transport Canada to help crews respond to a yaw trim runaway and to address the underlying causal factor. Also, the flight recorder manufacturer improved the way it reported the results of CVR recording inspections.

Two Safety Recommendations are made: one to Transport Canada in relation to conduct of the Power Assurance Check; and one to the European Union Aviation Safety Agency to ensure that the installation of new equipment on aircraft does not have a detrimental effect on existing equipment.

The first event on 15 June 2018 occurred during a PAC when the pilot's feet were clear of the pedals. The yaw trim actuator operated but the pedals could not move because of a restriction, and so the actuator wound up the artificial feel spring instead. When the restriction cleared, the pedals 'snapped' to full deflection as the spring unwound, increasing tail rotor thrust and causing the helicopter to rotate rapidly to the left through two and a half revolutions. The investigation did not determine the cause of the trim runaway or the pedal restriction.

Yaw out-of-detent indication

A similar yaw trim runaway on 2 January 2019 was controlled because the pilot's feet were resting on the pedals. The manufacturer determined that the AFCS logic meant that it was possible for pilots to inadvertently induce a yaw trim runway and issued a revision to the RFM to reduce the risk of a recurrence. The manufacturer also undertook to address susceptibilities in the flight control system software identified during the investigation into these events.

The PAC is a normal procedure which was not reflected in the Normal Procedures section of the RFM. A Safety Recommendation has been issued to update the RFM with an appropriate procedure.

It was found that the CVR audio performance was poor after the installation of the TETRA communication system. A Safety Recommendation has been issued to EASA to remind Minor Change applicants of the importance of verifying that new equipment does not have a detrimental effect on existing equipment with which it has a direct interface.

Safety Recommednation and Safety Action Overview

Safety Actions taken by the manufacturer:

- Published a revision to the Rotorcraft Flight Manual to reduce the risk of a yaw trim runaway. This included procedures for responding to a runaway so that control of the helicopter would be maintained.
- Amended the Integrated Avionics Manual to include a note that automatic pedal trim remains operational on the ground if force trim is engaged.
- Recorded a Problem Report against their flight control system software related to the susceptibilities identified. The susceptibilities would be addressed by future enhancements to the automatic pedal trim function of the software.

Safety action taken by the flight recorder manufacturer:

- The flight recorder manufacturer included a plot of CVR signal waveforms as part of its CVR recording inspection report to enable anomalies such as clipping to be easily identified.

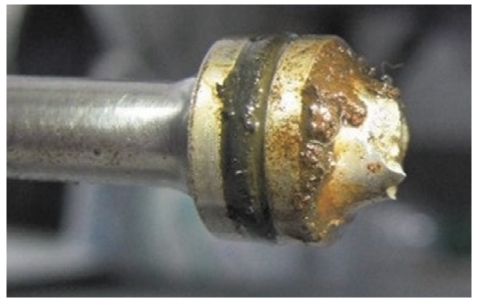
Safety action taken by the regulator:

- Transport Canada issued Emergency Airworthiness Directive CF-2019-16, which mandated the incorporation of the Rotorcraft Flight Manual revision and required all flight crews to be advised of the changes.

Eurocopter EC135T1, VP-CPS
26 February 2019 at Owen Roberts International Airport, Cayman Islands

At the start of a 'training and search' detail in the Cayman Islands, the pilot lifted the helicopter to a height of approximately four feet and felt the cyclic control stick shake and exert a rearwards force. He immediately lowered the collective lever and the helicopter landed heavily, sustaining damage to the tail boom, landing gear and transmission deck. A subsequent inspection of the helicopter revealed the longitudinal axis of the main rotor actuator had failed. A tie bar within the actuator had suffered pitting corrosion, leading to intercrystalline corrosion and cracking which resulted in overload failure of the remaining material. It is possible that moisture penetrated into the actuator and allowed the tie bar to corrode. The environment conditions of the Cayman Islands may have contributed to the corrosion. Safety actions have been taken to ensure the continued airworthiness of the worldwide fleet and to review the design of the actuator to prevent moisture ingress.

Following this accident, where longitudinal control of the helicopter was lost at low level, it was discovered that a tie bar within a main rotor actuator had fractured. This fracture was caused by the reduction in area of the tie bar through the propagation of a crack initiated by pitting corrosion. It is highly probable that the corrosion pits were caused by the accumulation of salt moisture in the end of the actuator, which had penetrated into the actuator through a gap.



Material adjacent to tie bar fracture surface

Safety action taken by the helicopter manufacturer:

- To issue instructions for continued airworthiness in the form of a mandated (by EASA EAD) Alert Service Bulletin to inform all operators to inspect the main rotor actuators. If evidence of tie bar corrosion is found, or the time in service exceeds a defined period, then the tie bar is to be replaced. To initiate a review of the actuator design with the equipment supplier to identify changes that could be made to prevent moisture ingress and a corrosion initiated failure of the tie bar.

ERJ 190-200 LR (Embraer 195), G-FBEJ
28 February 2019 at Exeter Airport, Devon

As the thrust levers were advanced for takeoff, on an early morning scheduled passenger flight, the flight crew detected an unusual odour and observed smoke entering the cockpit. They then moved the thrust levers to the idle position and applied the parking brake. The cabin crew subsequently reported that there were smoke and fumes in the cabin. Following an assessment of the situation, the commander initiated an emergency evacuation. During the evacuation, passengers who evacuated via the overwing exits reported being unsure of how to get down from the wing to the ground and several re-entered the cabin and exited via one of the escape slides.

The smoke and fumes were subsequently attributed to an incorrectly performed engine compressor wash procedure, which was carried out by maintenance personnel the night before the occurrence flight.

As a result of the findings of this investigation, the European Union Aviation Safety Agency (EASA) has undertaken two safety actions relating to the certification requirements for overwing emergency exits. The operator has also undertaken several safety actions relating to passenger safety briefings, processes for maintenance planning, engineer training, competency and welfare and monitoring of ground equipment.

Four Safety Recommendations are made relating to the certification requirements for overwing exit markings and the height requirement for overwing exits to be equipped with an assisted means of escape.

Drop to the ground from wing trailing edge with flaps in flap 1 setting

A lack of maintenance planning, training and control of resources led to an undesirable situation where a maintenance task was allocated to an engineer who was neither qualified nor competent to complete the task. A key step in the engine drying procedure was only described as 'recommended' and the engineer did not complete all the elements of the task. This resulted in residual cleaning solution remaining within the ECS system, causing smoke and fumes within the cabin and cockpit and leading to an emergency evacuation. The engine drying procedure has since been amended to require this step to be carried out.

Due to the order in which the emergency evacuation vital actions were performed, the flaps had insufficient time to travel to the selected position. This resulted in an increased drop to the ground for passengers evacuating via the overwing exits, with many reluctant to jump or slide off the wing. Additionally, despite the presence of a marked exit route on the wing with a non-slip surface, many passengers who exited via the overwing exits were uncertain where to go once out of the aircraft. Both of these factors increased the time taken for emergency evacuation to be completed.

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Safety actions taken by the operator:

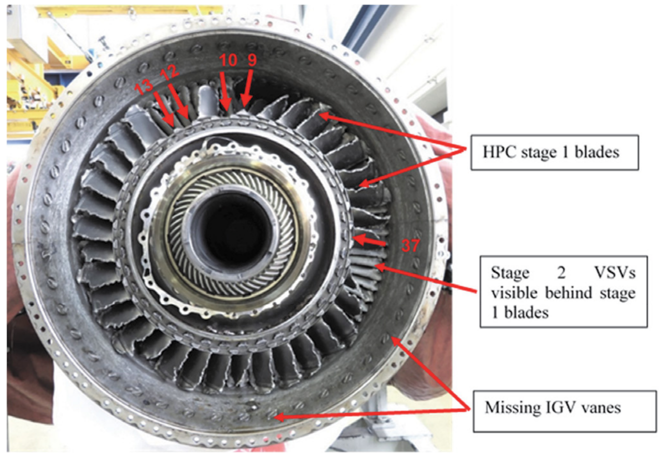
- Updated the content of its briefing to passengers seated in the overwing exits of the E195.
- Enhanced the control and tracking of maintenance ground support equipment to enable calibration expiry dates to be managed more effectively.
- Introduced a maintenance planning procedure so that maintenance requirements are identified earlier in the working day to allow appropriate resources to be identified and allocated.
- Undertook a review of tasks performed within the hangar to identify specific training requirements with a view to developing training programmes.
- Launched an engineer's competency passport scheme to enable maintenance planning departments to allocate specific maintenance tasks to maintenance stations where the correct resources are available.
- Introduced additional simulator training for engineers to undertake engine ground runs and committed to review the its recency period for conducting engine ground runs.
- Introduced a programme to verify that engineers have the correct procedures, records, equipment and tooling, personnel requirements, approvals, replacement parts, environment and information before commencing a maintenance task.
- Committed to undertake fatigue risk assessments for night shift maintenance personnel and initiated an engineer welfare programme.
- Updated its change management process to ensure appropriate management of the risks associated with the changing nature of maintenance being conducted in its base hangar.
- In June 2020, the engine manufacturer updated ESM subtask 72-00-00-410-004 to require, rather than recommend, that a high-power engine dry-out run is conducted after a compressor wash using detergent.

[Airbus A320-214, OE-LOA](#)
1 March 2019 at London Stansted Airport

The aircraft was on a scheduled flight from London Stansted Airport to Vienna International Airport, Austria. Shortly after the takeoff roll was commenced it was rejected, due to a contained failure of the left engine, and the aircraft was brought to a stop on the runway. Just as the flight crew were about to taxi the aircraft off the runway, an evacuation was commanded by the Senior Flight Attendant. The investigation identified several factors that contributed to this decision. Ten passengers were treated for minor injuries that occurred during the evacuation and there was a risk of serious injury due to one of the engines running during the evacuation. The operator has taken several safety actions, principally based around the training of its flight attendants. Two Safety Recommendations regarding passenger evacuation have been made in this report.

The left engine experienced a contained failure following the rupture and release of several blades from the first stage of the high-pressure compressor. The investigation found that the blades fractured as a result of high-cycle fatigue loading which initiated in the dovetail (part of the blade root), due to a once-per-revolution aerodynamic excitation. An inlet guide vane lever arm had been improperly assembled which led to aerodynamic excitation of the passing blades and the resulting forces exceeded the design loads of the blades.

The left engine experienced a contained engine failure. All the damage found in the engine was consistent with the release of one or more high-pressure compressor stage 1 blades as a result of high-cycle fatigue arising from aerodynamic excitation of the blades. A single inlet guide vane lever arm, which had been improperly assembled in the connecting link on the inlet guide vane actuation ring, was identified as the source of the stimulus that resulted in the blade release.



HPC module showing missing IGVs and damaged stage 1 blades

As a result of the engine failure and subsequent rejected takeoff, the Senior Flight Attendant commanded an emergency evacuation that was not necessary in the circumstances. This was probably the result of a combination of factors that heightened her emotional response to the event and affected her decision making. The factors included inexperience as a flight attendant, weaknesses in her training and communication difficulties during the event.

As a result of the flight crew not being consulted before the evacuation was commenced, the right engine remained running for the first few minutes of the evacuation. This led to an

increased risk of serious injury to those passengers that evacuated on the right side of the aircraft. Indeed, several passengers sustained minor injuries having been blown over by the exhaust.

During the evacuation several passengers hindered the evacuation by taking their cabin baggage with them. While some were removed by the flight attendants at the supervised exits, this was not possible at the overwing exits. Two Safety Recommendations are made regarding passengers evacuating with carry-on baggage.

Safety actions taken by the operator:

As a result of this event the operator has stated that several safety actions have been or will be completed, including:

Procedures

- The operator sent a Memo, on 19 May 2020, to all its Airbus pilots instructing them to ensure the PA recept is selected on an Audio Control Panel, thus ensuring the CVR records any PA announcements.
- The operator's Flight Safety Manual will be amended to instruct the Flight Attendants to attempt to establish communications with the flight crew to check that an evacuation is safe and necessary before commanding it independently.

Training

The operator has taken the following safety actions in relation to its flight attendant training. The operator has:

- Augmented the team responsible for training with the addition of a deputy manager of flight attendant training.
- Introduced a maximum limit of 25 trainees in initial flight attendant training courses. After approval from the operator's competent authority, it was subsequently increased to 30 in April 2020.
- Added practical training in the CEET to the senior flight attendant course as standard. Practical training has also been incorporated in their annual recurrent training.
- Improved variety of training scenarios in the CEET, including scenarios that result in a return to normal operations rather than an evacuation.
- Improved the syllabus of flight attendant training to include the performance effects of startle, an improved 30-second review15 technique and enhanced communication training.
- Produced a video training aid that will introduce flight attendants to the actions of the flight crew after a rejected takeoff.

- Extended the aeroplane familiarisation phase during initial training with additional familiarisation flights.

Crew composition

- The operator has introduced a requirement in the Operations Manual regarding flight attendant team composition. A minimum of two experienced flight attendants shall be part of the operating crew's complement. This is 50% of the operating crew members, as their A320s are operated with four flight attendants.

The engine manufacturer has stated the following safety actions have or will be taken

Dissemination of information

- Provided a presentation on the subject of improper IGV/VSV lever arm assembly and its consequences at an All Operators Conference in June 2019 and published an article in its monthly publication 'Fleet Highlites' in January 2020.
- Highlight the issue of improper IGV/VSV lever arm assembly during calls with its field service representatives for onward dissemination to operators and overhaul facilities.

Engine performance analysis

- Evaluate the use of a HPC performance analytic tool to determine if the effects of a mis-assembled lever arm could be identified from a detectable shift in engine performance.

Jodel D117A, G-AZII
8 April 2019 at Full Sutton Airfield, York

The aircraft landed heavily when the pilot's prosthetic adapter disconnected from the control column late in the approach. The pilot was unhurt.

The pilot has since modified the interface between the prosthetic adapter and the aircraft control column. The UK CAA has amended the medical certification pathway for pilots with musculoskeletal disability to include an engineering assessment of interface between any prosthesis and the aircraft flying controls.

Prosthetic adapter in use

The aircraft landed heavily when the prosthetic adapter detached from the control column late in the approach and the pilot was unable to regain control before touchdown.

The pilot met the requirements for medical fitness to fly, but there was no engineering assessment by a suitably qualified individual of the interface between the prosthesis and the aircraft controls. The lack of a secondary device securing the prosthetic adapter to the control column meant that its security was solely reliant upon the interference fit.

Safety action taken by the pilot:

- The pilot has added a velcro strip, which attaches to the prosthetic adapter and the control column, providing added security to the interface in the axial plane while retaining ease of disconnection in the event of an emergency.

Safety actions taken by the regulator

- The Civil Aviation Authority of the United Kingdom has reviewed the medical certification pathway of pilots with a musculoskeletal disability and is amending the Medical Flight Test form to implement a 3-stage process involving:
  - An assessment by the prosthetist relating to the manufacture and fitting of the prosthetic with regard to use in general in an aircraft, eg flight control system forces and movements;
  - Assessment of the prosthetic interface with the aircraft control(s) in an aircraft engineering context by a suitably licenced engineer or inspector;
  - The conduct of a general medical flight test by a CFI staff examiner or single pilot aircraft senior examiner, either of whom must be designated by the Authority for this purpose, to:

a) assess the ability of the pilot to fly and control the aircraft through the use of the prosthetic and operate equipment in normal operations and emergencies including ingress/egress from the aircraft and

b) consider how to ensure control of the aircraft is retained in the event of a failure.

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Airbus A320-214, G-EZTD
24 April 2019 at Lisbon Airport, Portugal

During pre-flight preparations, both pilots completed a takeoff performance calculation for a takeoff from the runway intersection with Taxiway U5. During subsequent re-planning, the crew thought they had recalculated performance information from Taxiway S1 but had, in fact, used S4 (runway full length). The aircraft took off from Taxiway U5 with performance calculated for the full runway length. The takeoff distance available from U5 was 1,395 m less than that used for the performance calculation, and the aircraft passed the upwind end of the runway at 100 ft aal. The operator had another identical event 14 days later.

Following this event, the operator acted to raise awareness of the issue with its crews and engaged with the aircraft manufacturer to review possible technical developments which might prevent a recurrence of these type of events.

EFB dropdown menu showing the all the intersections available

One Safety Recommendation is made to mitigate the risk of further confusion relating to takeoff positions.

Both aircraft took off using incorrect performance data for the intersection used. In each case, a selection error was made in the EFB which led the crew to believe that they had calculated performance information for a departure from S1 when in fact they had selected the full length of the runway. In both cases, the procedural barrier of cross-checking the runway distance against the aerodrome ground chart failed to prevent to error. Human performance limitations mean it is difficult for pilots to recognise and react to reduced performance (acceleration) once the takeoff has begun, so robust adherence to procedures is a key defence against such incidents occurring.

Safety action taken by the operator and airport authority:

As a result of these serious incidents the following safety action was taken:

- The aircraft operator issued a notice to its flight crew clarifying the takeoff positions available on Runway 21 at Lisbon Airport.
- A NOTAM was issued highlighting 'confusing runway holding point naming' and reminding crews that 'Position S' referred to the full length of Runway 21.
- The aircraft operator issued a description of the events and their causes to its flight crew to raise awareness of the risks of using the wrong intersection and distance for takeoff.
- The aircraft operator engaged with the aircraft manufacturer to review future developments that could offer extra protections against events such as those covered in this report.

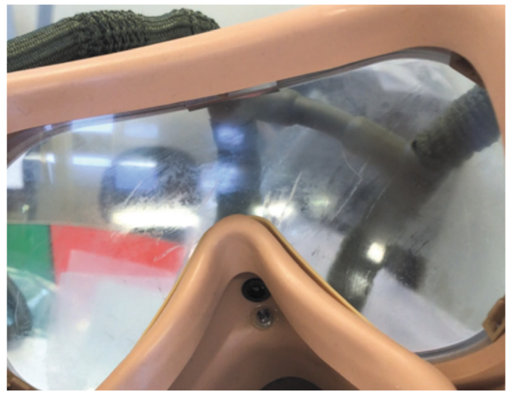
Safety Recommednation and Safety Action Overview

- The airport authority undertook to rename taxiways so that Taxiway S intersected the runway at only one point; S4 (full length).

Airbus A319-111, G-EZNM
11 May 2019 en route to Bristol Airport

The lenses of both pilots' oxygen masks misted when donned during a smoke and fumes event, obscuring their vison. The commander removed his mask so he could see the flight instruments. The aircraft diverted to Birmingham and landed without further event.

The investigation found that the masks misted up due to a combination of the environment in which they were stowed and the condition of the lenses. The source of the smoke was probably an accumulation of dust in the transformer rectifier unit (TRU).


Co-pilot's mask showing fogging and marks on internal lens

The aircraft manufacturer has added a cleaning procedure for the TRU in the Aircraft Maintenance Manual. The operator has added a practical demonstration on the use of the mask and its selectors during its recurrent training cycle.

The aircraft had a smoke and fumes event that was probably a result of dust accumulation on its TRUs. The pilot's oxygen masks misted up shortly after donning, due to a combination of the environment in which they were stowed, the crews' breathing rate and the condition of the lenses. This left them unable to see the flight instruments, resulting in the commander removing his mask. Selecting the emergency pressure setting helps clear a mask and reduced exposure to any remaining smoke and fumes.

Safety actions taken by the operator and aircraft manufacturer:

- The operator has added a practical demonstration on the use of the mask and its selectors during its recurrent training cycle.
- The aircraft manufacturer has taken safety actions in the following areas as a result of this incident:
- At the operator's request, the aircraft manufacturer has moved the relevant warning to the beginning of the procedure and highlighted it as follows:

  'CAUTION: BE CAREFUL NOT TO PUT DETERGENT SOLUTION, DISINFECTANT OR WATER ON THE MASK VISOR. IF YOU DO, DAMAGE TO THE ANTI-MIST LAYER OF THE MASK VISOR CAN OCCUR.'

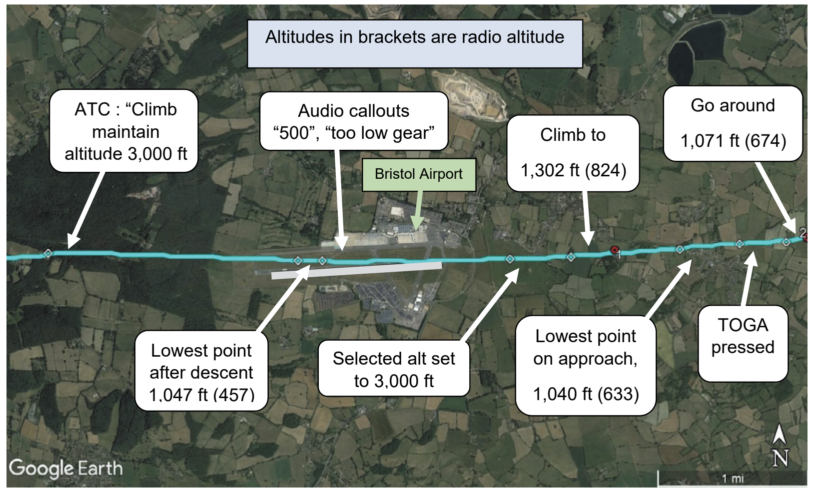
  This was incorporated into the February 2020 revision of the AMM.
- The aircraft manufacturer introduced a cleaning procedure for the TRUs in the AMM. This was incorporated into the May 2019 revision of the AMM.

Boeing 737-86N, I-NEOT
1 June 2019 at Bristol Airport

During an unstable approach to Runway 27 at Bristol Airport, I-NEOT descended below the approach path before being instructed to go around by the tower controller. After initially climbing away as expected during the go-around, the aircraft then descended for over 30 seconds reaching a minimum radio altitude of 457 ft. Simultaneously, the crew and the controller realised the aircraft was not climbing away as they expected. The crew corrected the flight path and the aircraft was vectored for a further uneventful approach.

The loss of altitude occurred because the target altitude on the Mode Control Panel was set to the minimum altitude for the approach having not been set to the missed approach altitude before the go-around. Neither crew member noticed initially that the aircraft was descending.

The operator has taken two safety actions as a result of this incident. They have used this incident as part of their annual recurrent ground school to highlight the risks of rushed and unstable approaches. They are also continuing to work on their flight data monitoring programme so that similar approaches will be identified more rapidly and easily in future.



I-NEOT go-around

Flying a shortened routing led to a rushed and unstable approach which did not follow the correct vertical flightpath. This was observed by ATC who instructed the aircraft to go around. The crew found themselves performing a go-around unexpectedly but did not know why they had been required to do so. The go-around was conducted with a mis-set altitude on the MCP, and neither crew member noticed for a significant period that the aircraft was descending during the manoeuvre.

Crews should always be ready to perform a go-around because there can be many reasons why they might have to, either internal or external to the aircraft, such as on instruction from ATC.

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Safety actions taken by the operator:

- The ground recurrent training syllabus was changed to include stable approach criteria, a review of applicable rules and Flight Data Monitoring (FDM) statistics as well as a presentation of this event.
- The operator improved its FDM system to identify events such as this unstable approach and planned to continue development of the system to make the process easier and more rapid.

Safety Recommendation and Safety Action Overview

[Boeing 737-4Q8, G-JMCR](#)
4 June 2019 at Brussels National Airport, Belgium

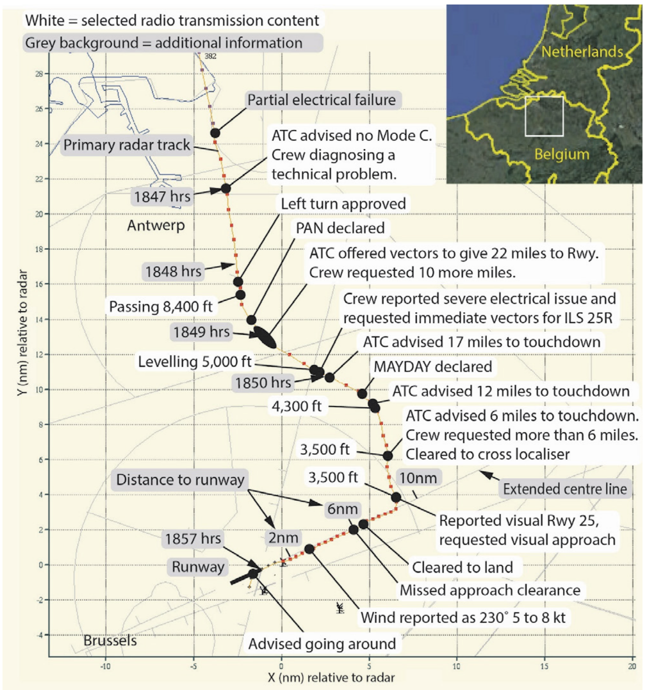
While descending to land at Brussels National Airport, a partial electrical failure occurred resulting in the loss of a number of systems including the electronic and analogue flight instruments on the left side of the cockpit. The pilot declared a MAYDAY and aware that a thunderstorm was approaching the airfield, assessed that the weather reported by Air Traffic Control (ATC) would allow him to continue and land at Brussels. However, visual references were lost at a late stage of the approach when the aircraft entered a heavy rain shower. A go-around was initiated during which the pilots estimated the amount of thrust required; the aircraft initially appeared to be slow to accelerate and establish a positive rate of climb. The aircraft entered an orbit and subsequently landed successfully from a second approach.

The electrical failure was caused by a fault in the transfer relay which resulted in the loss of power to a number of electrical buses. The aircraft documentation was unclear as to which aircraft in the fleet were configured to enable the cockpit instruments to be powered from a standby electrical source; this may have affected the pilots understanding of the failure. Safety action has been taken by the operator to provide clarity in the aircraft documentation.

The electrical failure was caused by a fault in the transfer relay which resulted in the loss of power to a number of electrical buses.

Following the electrical failure, the commander's assessment was that the aircraft was in a stable condition so continued the approach to land at Brussels National Airport. This gave the pilots relatively little time to assess the situation and a number of non-normal checklists actions were not carried out; consequently, the aircraft was incorrectly configured for the approach and landing.

At a late stage of the approach the pilots lost visual references and executed a go-around. The aircraft then orbited while the thunderstorms cleared the airfield and the pilots used the time to further analyse the failure. The second approach and landing were uneventful.



Primary radar track and timing of some radio callls

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Safety action taken by the operator

- Following this serious incident, the operator identified the aircraft in their fleet configured to enable the left EFIS displays to be powered by the AC Standby Bus. Aircraft documentation has been amended to inform pilots of the status of each aircraft.

Safety Recommednation and Safety Action Overview

Boeing 747-436, G-BNLN
9 June 2019 in flight from London Heathrow Airport to Phoenix International Airport, USA

On reaching top of climb the aircraft experienced unreliable airspeed indications resulting in overspeed warnings and activation of the stall warning system. In recovering, the crew carried out the unreliable airspeed procedure but also carried out the stall warning procedure, which was not required.

The problem was believed to have been caused by a fault with the right Air Data Computer (ADC), although this could not be replicated.

As a result of this incident, the aircraft manufacturer is providing additional information as part of their published unreliable airspeed procedure. The aircraft operator is also reviewing its maintenance procedures due to the accidental erasure of fault codes on the right ADC as part of the post-incident inspection process.

No evidence was found to account for the initiation of the event sequence, but the sequence of events was consistent with a known fault mode of the model of ADC which was fitted to the aircraft, for which a modification was available but had not been incorporated.

The malfunction of the right ADC was not identified despite extensive functional testing. It is likely that the false warnings had been generated erroneously as a result of an incorrect Mach number being supplied by the right ADC. This would then also have caused the stall warning system to operate erroneously at a safe airspeed.

The identification of the recorded faults within the right ADC unit during the flight was not possible as the fault codes had been deleted after the unit had been received into the operator's avionics workshop.

The QRH procedure applicable at the time of the incident noted that 'overspeed warnings and AIRSPEED LOW alerts may occur erroneously or simultaneously'. Stall warnings were not mentioned specifically as the aircraft manufacturer considered that crews would understand this was included. It is apparent this was not however the case with the crew involved who considered they must react to the stall warning when it occurred. The AIRSPEED LOW alert is a specific warning and the crew considered that as the stall warning was not mentioned separately in the procedural note, operation of the stick shaker should not be considered erroneous. This seemed to be confirmed to them when the stick shaker operation ceased when pitch was reduced, as they would expect after a genuine stall warning. This highlights the importance of clear, unambiguous information being readily available to crews at times of high workload when dealing with potentially critical incidents. It also reinforces the need for crews to understand the protection afforded by adopting the pitch and power settings provided as part of the procedure.

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Safety actions taken by the manufcaturer and operator

- The aircraft manufacturer is planning to update the QRH procedure to specifically include stall warnings as part of the note. This update is due to be included in the block revision to the B747-400 FCOM in April 2020. They are also considering similar action with other relevant types.

- Since the event, the operator has taken steps to identify the process shortcomings that permitted the loss of the fault codes to occur following arrival of the ADC in their avionics workshop. As a result, procedural changes are being introduced aimed at preventing future loss of troubleshooting and fault data that can assist incident investigations.

Guimbal Cabri G2, G-CILR
22 July 2019 at Wycombe Air Park

The helicopter had flown from Dunkeswell, Devon, to Wycombe Air Park, Buckinghamshire. As the pilot was shutting down the helicopter, he noticed smoke emanating from the left side of the rotor mast. He evacuated the helicopter and tried, unsuccessfully, to extinguish the fire with the helicopter's on-board fire extinguisher. The helicopter was destroyed.

Examination of the wreckage identified that the electrical cable connecting the alternator to the starter relay had short circuited against the aluminium baffle that surrounds the engine, probably as a result of the cable clips being incorrectly fitted.

As a result of this investigation the helicopter manufacturer issued a service bulletin to instruct operators to inspect for correct installation of the cable clips and has also completed a redesign of the clips to ensure they cannot be fitted incorrectly.


G-CILR prior to being moved

The helicopter caught fire shortly after landing because the heat generated from a short circuit in the engine compartment ignited a nearby carbon fibre structure. The short circuit was made between the cable that connected the output of the alternator to the starter relay and the aluminium air baffle through which the cable passed. It is likely that the cable clips that should have held the cable as it passed though the baffle were either not present or, most likely, incorrectly fitted. The upward movement of the engine as a result of the clutch disengagement was sufficient to allow the unsecured cable to contact the unprepared edge of the aluminium baffle, allowing the insulation to be cut and initiate the short circuit.

Safety actions taken by the helicopter manufacturer

- A Service Bulletin was issued by the helicopter manufacturer to inspect the clips to ensure correct installation.
- The helicopter manufacturer has completed a redesign of the clipping system to ensure the cable clipping cannot be installed incorrectly. The new design of clip is being fitted to new production helicopters and will be available via service bulletin from the manufacturer.

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Standard Cirrus 75, G-DDGX
27 July 2019 at Gwernesney Airfield, Monmouthshire

The glider was undertaking an aerotow launch to the west at Gwernesney Airfield which was operated by the resident gliding club. During the early stages of the ground roll the horizontal tailplane (tailplane) detached from G-DDGX and fell to the ground. Club members assisting with the launch signalled for the takeoff to be aborted but the message did not reach the aerotow tug pilot; the accident pilot did not appear to hear or see the stop signals either. The glider became airborne and climbed rapidly, before the tow cable released and the aircraft's nose dropped. The glider descended steeply and struck the ground nose first. It came to rest inverted pointing in an easterly direction. First responders extricated the pilot from the aircraft before he was airlifted to hospital. He died five days later from complications related to injuries sustained in the accident.

The investigation determined that the tailplane had not been correctly attached when the glider was rigged and this condition was not detected prior to the flight. Several possible mis-rigging scenarios were identified during the investigation, but the precise manner in which the tailplane had been mis-rigged could not be determined.


Locking lever when tailplane attached
(left image)
and when locked with safety pin inserted
(right image)

Two Safety Recommendations are made relating to communication for glider launching and detecting incorrect alignment of tailplane locking features. In addition, the gliding club has undertaken several safety actions regarding launch signalling and detection of incorrect tailplane locking on other Standard Cirrus gliders.

The glider tailplane was mis-rigged in such a way that it passed positive control checks but was not secure for flight. It detached early in the ground roll and the aircraft became airborne with no pitch control available to pilot. Stop signals were relayed by the forward signaller but they were not effective in alerting either pilot to the failure.

Effective signalling, radio or visual, might have prevented the glider taking off or reduced the severity of the outcome.

Safety actions taken by the gliding club

- The forward signaller position was formalised in the club's Operations Manual and their use of a white winch-signalling bat was made mandatory.
- Where appropriate, lever alignment marks were to be added to gliders at the club as additional confirmation that rigging had been completed correctly.

Safety Recommendation and Safety Action Overview

EMB-145EP, G-SAJK & Cessna P210N Pressurized Centurion, G-CDMH
7 August 2019 at London Southend Airport

An Embraer 145 landing at London Southend Airport ran over a general aviation towbar which had been dropped on the runway. No damage was caused to the aircraft. The investigation found that the towbar had fallen from a Cessna 210 which departed Southend Airport 30 minutes before. The Cessna pilot had likely been distracted during his pre-flight checks by an earlier road traffic incident in which he was involved, and had inadvertently left the towbar attached.


Towbar recovered from the runway

One Safety Recommendation has been made to the CAA to improve the visibility of general aviation ground equipment.

A general aviation towbar was inadvertently left attached to an aircraft because the pilot had been distracted by an earlier stressful event during his journey to the airport. The towbar dropped onto the runway during the departure and remained there for approximately 30 minutes, during which two other aircraft used the runway and a runway inspection was completed. A landing aircraft then ran over it. The towbar was inconspicuous because it did not have any reflective or other high visibility markings.

Safety action taken by the regulator

- The CAA has stated that if, during the general aviation-specific audits and inspections it conducts, it observes ground equipment that due to its colour is not sufficiently visible, it will bring this to the attention of the relevant operator.

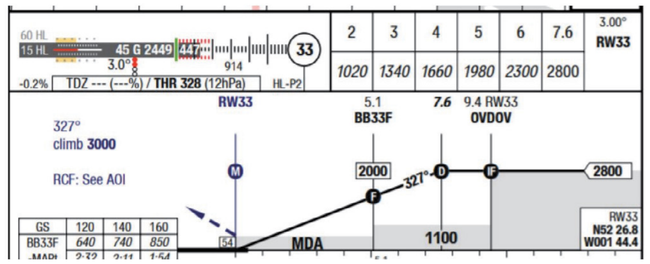
Airbus A320-216, EC-KLT
26 August 2019 on approach to Birmingham Airport

The aircraft made two approaches above the correct descent profile, on each occasion leading to a missed approach. On the second missed approach the aircraft initially continued descending and was not configured appropriately, reaching an angle of attack at which the alpha floor1 energy protection mode activated to increase engine thrust. The aircraft made a subsequent approach, landing without further incident.

During a subsequent event, involving the same operator and aircraft type (but different flight crew), the aircraft remained above the correct approach descent profile initially but descended below it later in the approach and performed a missed approach. The pilots in this case managed the vertical profile manually using a flight control mode with which they were not familiar.

In both cases the pilots appeared not to have understood when to commence the final descent to follow the vertical profile of the approach. The operator's safety department has recommended improvements in approach training and strategies to assist situational awareness. The operator and air traffic services provider are working to gain a better understanding of each other's approach requirements.

The aircraft did not maintain the correct vertical profile because the pilots were not sure when to commence the final descent. The depiction of the descent profile on charts provided by the operator may have contributed to this uncertainty.



Extract from operator's chart for RNAV approach to Runway 33 at Birmingham

In the first event it is likely that the increased workload of an unplanned missed approach contributed to the pilots not configuring the aircraft correctly for the go-around, resulting in the aircraft entering the alpha floor protection mode. In the second event, having also commenced the final descent late, the pilots did not maintain the correct profile thereafter because the type of approach required them to manage the vertical flight path manually, and they were not familiar with the flight mode they were using.

Safety actions taken by the operator and air traffic control services provider

- The inclusion of high energy approaches and go-arounds in future company simulator training;
- A review of approach intercept procedures to ensure they make adequate provision for approaches without a glideslope;
- The introduction of procedures to assist pilots in estimating distance to run during an approach; and

- Procedures to deal more effectively with a loss of situational awareness.
- The operator and air traffic services provider are working to gain a better understanding of each other's approach requirements.

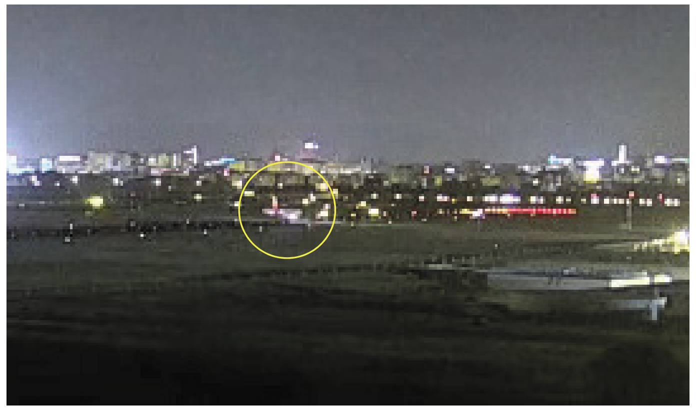
Airbus A320-214, G-EZWE
16 September 2019 at Lisbon Airport, Portugal

Under international protocols, this investigation was delegated to the AAIB by the Gabinete de Prevenção e Investigação de Acidentes com Aeronaves e de Acidentes Ferroviários (GPIAAF) in Portugal.

During pre-flight preparations, both pilots completed a takeoff performance calculation for a takeoff from Runway 21 at Lisbon Airport. In calculating the performance, the crew believed they had selected the shortest runway length available (from the intersection with Taxiway S1) but had, in fact, used the runway full length (from Taxiway S4). The aircraft was cleared for takeoff from another intersection (Taxiway U5) and used performance calculated for the full runway length. The takeoff distance available from U5, although longer than from S1, was 1,395 m less than that used for the performance calculation, and the aircraft became airborne with only 110 m of the runway remaining.

As a result of this and previous, similar incidents, the airport operator renamed part of Taxiway S to have only one intersection on Runway 21 with the letter S.

The aircraft operator moved onto a newer software version for performance calculations in December 2019 which gives a pictorial representation of the runway. They also worked with the data supplier to change the menu for intersection selections for Lisbon Airport to eliminate any confusion over which position refers to the full runway length.



CCTV screenshot showing G-EZWE just after reaching V_1

The aircraft took off using incorrect performance data for the intersection used. A selection error was made in the EFB calculation which led the crew to believe that they had calculated performance information for a departure from S1 when in fact they had selected the full length of the runway. In this case, as in the two previous identical incidents, the final barrier of checking the runway distance in the performance calculation against the aerodrome ground chart failed to prevent the error. Human performance limitations mean it is difficult for pilots to recognise and react to the performance error once the takeoff has begun, so robust adherence to procedures is a key defence against such incidents occurring.

Safety actions taken by the airport authority, operator and UK regulator

- Following the previous incidents, the AAIB reported that the Lisbon Airport operator intended to rename taxiways to remove the risk of confusion between the two points where Taxiway S crossed Runway 21. The taxiways would be renamed so that Taxiway S intersected the runway at only one point; S4 (full length). This safety action was completed, albeit after the incident to G-EZWE, and is reported here.

- The operator has moved onto Flysmart L6 performance software which now shows the crew a pictorial image of the takeoff point used for the calculation. The takeoff point selection menu was also amended to eliminated Position S making it clear to the crews that this was full length for Runway 21.

- The UK CAA decided to revise the EFB compliance checklist, SRG form 1849, to ensure that the need for a periodic battery replacement programme is emphasised.

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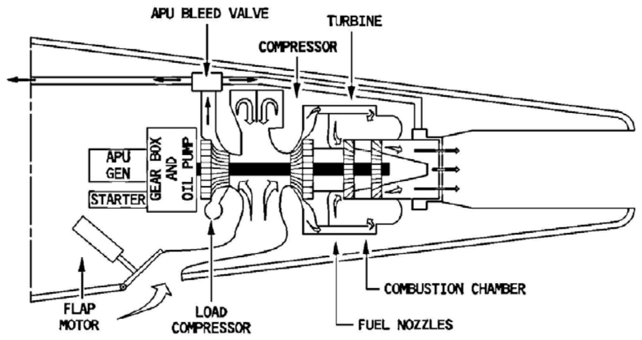
Airbus A320-232, G-EUYB
23 September 2019 on approach London Heathrow Airport

During approach to London Heathrow Airport the flight crew detected strong acrid fumes on the flight deck. They both donned oxygen masks and continued to land at Heathrow. After shutting down on a taxiway and removing their masks, the co-pilot became incapacitated and the commander felt unwell; both pilots were taken to hospital but released later that day.

Investigations carried out by the AAIB and the operator did not identify the source of the fumes.

Numerous other similar fume events have been reported to the AAIB and the CAA. This report reviews five other similar events which occurred with the same operator on the same aircraft type. It was not possible to identify the cause of these events, but, several common features have been identified.

The operator and aircraft manufacturer have taken action to try to reduce the number of events, which includes; the development of detailed maintenance procedures to identify the source of fumes, changes to flight crew operating procedures and the evaluation of modifications to enhance cabin air recirculation filtration systems.



APU schematic

While it has not been possible to positively identify the compound that was responsible for the fumes and odours experienced in G-EUYB, or any of the other recent events, a number of common factors have been identified. The majority of events occurred after the aircraft had been parked or operated in precipitation. The fumes become apparent during the later stages of the descent, sometimes preceded by a minor event during the climb phase. The generation of fumes appears to be transient; they dissipate rapidly and leave no detectable trace. No link between changes to engine power or changes in other system settings and the generation of fumes was identified.

In some cases, the presence of fumes has resulted in physiological reactions which have interfered with a flight crew member's ability to carry out their normal duties. However, by following the smoke and fume checklist, and donning oxygen masks the flight crew were able to ensure the continued safety of the aircraft.

Safety actions

Although a specific cause has not been found in these and other recent events, the operator and aircraft manufacturer have taken several actions based on current knowledge to alleviate the odour and fume events.

Safety actions undertaken by the manufacturer:

- Project FRESH has been initiated by the manufacturer to investigate and regularly inform operators of fume event arisings.
- Published an In-Service Information paper (Ref ISI 21.00.001.139) setting out all the known aspects of fumes and smoke events and includes the details of a filter and sensor product research and development programme.

Safety actions undertaken by the operator:

- Developed the post-smoke and fume events maintenance procedure.
- Taken action to ensure that the correct APU start up bleed air selection and shut down procedures are used.
- Will consider the installation of the manufacturer's ECS air filtration modification when it becomes available
- Carried out a fleet-wide check to confirm that oxygen masks were correctly stowed and issued a Quality Alert Bulletin to all engineering staff to reminded them of the importance of stowing the masks in accordance with the AMM.

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Jabiru UL-450, G-ROYC
27 October 2019 at Gransden Lodge Airfield, Sandy, Cambridgeshire

G-ROYC was being flown with two pilots onboard. The pilot in the left seat had 28 hours on type and the pilot in the right seat had not flown the type before. The approach to the runway was flown by the pilot in the right seat. During the approach he decided the aircraft was not stable so elected to go around. During the go-around the aircraft descended and drifted to the left. The aircraft collided with a stationary glider which was waiting to launch. One of the occupants of G-ROYC sustained a minor injury; the glider pilot was uninjured.

Damage to the tail and left wing of an SZD-51 glider caused by G-ROYC

The investigation found that it is likely that the aircraft did not climb due to a combination of the inadvertent retraction of the flaps, a brief delay in applying full power and the aircraft being slightly above the maximum takeoff weight.

The LAA provides a Pilot Coaching Scheme to enable pilots to safely learn new aircraft types and develop their flying skills with experienced instructors.

The BGA and the gliding club have taken safety action to ensure the risk of ground collisions continue to be minimised.
Whilst attempting to go around from low height G-ROYC descended and drifted left and collided with a stationary glider which was waiting to launch.

It is likely that the aircraft did not climb due to the combination of the inadvertent retraction of the flaps, a brief delay in the application of full power and the aircraft being slightly above the maximum takeoff weight.

The BGA and the gliding club have taken safety action to ensure the risk of ground collisions is minimised.

Safety actions

- The BGA has undertaken to remind all gliding clubs about the risk of landing aircraft colliding with aircraft on the ground and to provide advice on how to minimise the risk.
- Cambridge Gliding Club will review its procedures and consider advice from the BGA to ensure that the risk of ground collision remains as low as is reasonably practical.

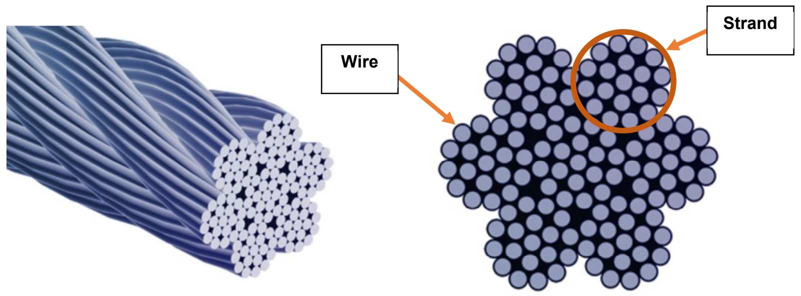
Safety Recommednation and Safety Action Overview

[DHC-8-402, G-FLBE](#)
14 November 2019 in-flight from Newquay Airport to London Heathrow Airport

Shortly after takeoff in a strong crosswind, the pilots noticed that both handwheels were offset to the right in order to maintain wings level flight. The aircraft diverted to Exeter Airport where it made an uneventful landing.

The handwheel offset was the result of a break in a left aileron cable that ran along the wing rear spar. In the course of this investigation it was discovered that the right aileron on G-FLBE, and other aircraft in the operator's fleet, would occasionally not respond to the movement of the handwheels. Non-reversible filters were also fitted to the operator's aircraft that meant that it was not always possible to reconstruct the actual positions of the control wheel, column or rudder pedals recorded by the Flight Data Recorder.

The aircraft manufacturer initiated safety actions to improve the maintenance of control cables and to determine the extent of the unresponsive ailerons across the fleet. Three Safety Recommendations are made in this report for the unresponsive aileron and filtering of the control position data.



Construction of the control cable

The most probable reason for the aileron cable breaking was that its strength had reduced as a result of wear leading to the failure of individual wires within the cable. The cable failed where it passed over a pulley on the rear wing spar where dirt accumulates which can penetrate into the strands and form an abrasive compound. This can accelerate the normal rate of cable wear. Post-modification cables are available which have a sleeve fitted over the susceptible section to prevent the ingress of dirt. The investigation established that the inspection procedure in the AMM would not have detected the damage to individual wires that run inside the cable.

The unresponsive right aileron on G-FLBE was not causal to this serious incident. As the operator ceased trading before they could establish the cause on G-FLBE, and other aircraft in their fleet, further investigation is required to determine if there is a wider safety issue.

Filters applied to some of the flight control parameters recorded on the FDR can affect the reconstruction of the rapid movement of the controls. Such filters are not permitted to be installed on the DHC-8-400 aircraft registered in the USA, but there is no similar requirement on aircraft registered in Europe or the UK. While this did not affect this investigation, this could affect other safety investigations.

Safety actions taken by the manufacturer

- The aircraft manufacturer reviewed the periodic cable inspection procedure and advised that they would amend the procedure to increase the likelihood of identifying cable damage. They also stated that they would issue an All Operators Message to highlight this serious incident and the changes to the inspection procedure.
- The aircraft manufacturer advised that it would provide literature to operators to monitor for unresponsive ailerons using their Flight Data Monitoring Programmes.

Bombardier BD-700-1A10 Global 6000, 9H-VJM
11 December 2019 at Liverpool Airport

The aircraft suffered a nosewheel steering failure shortly after touchdown. During the subsequent landing roll, directional control was lost due to the inadvertent application of right braking and the aircraft departed the runway surface onto the grass.

9H-VJM on the soft groundc

As a result of a fault, the NWS went into free caster shortly after touchdown. During the subsequent landing roll, directional control of the aircraft was lost, and the aircraft departed the right side of the runway and onto the grass. The commander, in applying left rudder to try to keep the aircraft straight, had inadvertently applied some right braking. As the aircraft slowed, full left rudder was unable to counteract the effect of this braking.

Safety actions

Following the event, the operator took the following safety actions to address the issues of inadvertent brake application and use of differential brake for steering at high speed:

- It issued a Safety Alert to all its pilots which included the following:

  'we would like to recommend all pilots, at the first occasion and when on the ground at parking on board of the airplane, to apply FULL rudder deflection. At full rudder deflection one should check if both brakes can be pushed. In addition, notice that the opposite rudder pedal moves physically closer to your body, if you feel the pressure of the closer pedal increasing and if you apply any unwanted brake pressure due to the position of your shoe on the pedal, the pedals/ seating position should be adjusted. This should be checked in the normal seating position with the respective shoe position adopted for takeoff and landing.'

- In its Training Syllabus for 2020 the operator has included a failure of the NWS system after landing as a preferred malfunction

DJI M600 Pro (UAS, registration N/A)
13 December 2019 at Wallsend, Tyne and Wear

The UAS, a DJI M600 Pro, was being operated in an automated flight mode to survey a construction site when a GPS-compass error caused the aircraft to revert to a flight mode that required manual control. By the time that the pilot and observer realised that it was not responding to the return-to-home (RTH) function, visual line of sight was lost when the aircraft drifted with the wind beyond a line of trees. It subsequently collided with the roof of a house before falling into the property's rear garden. No persons were injured.

The pilot, and the observer who was also a pilot, had operated UASs since 2018 and had the required permissions from the UK CAA. Both pilots had relied predominantly on the automated flight capability of their aircraft and had not, nor were required to have, practised for emergencies since completing their flying training in 2018. One Safety Recommendation is made to the UK CAA.


The aircraft after falling into the garden

The pilot was required to take manual control of the aircraft following the loss of its automated flight modes due to signal interference. However, no manual control inputs were made, and the aircraft subsequently drifted with the wind until it collided with a house roof and fell to the ground. No persons were injured.
Operators holding a PfCO issued by the CAA are not currently required to practise routinely for emergencies or demonstrate the ability to fly their aircraft in a degraded flight mode. These skills are perishable but, as this accident shows, they may be needed at any time; it is important that they are maintained to prevent a risk of injury to people or damage to property. To address this, one Safety Recommendation has been made to the CAA.

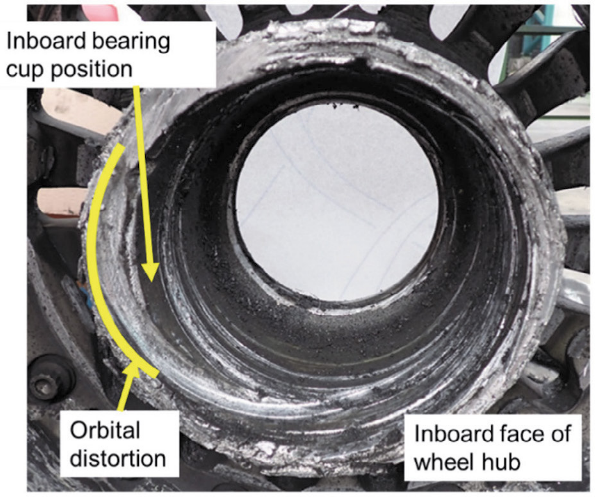
Safety action taken by the operator

- The operator's pilots have undergone refresher training on responding to emergency situations and operating their multi-rotor UASs in the ATTI flight mode.

[Boeing 737-8K5, G-TAWG](#)
24 December 2019 at Manchester Airport

Shortly after a normal touchdown, the right outer (No 4) mainwheel separated from its axle and was seen, by the pilots, to pass down the right side of the aircraft. The aircraft vacated the runway and was safely brought to a halt on the taxiway. The wheel separated as a result of a failure of the inboard wheel bearing which led to the failure of the outer bearing. The exact cause of the initial failure to the inboard bearing could not be determined.

Bearing failure investigations such as this are often inconclusive due the severity of the material damage within the bearing destroying evidence of the initiation. Therefore, it was not possible to determine the cause of the bearing failure, or to discount the possibility that there was a pre-existing fault, or the bearing had become damaged as a result of the ingress of debris or moisture.



Hub damage around the inboard bearing cup area

It is possible that preload torque applied was slightly below the minimum required; however, it was still considered enough to ensure that the bearing assembly was correctly seated and makes it unlikely to have affected the bearing running condition. However, a combination of the possible causes set out in this report cannot be ruled out. The AAIB will review the findings of the operator's investigation into the bearing failure on G-FDZB and will provide an update to this report if it provides further clarification on the cause of the bearing failure on G-TAWG.

Safety action taken by the operator

- As a result of the No 4 inner wheel bearing failure found on Boeing 737-800, G-FDZB, and its similarities with a preceding bearing failure on Boeing 737-800, G-TAWG, a component failure investigation will be carried out to ascertain if there is a common cause for both failures.

CORRESPONDENCE INVESTIGATIONS

[Embraer E55P Phenom, D-COLT](#)
12 March 2019 at Runway 23R, Manchester Airport

While the aircraft was lining up on Runway 23R from intersection J1 at Manchester Airport, the sun's glare on the wet runway made it difficult for the pilot to see the runway markings. He aligned the aircraft with the runway edge stripe, rather than the centreline and, as instructed by ATC, commenced a rolling takeoff.

The ATCO noticed the misalignment and instructed the aircraft to abandon its takeoff, which it did without damage or injuries to those onboard. Several safety actions have been undertaken by the airport authority and the air traffic service unit.

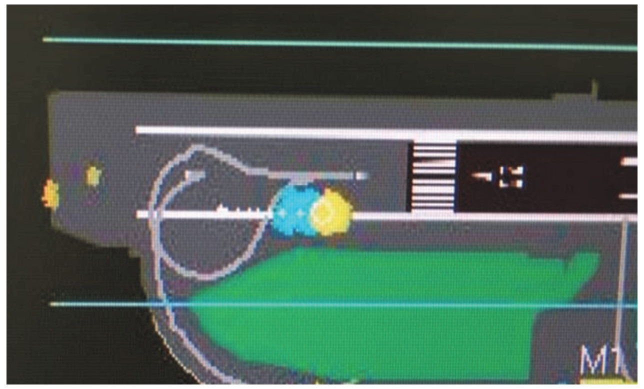


Image of SMR at the commencement of D-COLT's takeoff roll

The aircraft began taking off on the edge stripe of Runway 23R at Manchester after lining up via intersection J1. The sun's glare on the wet runway, and the orientation, dimensions and slope of the intersection and runway surfaces, contributed to the pilot misidentifying the centreline. The rolling takeoff reduced his opportunity to check the aircraft's position.

As a result of this and a previous similar event, the airport authority is implementing several safety actions to assist pilots lining up at J1.

The ANSP stated that it intends to include the lessons from both events in its annual refresher training for ATCOs, and in other training opportunities.

Safety actions taken by the the airport authority and the air navigation services provider

The airport authority has undertaken to:

- Instate a 'runway excursion' hotspot at J1.
- Reconfigure J1's lead-on lights so that they will always illuminate when its stopbar is lowered.
- Apply green paint to the areas of the J1 turning circle outside of the runway edge lighting, giving the impression of grass.

The ANSP has undertaken to:

- Promulgate the lessons learned from both occurrences across all its airport units, by including them in its upcoming annual refresher training course for ATCOs and otherwise; and by highlighting the use of SMR for monitoring aircraft lining up, particularly small aircraft on large runways with wide shoulders.

Agusta Westland AW189, G-OENC
25 March 2019 on Forties Charlie platform, Northern North Sea

While operating to the Forties Delta platform the pilots misidentified and landed on the visually similar Forties Charlie platform.

The operator has issued a safety notice detailing the lessons learned from the incident and a Flying Staff Instruction amending the guidance in the Operations Manual on the Avoidance of Wrong Deck Landings.

The pilots landed the helicopter on the Forties Charlie (40C) platform having misidentified it as the destination platform (40D). Controls in place at the time proved inadequate to break the confirmation bias of the pilots.


Forties Charlie (40C) platform

Discussion between the pilots about the position of the crane on the 40C platform probably resulted in them switching their attention incorrectly to this platform and away from the 40D platform. The crane was not stowed on either platform, so did not serve as a distinguishing feature.

The pilots' familiarity with the Forties field, the physical similarity of the platforms, and the identical approach and landing flight path to each of them served to reinforce their selection of the wrong deck.

The pilots did not verify they were approaching the correct platform by cross-checking the position of the platform against the FMS bearing and distance to the destination or reading the platform name on the helideck before committing to land.

Safety action taken by the operator

The operator has issued a Safety Notice to pilots highlighting four lessons learned from the incident, detailing:

- When to hand over control to the landing pilot
- The importance of pilots monitoring and cross-checking the GPS/FMS bearing and distance
- That pilots must read the platform name before committing to landing
- That pilots should wait for the cranes to be stowed even if this incurs a delay

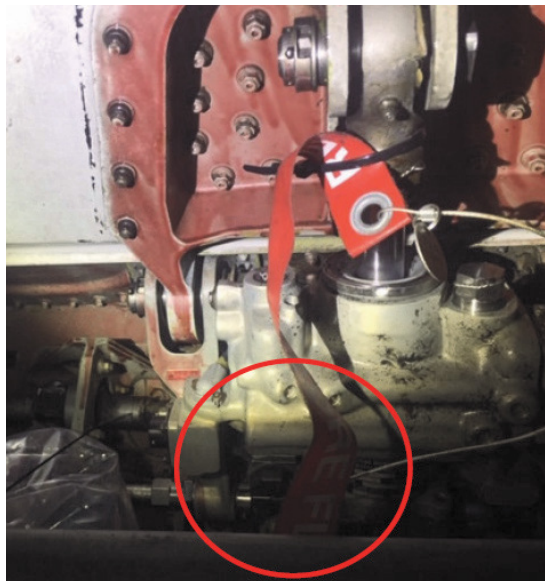
The operator has issued a Flying Staff Instruction amending the guidance for the 'Avoidance of a Wrong Deck Landing' given in the operations manual to emphasise the importance of the following actions:

- The need for pilots to highlight the risk of a wrong-deck landing at both the pre-flight planning and the approach brief phase
- The need for pilots to ensure the route is fully and correctly entered into the FMS
- The use of GPS/FMS needle bearing and distance guidance to the point that the platform name is read
- The need for pilots to read the platform name and cross-check with the GPS/FMS bearing and distance prior to committing to landing on the heli-deck

[Airbus A319-131, G-DBCD](#)
2 April 2019 en route London Gatwick Airport to Palma De Mallorca

During pre-departure maintenance activity to resolve a flight control status message, the No 1 spoiler was unintentionally left in the maintenance position with the maintenance key installed. During the flight, the spoiler was able to 'float' up resulting in uncommanded left roll and vibration. The crew landed the aircraft without further incident. The operator's internal investigation identified a number of factors which contributed to the maintenance error and it made 11 internal recommendations.

Following maintenance action intended to deactivate a spoiler, the aircraft departed with the spoiler in the maintenance position. This allowed the spoiler to 'float' up in the airflow causing an uncommanded roll input. The aircraft landed without further incident and the spoiler was correctly deactivated for the return flight.



Spoiler maintenance key and flag as found on arrival

The operator's safety investigation identified that the LAEs had not followed the AMM procedure correctly. The maintenance activity was, by necessity, being conducted in bad weather and it was an unfamiliar task. They were distracted during the task and had difficulty using the APP on the tablet device which was provided to display the required maintenance information.

The LAEs had difficulty interpreting the modification status of the actuator and identifying the relevant sections of the procedure to use, relating to the modification status and position of the actuator, on the tablet device they were using. They were not clear on how the maintenance key was to be used to deactivate the spoiler actuator for dispatch. A physical check for correct deactivation was not completed and an independent check for correct deactivation was not required to be carried out. The log book entry for the deactivation was incorrectly certified.

The operator's report also identified a number of contributory factors including how the maintenance information was accessed and presented to the engineers, and differences in how similar information is presented more effectively to flight crews.

Safety actions taken by the operator

- Improving the ease of access to, and the presentation and clarity, of maintenance information.
- Discussion with EASA and Airbus about the possibility of having critical lock out tasks clearly defined within the MEL in the style of a QRH for use alongside the crew OPS procedures.
- Reviewing the policy and standards for duplicate inspection to clearly identify that this deactivation task should require a duplicate inspection.
- Reviewing the effectivity of current line manager's task audits at the Maintenance Safety Group.
- Highlighting to other engineers the importance of fully understanding the AMM and Trouble Shooting Manual tasks.

Fuji FA-200-180 Aero Subaru, G-HAMI and Cessna 172R Skyhawk, G-BXGV
23 June 2019 near Henley-on-Thames, Oxfordshire

Two aircraft had what was initially believed to be a near miss while giving air experience fights to disabled children at a multi-aircraft charity event. It was later discovered that the two aircraft had collided, with one aircraft sustaining minor damage, but both aircraft landed safely.

The investigation discovered that one of the accident pilots was asked to present the pilots' briefing at short notice. The briefing did not include a discussion of how all the participating aircraft would be deconflicted or how they would communicate. Neither aircraft had any form of Electronic Conspicuity.

The airfield that hosted the event has committed to take safety actions before hosting the event again.

Safety action taken by the airfield

- The host airfield stated that it will conduct a risk assessment before holding the event again. It will also ensure that the Deputy Airfield/Safety Manager or another responsible representative from the airfield is available to make a full and complete briefing, adopting the template of their Members' Day briefing. An overview of the flying will also be maintained throughout the event.
- The owner of G-BXGV has fitted an EC device and linked it to the navigation software installed on his personal electronic device.

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Agusta A109E, G-ETPI
27 June 2019 in flight North of Seaton, Cornwall

Window aperture of left cockpit door, showing no evidence of adhesive

During a post-maintenance flight, the left cockpit door window separated from the helicopter. The window had been removed and reinstalled during recent maintenance. The investigation determined that insufficient adhesive had been applied to the rubber retaining seal. In addition, liberal application of high-concentration soap solution during reinstallation likely contributed to the loss of the window, by reducing the frictional ability of the rubber seal to retain the window. As a result of the findings of this investigation, the maintenance organisation has taken four safety actions.

Deviation from the prescribed maintenance manual procedure and lack of effective supervisory oversight were identified as contributory factors.

Safety actions taken by the maintenance organisation

- Following its internal safety investigation, the maintenance organisation debriefed all involved staff on the findings of the investigation. On 28 August 2019 it issued a temporary notice to all engineers informing them of the incident and requiring the installation of windows to be considered as a critical maintenance task, requiring an independent inspection to be performed during the installation of any acrylic window. The task was subsequently included on the organisation's formal list of critical maintenance tasks, when it was next updated. The details of the incident are also to be included in company continuation training, with a focus on the requirements for effective supervision, stage checks and adherence to procedure.
- The maintenance organisation has undertaken to review its Emergency Response Plan (ERP) and to consider implementing a process to ensure that staff involved in maintenance activity prior to a suspected maintenance error, incident, or accident are stood down from duty, and are not allocated to be part of the maintenance response team. It indicated that the review of the ERP would be completed by the end of October 2019.
- In September 2019 the maintenance organisation introduced a new production planning tool across all its maintenance bases to control and monitor to allocation of manpower, including supervisory staff, to aircraft undergoing base maintenance.

Safety Recommednation and Safety Action Overview

[Parrot Anafi (UAS, registration, n/a)](#)
17 July 2020 at : Green Lane, Yeadon, West Yorkshire

The operator was conducting a night search of roof tops. About 15 minutes after takeoff, when the UA was at about 50 agl, the pilot noticed the control screen flicker and heard the speed of the UA's motors increase without any input from him. The UA then started to turn and, despite inputs from the pilot, was unresponsive. He attempted to descend the UA to conduct an emergency landing and then selected the 'Return to Home' function, but it did not respond. The UA then entered an uncontrolled descent onto the roof, where it came to rest.

The UA was recovered with damage to its two front left propellers and battery. There was also minor damage to the roof covering.

The pilot believed that, given the clean fractures on the propellers and the way the motors reacted, the UA had suffered a failure of the two propellers.

The AAIB published another reported failure of propellers on a Parrot Anafi in its 9/2020 Bulletin.

Safety action taken by the operator

- Previously the operator would only replace damaged propellers but, as a result of the safety action taken in the published event, they will now also change the propellers every 5 hours flight time. They will also make a video recording of all pre- and post-flight safety checks.

[DHC-8-402 Dash 8, G-PRPK](#)
22 July 2019 en route from Edinburgh Airport to London City Airport

During a scheduled flight from Edinburgh Airport to London City Airport the cabin press warning illuminated and the crew initiated an emergency descent. The aircraft diverted to Birmingham and landed without further incident. Following some rectification work the aircraft was returned to service later that day.

During the ensuing weeks the aircraft experienced several more pressurisation events until the operator decided to withdraw it from service for in-depth engineering investigation, after which it was returned to service again. To date no more pressurisation events have been reported.

The operator has taken safety action intended to enhance the monitoring of recurring aircraft faults.

After the ninth event, involving another emergency descent, the operator withdrew the aircraft from service and conducted an in-depth investigation into the recurring fault. Several bleed air and pressurisation components were replaced before the aircraft returned to service.

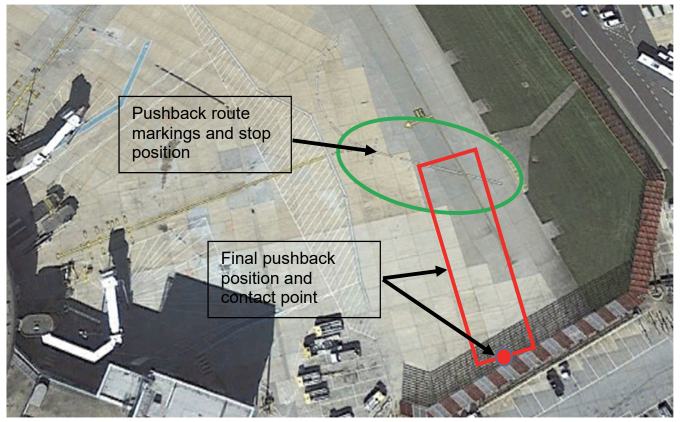
The absence of further reported pressurisation faults since the aircraft returned to service indicates that this intervention was successful. It is therefore possible that several events, including the second emergency descent, would have been avoided if this intervention had occurred sooner.

Safety actions taken by the operator

- The operator issued a notice to all its flight crew (NOTAC 101/19) on 9 August 2019 with guidance on the reporting of safety events. It also conducted a 'roadshow' for crews and engineers at all its bases, encouraging the submission of ASR reports.
- The operator has initiated a review of its reliability program to, among other things, enable more robust monitoring of recurring defects.

[Boeing 787-9 Dreamliner, G-CKWB](#)
12 August 2019 at London Gatwick Airport

G-CKWB was parked on Stand 38 at London Gatwick Airport. The aircraft was loaded, with the doors closed ready to depart for its flight to the USA. Permission was granted by the ground controller for the aircraft to push back and start engines at 0910 hrs. The aircraft was pushed back using the incorrect line and as a result the aircraft tail cone struck the blast screen.



Final pushback position

Safety actions taken by the operator

- Use of Stand 38 by the operator was suspended temporarily.
- The aircraft operator decided to prepare a risk assessment on the use of additional ground staff to watch the wingtips and tail of aircraft during the pushback. The airport operator agreed to consider this assessment once it was complete.
- Notices were issued by the aircraft operator to all pushback crews to remind them of the procedures and importance for stopping a pushback should the aircraft deviate from the centreline.
- Additional training was given to headset operators to increase their understanding and awareness of pushback hazards.
- A 'STOP' mark was painted on the ramp beside the nosewheel stop line on Stand 38 to make it clear that the aircraft should not be pushed back further than this line. This mark matches others at Gatwick where the pushback is limited by the confined space.

[Antonov AN12, UR-CKL](#)
30 September 2019 at Liverpool Airport

The aircraft's left wing struck a lighting stand whilst leaving its parking stand. The aircraft had been parked in a position where the crew could not see the stand's ground guidance markings and there was no marshaller to guide them.

The airport had accommodated the fact an appropriate tow bar was not available for the aircraft by parking it on an existing stand in a manner not intended for that stand. Whilst this enabled the aircraft to leave the stand without needing to be pushed back, it had put the wing in a position where it was in danger of colliding with the lighting stand. This foreseeable outcome might have indicated the need for appropriate guidance to be made available to, and requested by, the crew to ensure adequate clearance from the lighting stand.

Safety action taken by airport authority

- The airport has re-designated Stands 11-14 and 33-41 to allow parking by self-manoeuvring. The AIP entry has been updated to inform pilots that under such circumstances a marshaller will be available during departure and to instruct pilots to request assistance at any time they need it when taxiing.

[Aerialtronics Altura Zenith ATX8 (UAS, registration n/a)](#)
1 October 2019 in Stoke Gifford, Gloucestershire

Shortly after takeoff for a flight from a road bridge above two railway tracks, the UAS in GPS mode started to drift, accelerate and descend away from the pilot. The pilot was unable to regain control before it crashed into vegetation next to the tracks. A subsequent investigation by the operator found that magnetic deviations of up to 140° were observed over localised regions of the bridge below which the railway track's overhead high-voltage wires were being ducted.

The day after the accident flight, the operator went to inspect the takeoff site to try and identify any factors that might explain the aircraft's behaviour. A spectrum analysis of the radio frequencies at the site didn't identify anything of concern. However, when using a hand-held compass to check for any magnetic interference, deviations of up to 140° were observed over localised regions of the bridge below which the railway track's overhead high-voltage wires were being ducted.

Safety action taken by the operator

As a result of the findings, the operator has made changes in its flying procedures to reduce the possibility of the event reoccurring. These include:

- A magnetic interference check using a manual compass of an area 10 m around the planned takeoff location;
- A visual check for objects and structures that might have a large magnetic field;
- Takeoff and landings should take place as far away from any sources of magnetic interference; and
- The pilot should always be ready to switch out of GPS mode into atti(tude) or manual flight modes to retake control of the UAS if control is lost whilst in GPS mode.

[Airbus A321-231, G-EUXJ](#)
24 November 2019 on takeoff from Glasgow Airport

During the takeoff roll the flight crew realised the aircraft was not accelerating as expected. Just prior to V1 the commander applied full power. The aircraft took off and continued its planned flight without further incident. The flight crew subsequently discovered they had entered an incorrect reduced thrust temperature into the flight management computer.

The investigation found the incorrect entry was probably a result of distraction during the data entry. The subsequent standard procedures and checks did not detect the error.

The flight crew inadvertently entered a flex temperature of 79° instead of 49°. The error was not detected during the subsequent procedures and checks.

The error was likely made due to a combination of brief distraction and entering a nonstandard acceleration height. The subsequent checks do not require the flight crew to refer back to the source data and, whilst the selected flex temperature was unusual for a A321, it was not usual for the A319 which the flight crew had been operating during the tour.

The flight crew realised there was insufficient power during the takeoff roll and applied TOGA power.

The operator has reminded its pilots about the hazard of distraction during critical data loading and are reviewing their procedures to improve the likelihood that data entry errors are detected.

Safety action taken by the operator

- The operator has issued a safety notice to all its flight crew highlighting this and previous events. The notice emphasises the importance of avoiding distractions whilst loading the takeoff performance data.
- The operator is also reviewing its takeoff performance data entry and checking procedures in order to ensure that there are sufficient opportunities in the procedures to trap any error.

Boeing 747-436, G-CIVU
20 December 2019 at London Heathrow Airport

A Boeing 747 collided with a fuel transfer vehicle (FTV) as it was approaching its final parking position on stand at Heathrow. The FTV had remained on stand after refuelling the previous aircraft. Neither the flight crew nor the ground staff responsible for the arrival saw the FTV before the collision.

The operator and airport authority have taken safety action to prevent reoccurrence.

Safety actions taken by the operator and airport authority

The operator is taking the following safety action to resolve these issues:

- The operator will conduct an independent review of the available standard operating procedures and associated documentation to ensure they are;
  - clear and workable,
  - the accountabilities and responsibilities are detailed and,
  - there is a single source of information.

The operator will take the following safety action:

- The operator will establish a procedure to ensure all visually restricted stands have a 'mid-man', in the line of sight, to act as an additional pair of eyes for the colleague manning the emergency stop button at the head of the stand.

The airport authority is taking the following safety action:

- The airport authority has changed the parking arrangement on Stand 331 to prevent vehicles obscuring the view from the head of stand. The airport authority is undertaking a review of the emergency stop button locations on all stands

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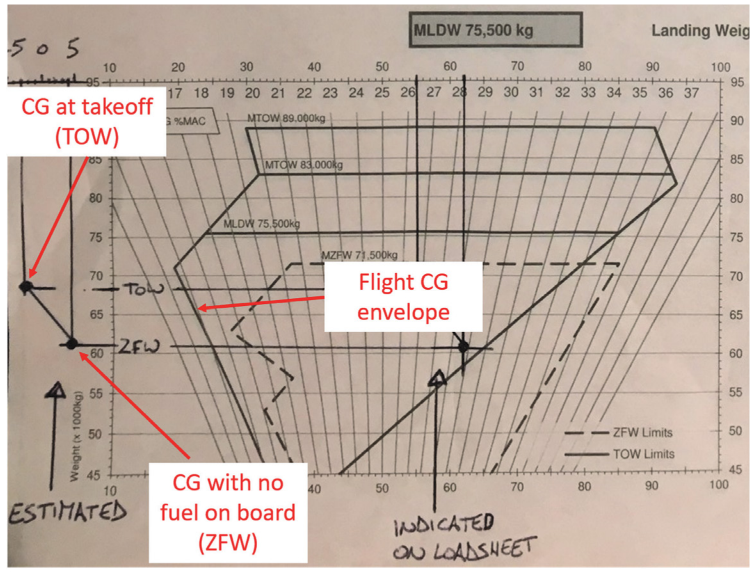
Airbus A321-231, G-WUKG
16 January 2020 at London Luton Airport, Bedfordshire

The aircraft was departing from Runway 26 at London Luton Airport, but when the PF made a normal aft movement of the side stick control at rotation airspeed, the aircraft did not pitch up. The PF increased the side stick input close to the maximum deflection. When the aircraft still did not pitch up, the PM selected TOGA thrust. The aircraft responded and a climb was commenced with the flight continuing to the planned destination of Prague Airport, Czech Republic.

An aircraft change had been made for operational reasons from an Airbus A320 aircraft (A320) to an Airbus A321 aircraft (A321), but no adjustment had been made to the passenger distribution. This led to the passengers being seated towards the front of the aircraft, placing the CG outside the forward limit of the permitted operating envelope.



The A321 Load and Trim Sheet that would have resulted on the incident flight

Following this event, the operator took action to: highlight this event to its staff and improve their understanding of the issues raised; and improve the flow of information between operational departments when there is a change of aircraft type to reduce the risk that a similar event would occur in the future.

The incident occurred due to the aircraft change from an A320 to an A321 not being notified to both OHD and PSD. As a result, the passengers were seated at the front of the aircraft, placing the CG outside the forward limit of the operating envelope. The effect of this was that, at rotation, the aircraft appeared to the crew not to respond as expected to the normal side stick control inputs due to the forward CG. The PF required almost maximum aft control input and the PM selected TOGA thrust before the aircraft nose lifted. The crew analysed the problem but considered that an incorrect stabiliser setting, taken from the load sheet, had caused the problem. Only at the top of the descent for the destination did it become apparent that the passengers had possibly been incorrectly distributed in the cabin. The crew did not experience any unusual control response during the approach and landing.

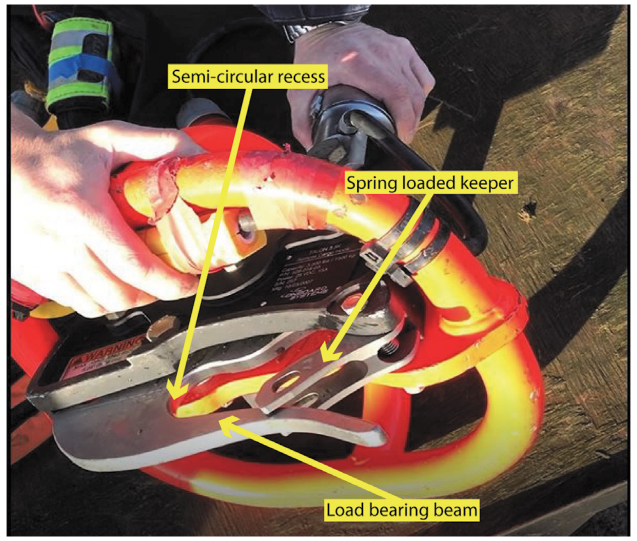
Safety Recommednation and Safety Action Overview

Safety actions taken by the operator

- Improve the passage of information between the OCC and the flight crew when a change of aircraft variant takes place.
- Improve Ground Handling Agents' awareness of the implications of a change in aircraft variant.
- Distribute and make highly visible to all staff briefing material on this incident.
- Include any variant change at the flight and cabin crew briefing.
- Provide additional training for cabin crew on weight and balance distribution and its affects.
- Produce a Safety Bulletin to provide staff with a more detailed description of the incident.
- Issue a Crew Order (change to Operations Manual Part A) with enhanced awareness and guidance if suspicion is raised onboard.

Eurocopter AS350B2, G-PDGF
3 March 2020 at Glencoe, Argyll, Scotland

During the refurbishment of an electricity line, G-PDGF was carrying an underslung load consisting of a 700 kg wooden pole which was then inadvertently released. The pole broke into two pieces when it struck a steep hill approximately 200 m from a minor public road, but clear of any built-up areas and third parties. There was no damage to the helicopter or lifting equipment. The operator considered the most probable cause for the inadvertent release of the load was that the sling, which was carrying the load, was not positioned correctly in the helicopter's hook which was of the spring-loaded keeper design. As a result of this incident, the operator is continuing to phase out the use of this design of hook for most of its operations and has changed its procedures so that only the operator's employees are permitted to load the hook when spring-loaded keeper hooks are used.



The spring-loaded keeper hook fitted to G-PDGF

The most probable cause for the inadvertent release of the load was that the load had not been positioned correctly across the hook's load bearing beam when the load was hooked on. At this time, the client's employee, although having been trained in underslung load lifting operations, was working alone and was not being directly supervised. However, an intermittent fault could not be ruled out as an alternative cause for the release.

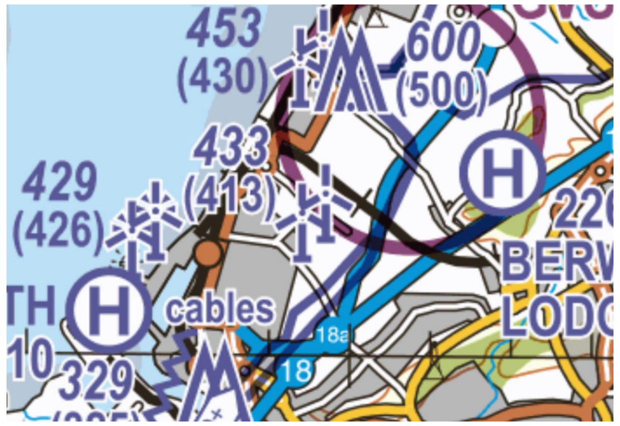
Safety action taken by the operator

- The operator is continuing to phase out the use of hooks with spring-loaded keepers in favour of using keeperless hooks for most of its operations. Additionally, the operator has amended its procedures so that, if spring-loaded keeper hooks are used, only the operator's employees will carry out loading operations. The operator advised that, as keeperless hooks require the use of two hands, it will retain a few spring-loaded keeper hooks for tasks such as lifting a load from a scree-covered hillside, where using both hands poses a greater risk to the loader.

DJI Phantom 4 (UAS, registration n/a)
5 March 2020 at Bristol sewage treatment works

During an aerial survey of a sewage treatment works, the unmanned aircraft flew into a wind turbine, the height of which the pilot had misjudged.

The pilot was aware of the wind turbines at the site where the aerial survey was to be conducted but was unable to find any accurate information about the height of these either on the app used to plan the flight or from an internet search.



Extract from the CAA 250K aeronautical chart with the wind turbines at the sewage works in the centre of the image

For a UAS pilot flying visual line of sight with the aircraft, tall obstacles may be obvious to see but their actual height is difficult to assess visually. All known ground obstacles greater than 300 ft in height are shown on aeronautical charts. These charts, and apps that use the same obstacle database, are one source of accurate information, and provide a clear indication of areas to avoid flying a UAS if limited to flying not above 400 ft. However, for obstacles less than 300 ft, UAS pilots will need to determine their accurate heights from other sources.

UAS pilots are responsible for flying their aircraft within the limitations imposed by their CAA Permission and so must ascertain the accurate height of any hazard or obstacle near the planned flightpath.

Safety action taken by the operator

- Having been reminded of the obstacle and airspace information available on aeronautical charts or flight planning apps that have access to this information, the operator has amended its flight planning and risk assessment procedures to include reference to these.

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Yuneec H520 (registration N/A)
24 April 2020 at Hove, East Sussex

The aircraft dropped to the ground from a height of 15 m when power was lost to the electric motors even though the battery's energy level (State of Charge) was 97.7%. The wind conditions were turbulent and an investigation by the Unmanned Aircraft System's (UAS) manufacturer concluded that the probable cause for the power loss was that the battery had become loose in flight.

The sudden loss of power to the motors from a battery that was almost fully charged was consistent with the battery disconnecting in flight. The data indicated that the aircraft was pitching through 6° and rolling through 46° as it maintained altitude while moving slowly forward, suggesting that the conditions were turbulent enough to dislodge the battery if it had not been properly secured in place, even though the pilot had checked to make sure it was.

Safety action taken by the manufacturer

- The manufacturer stated that future versions of the Yuneec H520 will include logic to prevent takeoff if it detects that the clip holding the battery in its housing is not securely in place.

Believer (UAS, registration n/a)
2 May 2020 at Solent Airport, Hampshire

The flight was part of a test programme prior to the start of commercial operations to the Isle of Wight.

The accident UAS was considerably smaller than the production aircraft but it was representative in terms of the avionics and communications. It crashed shortly after taking off because the safety pilot switched the radio control transmitter off before the automatic flight control system was engaged. Several safety actions have been undertaken by the operator because of this accident.


General view of the Believer UAS

The safety pilot erroneously turned the transmitter off before the automatic control system was activated and before the instruction to turn the transmitter off had been issued.

The operator believed that the accident was unavoidable after the radio control transmitter was turned off because there was insufficient time to switch it back on and regain control of the UAS.

Safety actions taken by the operator

- Operations were reviewed to minimise the period where a UAS is under manual control. The UAS is now launched in a revised automatic mode where the safety pilot can apply control inputs to correct the flight path if appropriate. The safety pilot can also disable the automatic flight control system and take full control of the UAS in the event of an emergency.
- The fail-safe logic has been reviewed and modified so that settings are automatically configured depending on the status of the UAS.
- The operator has reviewed their fatigue risk management strategy and is introducing limitations with respect to permissible crew working times and a requirement for crew members to consider their well-being and declare themselves fit for operation during every flight briefing. The operator is updating their operations manual accordingly.

Hawker Hurricane 1, G-HRLI
1 June 2020 at Duxford Airfield, Cambridge

While landing with a crosswind the aircraft made an uncommanded right turn that was not corrected, and the landing gear collapsed. The landing technique, the pilot's lack of recency and the hard, dry runway surface may have been contributory factors. The operator will require that less experienced pilots do not operate the aircraft with a crosswind component above 5 kt from the right.


G-HRLI after the accident and application of fire-suppressing agent

The crosswind on landing induced a turn to the right. The reported application of brake and an absence of tail-down elevator coincided with the aircraft bouncing and pitching forward on the hard, undulating runway surface, aggravating the effects of the swing. In the absence of effective control inputs to oppose the swing, the aircraft began to slide sideways, eventually causing the landing gear to collapse. The pilot considered that his lack of relevant currency may have reduced his ability to anticipate and make appropriate control inputs on landing.

Safety action taken by the pilot

- The pilot intends to conduct refresher training in a relevant dual control aircraft such as the Harvard before flying the Hurricane after a significant absence. The operator will amend its Operational Control Manual to require that pilots new to the type with less than 5 hours experience on equivalent types will be limited to a maximum 5 kt crosswind component from the right.

Parrot Anafi Thermal
11 June 2020 near The Dicker, East Sussex

The operator was conducting training with the UAS for a pilot and observer. About 3 minutes after takeoff the UA was observed to be “twitching”. Despite attempts to regain control, it was observed to pitch, yaw and change height by approximately ± 20 ft, and the UA was flown to the emergency landing area.

As the pilot descended the UA for landing it became less responsive. It then pitched down and flew away, without any input from the pilot, and did not respond to any subsequent inputs. The pilot selected the ‘return to home’ function, without effect, and announced “control lost” to the observer. The UA then collided with a tree about 420 ft from the landing area and 100 ft agl, sustaining damage to its gimbal and front right folding propeller.

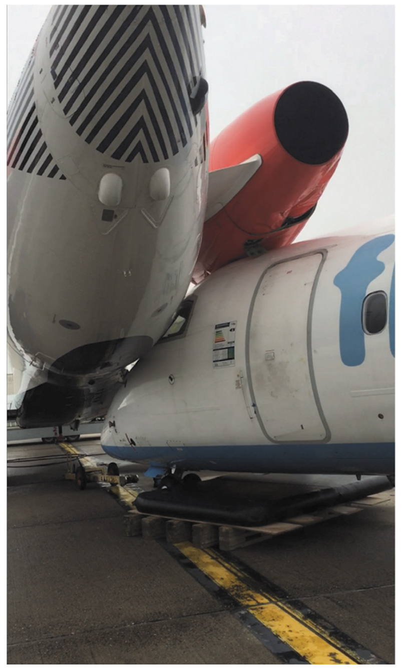
The operator believed that the flight characteristics and damage sustained indicated that the right front propeller failed in flight.

Safety action taken by the operator

- The operator had been replacing the propellers on all its UAs every 20 hours of flight time. At the time of the accident the propellers had flown for just under 9 hours. The operator will now change all folding propellers after 5 hours flight time and has made this a scheduled item in its electronic flight and maintenance logging software.

DHC-8-402, G-JECK and EMB-145EP, G-SAJS
16 June 2020 at Aberdeen International Airport

G-JECK was to be flown from Aberdeen Airport to Weeze Airport, Germany. The aircraft had been in storage at Aberdeen since March 2020 and was parked on a self-manoeuvring stand which had a 1° slope. During the pre-departure checks, the chocks were removed from both the mainwheels and the nosewheels. The hydraulic pressure in the park brake system subsequently reduced to the point where the brakes could no longer prevent G-JECK from moving, and the aircraft rolled across a taxiway before colliding with G-SAJS, which was parked on an adjacent stand. There were no injuries.



G-JECK and G-SAJS during recovery

Safety action has been taken by the CAA, operator of the aircraft, maintenance organisation, ground handling company and airport operator regarding the removal of wheel chocks during pre-flight preparation.

G-JECK rolled across Taxiway D from its parking position and struck G-SAJS because the nosewheel chocks had been inadvertently removed, and the hydraulic pressure in the park brake accumulator had depleted over several days to the point where it was unable to prevent the aircraft from moving on the 1° slope.

Safety actions

Following this event, safety action has been initiated by the following organisations:

The organisation that provided the pilots for the flight and sub-contracted the ground handling services has:

- Reminded its sub-contracted ground handling companies that permission must be obtained from the aircraft commander before removing chocks.
- Reiterated that chocks are to remain fitted until either a tug had been attached to the aircraft or, when self-manoeuvring, that nosewheel chocks remain fitted until permission has been given to remove them.
- Recommended that pilots check during their walkaround that chocks had not been inadvertently removed.

The CAMO:

- Circulated a tutorial, and included it in recurrent training, to all staff within its organisation to raise awareness of the circumstances of this event.

The organisation contracted to provide ground handling for G-JECK has:

- Updated its training of dispatchers to ensure that third parties undertake only those duties for which they have been explicitly briefed and trained to carry out.

Aberdeen Airport has:

- Issued an airside safety alert at Aberdeen, Glasgow and Southampton Airports highlighting the need to obtain permission before removing chocks.
- Undertaken to carry out audits of ground handling companies operating at Aberdeen to better understand chocking procedures and training.
- Requested airside operations to audit chocking procedures on the ramp area, with particular attention to self-manoeuvring stands.
- Undertaken to share safety lessons with ground handling companies via the ramp safety committee at Aberdeen.

The UK CAA:

- On 27 July 2020, the UK CAA published Safety Notice, SN-2020-0137 - Returning Aircraft to Service from 'Extended Parking', which highlights threats associated with this report.

Airbus A321-231, G-WUKJ
16 June 2020 at Doncaster Airport

During the takeoff roll, as the aircraft was approaching V1, the commander identified that the airspeed on the Primary Flight Display was reading zero and rejected the takeoff. Examination of the aircraft found insect larvae within one of the pitot probes. The aircraft had been parked for nearly 12 weeks prior to the flight. The operator has taken safety action to introduce a procedure that flushes the static and total pressure lines on any aircraft that has been parked for more than three days before it is returned to operation.

The post flight report produced a failure message '34-12-34 ADR1' associated with a flight control ECAM warning in the No 1 Air Data Reference (ADR1). Troubleshooting performed by the AMO transposed the No 1 and No 3 Air Data Inertial Reference Units (ADIRUs) and after a successful ground test, released the aircraft for the ferry flight.

During the subsequent takeoff, at approximately 1540 hrs, the aircraft performed a low speed rejected takeoff as the commander's PFD was still not registering an air speed.

Further troubleshooting over the following two days finally found three small insect larvae, approximately the size of a grain of rice, within the No 1 pitot probe. These larvae were liberated whilst performing a pitot probe flush, which was advised by the aircraft manufacturer. The larvae were not retained to enable further identification of the insect species.

The operator concluded that the insect larvae may have been deposited in the pitot probe whilst it was parked with the pitot probe covers fitted. To prevent differential pressure measurement issues in the air data system1 , pitot probe covers supplied by the aircraft manufacturer do not completely seal the probes, it is therefore possible that an insect could enter the air data system during prolonged parking. It cannot be ruled out, however, that the larvae were deposited once the aircraft had been prepared to return to service on 15 June or an insect had been within the pitot probe covers before they were fitted.

Safety actions taken by the operator and aircraft manufacturer

- The operator has introduced a requirement to flush all total and static pressure lines before any aircraft is returned to operation after it has been parked for more than three days.
- The operator is also looking to identify better pitot probe covers that may offer better protection than those currently used.
- The aircraft manufacturer is looking to update the aircraft AMM Return to Operations task to require air data system flushing prior to the next flight after prolonged time on the ground.

Reims Cessna F150M, G-CSBM
10 July 2020 at Winchfield, Hampshire

As the aircraft approached Blackbushe Airport the engine lost power and the pilot made a precautionary landing in a field. There was no damage to the aircraft and neither occupant was injured.

The engine lost power due to fuel exhaustion. The pilot had used a fuel dipstick through a desire to measure the fuel onboard more accurately, but the dipstick used was not calibrated for the aircraft; this led him to overestimate the fuel onboard.

G-CSBM after the precautionary landing

The pilot made a safe precautionary landing in a field due to loss of engine power. The engine had lost power due to fuel exhaustion.

Through a desire to measure the fuel accurately the pilot had used the incorrect fuel dipstick leading him to overestimate the fuel onboard.

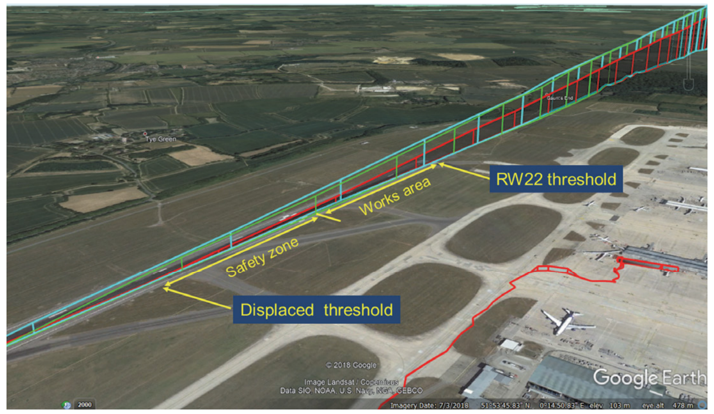
Safety action taken by the flying club

- The flying club have reminded pilots of the importance of only using the dipstick calibrated for the aircraft they are flying.

Airbus A321, YL-LCQ Airport, Spain
22 July 2019 on approach to London Stansted Airport

London Stansted Airport (STN) was operating with a displaced threshold on Runway 22 (RW22) while repairs were carried out at the normal threshold. RW22 ILS was unavailable during the works period. A revised RNAV approach (RNAV22C), which was steeper and based on the displaced threshold, had been promulgated for RW22. YL-LCQ was observed to be lower than expected during its approach and over the works area.

The pilots of YL-LCQ had not realised that a revised approach was required and flew the standard RNAV arrival. Radar data indicated that the aircraft was low over the works area and touched down close to the displaced threshold. Temporary approach plates were available to the pilots in their electronic flight bags (EFB), but the stated workinprogress (WIP) active periods on the temporary airfield chart were incorrect. ATC had made repeated references to the displaced threshold and the RNAV22C arrival during the period when YL-LCQ was on the terminal controller's frequency.



Comparative radar traces
(YL-LCQ trace in red)

After the incident, the operator highlighted the WIP implications to all their pilots operating from STN. The chart manufacturer reviewed their processes to address the issues which had resulted in incomplete information being presented on the temporary airfield chart.

Having read the relevant flight documentation paperwork, the pilots' mindset was that the runway works at STN were not active during their approach. Confirmation bias appears to have played a part in the pilots' selection of the wrong approach procedure and may have contributed to ATC not detecting the error. The reminder to follow PAPI indications was misinterpreted as an instruction to ignore them. The incident highlighted the importance of correct and complete radio transmission phraseology

Safety actions taken by the aircraft operator, air traffic servies, airport users safety group and chart manufacturer

- The aircraft operator alerted their crews to the error in the temporary airfield chart and the requirement to fly the revised RNAV procedure when the THR 22 works were active.
- The Stansted Airport air traffic services unit terminal control interface manager was tasked to raise the issue of incorrect or incomplete readbacks with the terminal control unit; the aim being to ensure that future poor radio phraseology would be robustly challenged.

- The airport's user safety group was tasked to conduct a full review of the phraseology used for the reduced runway operations.
- The chart manufacturer undertook an investigation into how the works scheduling had been incorrectly represented on the temporary airfield chart and took remedial action to prevent similar data transposition errors in the future.

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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 Union 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
KCAS	knots calibrated airspeed
kg	kilogram(s)
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

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