



Annual Safety Review 2016



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Foreword

I am delighted to introduce the AAIB's 2016 Annual Safety Review and would like to thank and pay tribute to Keith Conradi and David Miller who led the AAIB so successfully through this period. It was a great privilege for me to join the AAIB as Chief Inspector in January 2017, and I am determined to build on the world-renowned legacy of my predecessors, improving aviation safety through the independent and expert investigation of aviation accidents and serious incidents.

The AAIB received 656 notifications in 2016 and deployed 38 times to conduct field investigations, 14 of which were fatal accidents in the UK. A further 208 investigations were conducted by correspondence and overall these statistics were similar to previous years.



Analysis reveals that loss of control in flight of General Aviation (GA) aircraft was the most prevalent factor in fatal accidents in 2016. Of note, two fatal accidents were attributed to medical incapacitation. The 24 deployments to non-fatal occurrences in 2016 were mostly to serious incidents involving commercial air transport (CAT), where system, component failure or malfunction did not result in an accident.

During this period, the AAIB deployed to 6 accidents overseas, including to Nepal, Norway, Dubai and Colombia, and participated in 87 other international investigations as the UK's Accredited Representative or Expert.

A welcome change in 2016 was a significant increase in the Safety Actions taken by organisations in advance of the publication of the AAIB report (90 compared with 34 in 2015). This reflects the open dialogue with AAIB Inspectors and the appetite of regulators and operators to take immediate positive action. In contrast, the formal response to 57 Safety Recommendations was less encouraging with 36 responses currently classified as 'partially adequate' or 'not adequate'. We will continue to work closely with addressees to ensure that the underlying safety issues are fully understood and addressed appropriately.

The AAIB continues to actively seek and exploit technological advances to develop its capabilities. There are articles in this report on the increased use of simulators in air accident investigation and the use of drones to capture accident site imagery in a more efficient and effective way. The benefits of using drones to capture critical evidence at the crash site are proving to be substantial, particularly when used in conjunction with photogrammetry software to link and analyse the images.

2017 heralds major changes for the UK and its international relationships. However, the continual pursuit of aviation safety transcends national boundaries and the AAIB will continue to work very closely with regional and global partners not only to investigate specific accidents and serious incidents under the International Civil Aviation Organisation (ICAO) framework but also to develop agile, responsive investigation capability to meet the challenges of tomorrow.

Crispin Orr

Chief Inspector of Air Accidents



Contents

Foreword	i
Benefits of Using Drones at Aircraft Accident Sites	3
Flight Simulators and Air Accident Investigation.....	9
CICITT Factors on Investigations by the AAIB in 2016.....	17
Field Investigations	17
Correspondence Investigations.....	18
Accident Statistics for 2016.....	19
Category Definition.....	20
Notifications 2016.....	21
Notifications 2015.....	22
Notifications 2014.....	23
Safety Recommendations in 2016	25
Safety Actions from investigations reported on in 2016	41
Formal Inspector's Investigations.....	41
Field Investigations	43
Correspondence Investigations.....	48
Appendix 1 - CICITT Occurrence Categories.....	54

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Benefits of Using Drones at Aircraft Accident Sites

Introduction

Aerial images of accident sites are very useful for a number of reasons. They can capture the whole site from the initial impact point to the wreckage's final resting location. The ground marks and wreckage distribution help to identify how the aircraft hit the ground. Aerial images are also useful for showing the relative positions of obstacles, such as trees or buildings, that may have been struck before ground impact. They help to reveal the surrounding terrain and environment that the pilot faced if there was an attempted forced landing. And when it's a large aircraft at an accident site, aerial images help to document the damage to its upper surfaces.

The UK AAIB has, in the past, been primarily reliant on police helicopters and sometimes search-and-rescue helicopters to obtain aerial images. These images have been useful but did not always capture the angle or detail required, and often images would not arrive until a week or more after the accident. The AAIB could charter a helicopter, but this is expensive and can take time to organise.

About three years ago, it was noticed that small unmanned aerial vehicles (UAVs), or drones as they're now more commonly referred to, had become significantly less expensive and could provide aerial images within minutes of arriving at an accident site. Having the investigator controlling the drone's camera, all the angles and details needed are captured.

The AAIB bought their first drone, a DJI Phantom 2 Vision in February 2014 and first used it at an accident site on 14 March 2014 (Figure 1). The drone's 14-megapixel camera provided excellent stills, although the video quality was shaky due to a lack of a gyro-stabilized mount. After using it at five different accident sites an upgraded model, the Phantom 2 Vision Plus, with a gyro-stabilized mount was purchased in July 2014 (Figure 2, left), and has been used at 11 accident sites. As well as taking stable video, the additional benefit of the newer model was that the camera could be tilted 90 degrees downwards to take a series of overlapping images to map the whole accident site.

The expectation was to be able to use photo-stitching software to stitch all the images together, but the trials we did were of objects laid out in fields, and the lack of variation in the images, because they were mostly of green grass, was beyond the photo-stitching software. This led to exploration of what photogrammetry software could do. Not only could it generate 3D models from a series of overlapping images, but it could also create a stitched overhead image that was true to scale; an image that is called an orthomosaic.

The photogrammetry software the AAIB purchased was called Pix4Dmapper Pro. This provided some good photogrammetry results using the drone. In September 2015 the AAIB upgraded to the DJI Inspire Pro drone (Figure 2, right), which can operate in winds up to 20 kt and has a higher quality camera that can stream high-definition (HD) video to two tablet devices. This model is also available with dual controls for the pilot and camera operator.



Figure 1

First use of the AAIB's Phantom 2 Vision drone at an accident site on 14 March 2014



Figure 2

DJI Phantom 2 Vision Plus (left) and DJI Inspire Pro (right)

How the AAIB operates drones

Under UK regulations, the AAIB is not classed as a commercial operator flying for reward so can operate drones at accident sites under the standard regulations for recreational users. The main limits are maintaining visual line-of-sight, a minimum distance of 50 metres from people, buildings, and vehicles that are not under our control, and 150 metres from congested areas. Since operations are primarily inside a police cordon where everyone can be under our control, these limits have not been a restriction.

The AAIB operations manual lists flight limitations and training and currency requirements for our operators. The two main operators are AAIB engineering support staff. One of the operators will normally deploy to an accident site to assist with wreckage recovery and will fly the drone. The engineering investigator onsite will normally operate the camera. The AAIB requires two people to operate the drone, because to fly the drone safely the pilot needs to be heads up watching the drone and looking out for obstructions and people. To take good pictures, you need to be heads down. The only time single-operator flight is allowed is when the drone has been programmed to fly an automated route and automatically take stills; in this case, the operator is monitoring the flight and is able to override the autopilot.

Benefits of drones for accident site imagery

The main benefits of using drones over manned airplanes or helicopters are:

- Significantly lower cost (a suitable drone can be obtained for about £800).
- Drones can be deployed immediately on arrival at site.
- The images and video from the drone can be viewed live on the ground.
- The engineering investigator has full control over the images and videos that are taken.
- A drone can be easily relaunched to take additional footage.
- A drone can be flown closely to trees and wreckage to obtain close-up images without disturbing them with rotor downwash.
- A drone can be easily programmed to take a series of geo-tagged and overlapping overhead shots for photogrammetry purposes.
- A drone can operate in low-visibility and low-cloud conditions that would prevent an airplane or helicopter being operated.

The uses so far identified for drones at accident sites are:

- Wreckage and site survey,
- Wreckage search,
- Tree/object height estimations,
- Site safety assessments, and
- Flight path reconstruction/visualisation.



Figure 3

The AAIB's Phantom 2 Vision Plus being used to supervise the recovery of wreckage from a Jet Ranger helicopter that crashed in the sea below the cliffs

Creating orthomosaic images and 3D models of accident sites

With photogrammetry software like Pix4Dmapper Pro orthomosaic images and 3D models of accident sites can be produced using drone imagery. An orthomosaic is an image that is composed of multiple overhead images and is corrected for both perspective and scale, which means that it has the same lack of distortion as a map (Figure 4). The images are obtained by pre-programming the drone to fly in a grid pattern and to automatically take a series of overlapping shots with the camera pointing 90° down. The total flight time to capture the 59 images used to create Figure 4 was 9 minutes using our Phantom 2 Vision Plus. The processing time using a typical PC took about 2 hours but it can take longer for larger projects.

The photogrammetry software also generates a 3D point cloud and a 3D mesh from the images. An example 3D mesh is shown in Figure 5. The quality of the 3D model is improved by taking oblique images, and in this case we took images while flying the drone around the aircraft wreckage at two different heights with the camera pointing at the centre of the wreckage.

The 3D model can be used to take measurements of the site. In trials measurement accuracies of up to 1 cm using drone images captured from a height of 40 m have been obtained.



Figure 4

Pix4D orthomosaic generated from 59 overlapping images taken with a Phantom 2 Vision Plus from a height of 50 metres (a digitally zoomed-in section of this orthomosaic is shown in the lower right corner)



Figure 5

3D mesh created from oblique video from Phantom 2 Vision Plus while flying two circles at two different heights around the main wreckage

Benefits of photogrammetry software for processing accident site imagery

Taking aerial images of an accident site and processing them with photogrammetry software has a number of benefits.

- The 3D model is very useful for briefing people who have not attended the accident site. You can manually zoom in and out and rotate the model to show all the ground marks and wreckage distribution. This can make it easier for people to visualise the site compared to flicking through a number of still images.
- Pix4D can be used to create an animated video of the 3D model that can then be sent to people to view who do not have the Pix4D software.
- If some time has passed between attending the accident site and writing the report, then viewing the 3D model can serve as a useful refresher.
- The orthomosaic images serve as a very detailed wreckage plot.
- Measurements of the site can be made using the 3D model or orthomosaic that are more accurate than using a hand-held GPS, and can be up to 1 cm in accuracy.
- The orthomosaic is also a useful tool to search for missing wreckage and it can be reviewed in slow time back in the hotel or office.

Conclusion

The AAIB has found drones to be a very useful new tool at accident sites. They are very good for capturing the scene before we start disturbing it. They can be used to help us search for missing wreckage and to perform final flight path reconstruction/visualisations. A drone costs significantly less to operate than a manned aircraft and can be deployed immediately on arrival at site. A drone can be easily relaunched to take additional footage, and the investigator has full control over the images and video taken.

A drone can be easily programmed to take a series of geo-tagged and overlapping overhead shots for photogrammetry purposes. Photogrammetry software like Pix4D can then be used to create geo-referenced maps, orthomosaic images, and 3D models of an accident site. These are useful for both visualising the accident site, recording relative wreckage locations and for taking measurements.

(Adapted from a technical paper 'Using a Drone and Photogrammetry Software to Create Orthomosaic Images and 3D Models of Aircraft Accident Sites' delivered by an AAIB Inspector at ISASI 2016 in Reykjavik, Iceland, 18-20 October, 2016. The full text of this paper can be found on ISASI's website at www.isasi.org/Library/technical-papers.aspx)

Flight Simulators and Air Accident Investigation

Flight simulators are predominantly used for training and checking pilots, but how useful are they to an air accident investigator? There's not a simple yes or no answer to this question, however, the AAIB is a firm believer that when used pragmatically and within sensible bounds they are a powerful and versatile tool.

In this article, the aim is to briefly describe the major components of a modern flight simulator, pointing out some inherent limitations and advantages of the technology that is used, but also to cover a lesser discussed but nevertheless very important topic – how is the data that makes up the simulation derived and validated.

Having a firm grasp of both of these concepts is key to understanding when and how to use simulators in our investigations but, of greater importance, it allows a view to be taken on how much trust to place in the simulation and what it is telling you about the accident or incident. This is because, as investigators, it is crucial that only reliable evidence is used, not only when looking into what happened and why, but also in considering how the event could be prevented from happening again.

The term flight simulators covers a wide range of devices from the most basic, termed a flight navigation procedures trainer, which could be nothing more than a radio stack and a handful of instruments used to teach elementary navigational skills, up to a type specific simulator equipped with motion, visual and sound systems. This latter category of simulator, the full flight simulator, is the main focus of this article and is typical of what is found at most airline training centres around the world.



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Figure 1

A modern full flight simulator

Such a simulator is made up of several main components; an enclosure housing a dimensionally accurate and faithful replication of the cockpit, as well as space for the instructor, observers and the instructor's operating console, which all sits atop a motion system. This motion system, typically six legged, used to use hydraulically powered jacks, but with the ensuing maze of pipework and large, noisy pump rooms, hydraulics have generally lost favour to more space effective and almost entirely maintenance-free electric jacks. Similar hydraulics or electrical means are also used in the simulator to give feel to the aircraft controls, replicating how they would feel in flight. The other main components are a wrap-around visual screen, the means to project a full-colour image onto this screen, and a multi-speaker sound system, all of which are integral to the enclosure. Away from the simulator bay, there will be a room housing a series of computers for running the simulation model, as well as for the visual system, motion system and other support functions such as a software development facility.

The job of the motion system is to fool the human body into believing it is turning or accelerating just as if it were flying. Not only that, it also has to add to the basic motion of the simulated aircraft, the effects of turbulence or, perhaps, that resulting from an engine malfunction or of skidding on ice.

This may seem easy to achieve, until you consider that each jack typically has 60 inches of travel and, as all the jacks are attached to the same frame which supports the enclosure, they all need to work in unison. It then becomes hard to see how the surge of acceleration felt by a pilot on releasing the brakes at the start of a takeoff roll, which in reality takes place over several hundred metres of runway, can be recreated on the ground with less than 60 inches of jack travel. This is especially true when you take into account the need to gracefully stop the jacks before they hit their end-stops.

As such, although it is true that the initial surge is recreated in the simulator by a rapid acceleration over the short travel of the jacks, to give the impression of continual acceleration, the enclosure of the simulator is then tilted skywards. This tilt, whilst portraying a visual image that is not pitching up, fools the brain because the effect of gravity bends the hairs that we all have in our inner ears backwards. Normally these hairs give us an indication of whether we are tilting our heads but because they also move under a longitudinal acceleration and as the visual image we are being presented with is not tilting, our brain is confused. This sensation is then misinterpreted and it feels like we are rapidly accelerating down the runway.

This illusion that the simulator uses to such good effect is called a somatogravic illusion. Such illusions, likely have contributed to a number of fatal accidents, such as the Afriqiyah Airways crash to an Airbus A330 at Tripoli in May 2010. In these cases, often after executing a missed approach or go-around in inclement weather or at night, the aircraft's rapid acceleration with power causes the pilot, who is devoid of an outside view, to misinterpret the acceleration as a pitch up. In effect, this is the same illusion the simulator is using to function but in the reverse sense. Often and, incorrectly, this illusion is then opposed by the crew with a pitch down movement of the flying controls resulting in a dive, usually, from too low a height to allow for recovery of the aircraft's flightpath.

Although it is possible to convincingly demonstrate such scenarios in a simulator, as NASA showed at Ames Research Center with a heavily modified Boeing 747 full-flight simulator, we also use other receptors within our bodies to orientate ourselves. Any attempt to therefore replicate the feeling of somatogravic illusion, without also correctly stimulating these receptors is perhaps not representative. It is therefore very important for investigators to be aware of how the simulator technology is being employed, as this may impose restrictions on the use of the simulator for certain types of investigations.



Figure 2

Instructor Operating Station

A simulator's motion platform is always also trying to creep back to a central position, at a rate just under that which our bodies can perceive the movement of the jacks – another example of a simulator taking advantage of the limitations in our senses. This gives the motion system the greatest range of travel available for the next motion cue which is clearly beneficial if you're trying to deliver the feeling of heavy turbulence. However, the side-effect of this need to continually centralise and, of the limited travel range of the jacks, is that conventional motion platforms are just not set-up to deliver any sustained g forces.

Take, for example, the recovery of an aircraft from a high altitude stall such as the event that the AAIB investigated to a Cessna Citation Jet in December 2013. During a series of recovery manoeuvres, this aircraft experienced sustained g forces well above those expected in normal service. One of the effects of such g forces is to make any motor action, such as moving your arms, physically much harder to achieve and in any upset

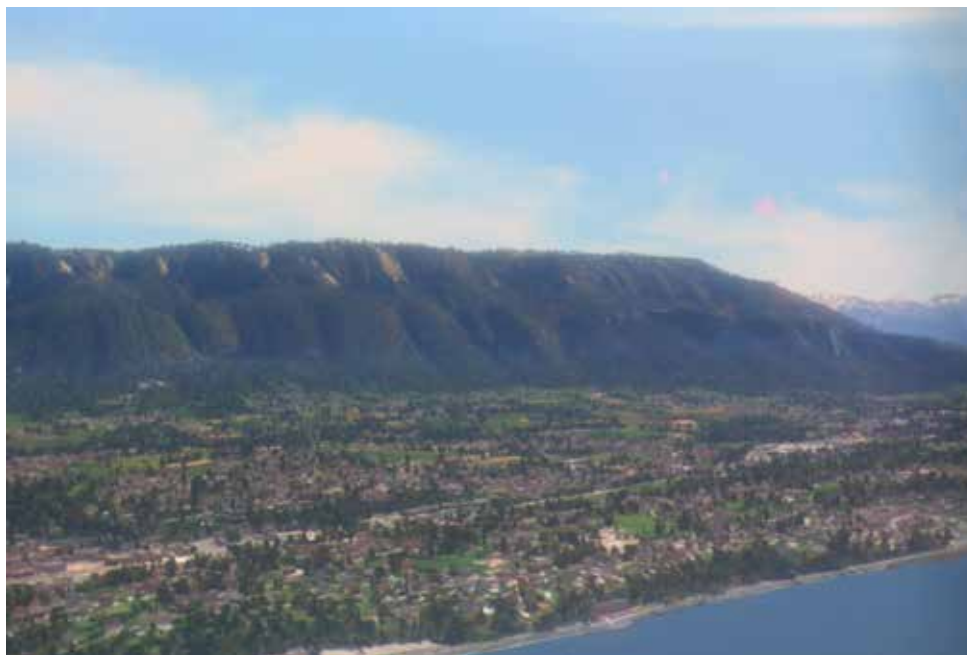
recovery training performed in simulators, these physical limitations cannot be faithfully reproduced. In fact, most simulators which have been programmed to allow for the training of upset recovery, purposefully disable the motion system not only to avoid injury, but also to avoid any training in a situation which doesn't reflect the reality of the event. Again, with this in mind it is easy to see how the limits of simulation technology have a direct bearing on how and when simulators are used for accident investigation work.

The latest visual systems on a simulator are highly capable and are able to create very persuasive models of the real world. This could be an airport environment, at night, with all the correct runway, taxiway and cultural lighting or an off-shore helideck, complete with articulating cranes, forming part of an extensive oil installation.

In the case of helicopter simulators this image can be very expansive, covering a field of view of up to 240 degrees horizontally and 80 degrees vertically - to provide all of the necessary visual cues for taking off and landing vertically. A field of 180 degrees by 40 degrees is more typical for fixed wing simulators. The vastly increased computing power of modern image generators, the processing units and heart of a visual system, allows these scenes to be rendered with photo-realistic textures, shadows correct for the time of day and season, and real-world physics-based models for effects. These effects could include the halos seen around airfield lighting in foggy conditions, the white-out experienced by helicopter pilots landing in snow or that of sand blowing across a runway in a desert environment. It is also worth highlighting that all of these scenes would be rendered with great accuracy to the height of the underlying terrain; this data often being accurate to a few metres.

It is this ability of the visual system to fully immerse and absorb a crew into their environment that is of immense benefit to an accident investigator. As an example, consider a runway incursion by an airliner at a major airport that occurred in foggy conditions at night and how, as an investigator, you could use a simulator to try and understand why this happened. In this instance, the precise taxi route taken, the sequence of lights and marker boards that were seen during the taxi, as well as the modelling of what would have been visible given the exterior visibility and cockpit window frames is a task well suited to use of a simulator.

The visual system is also responsible for portraying a whole manner of linked effects, such as thunderstorm cells. In these cases, the weather displayed outside of the cockpit needs to correspond both with the internal depiction of such storm cells on weather radar displays and also how turbulent a ride the motion system is required to deliver. Other systems are similarly linked, such as the Traffic Collision and Avoidance System and Enhanced Ground Proximity Warning System. It is this level of sophistication that allows complex scenarios to be re-enacted with ease in a simulator, again showing the value of using simulators, both for initial event investigation and the analysis of "what-if" scenarios.



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Figure 3

The scene, as rendered by a high-end image generator, on approach to Runway 18L at Chambéry, France

An investigator also needs to be mindful of how the data that forms the simulator is derived and over what flight conditions the data is valid. To answer the first part of this; when a new aircraft type is first certificated, it follows hundreds of hours of flight testing and it is this flight test data that, predominantly, the simulator is based upon. To expand upon this, all qualified simulators have a document called the Qualification Test Guide,

that contains tests on every facet of an aircraft's handling and performance – be it engine-out climb rate against distance and time, or the aircraft's response to a sharp input on the rudder. It is these tests that show how the simulator is performing in relation to the flight test data and the tolerances on each parameter of a test are incredibly tight. Therefore, by virtue of the need to qualify a simulator to its Qualification Test Guide, both when it is put into service and continually throughout its life, the simulator models are created to model the supporting flight test data. In fact, most aircraft manufacturers offer a verified simulator data package to simulator manufacturers once their flight testing is complete. In some cases, a preliminary data package is also provided prior to the completion of flight testing to allow for simulator availability to support an aircraft's entry into service.



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Figure 4

A set of Qualification Test Guides
supporting the simulators at
a typical training centre

However, this is also a simplistic answer, as take a relatively modern aircraft such as a Boeing 777, which was initially offered with engines from all three major manufacturers and, latterly with variants of these engines having different thrust ratings. The original flight test campaign would have data for some manoeuvres flown with one particular engine type and other areas covered by flight test data with a different engine type or thrust rating. If it were necessary to complete a whole flight test for each individual engine variant it would be a rather lengthy and costly exercise. Not only will these engines operate and perform differently at the engine level (albeit their thrust output may in some cases be similar) they are also likely to be different aerodynamically and thus this would have an effect on the aircraft's performance and handling. Product improvement throughout the lifetime of an aircraft type also means, that when the original flight test campaign is over, the heavily-instrumented original test aircraft may no longer be available or even cost effective to use for minor airframe or system updates.

This leads to the manufacturer supplementing or replacing elements of a simulator's data package, to reflect a particular engine variant or build standard of the aircraft, with what is called 'engineering data'. This data is derived from the manufacturer's theoretical model of the expected behaviour of the aircraft system or engine.

Further, in some cases, where the performance or handling of the aircraft is not particularly sensitive to the engine variant, the aircraft manufacturer and regulators prefer that flight test data is used and may insist that such data is used but from a different engine variant. Likewise, where the aircraft's performance is highly sensitive

to the engine variant, this requirement will outweigh any preference for flight test data and engineering data will be used instead. This complicated choice of data, with which to underpin the Qualification Test Guide, has therefore led aircraft manufacturers to producing matrices of the available data for aircraft types and these are called Validation Data Roadmaps.

The answer to the question of over which flight conditions is the data valid is, in contrast, simpler to answer. In short, the limits of data validity generally correspond to the operating envelope of the aircraft and, in some cases, to just beyond. This is because this envelope has been well-defined by flight testing. Yes, there will be some data points from the flight test to cover, for example the stall regime, but beyond a certain combination of angle of attack or sideslip little or no data is released to simulator manufacturers. Thus, use of a typical simulator to re-create a prolonged high angle of attack stall scenario, such as that experienced by Air France 447, the A330 lost in the Atlantic Ocean in June 2009, is unrepresentative.

Another area in which knowledge of how a simulator has been constructed is useful, is when discussing malfunctions. These are a set of proscribed scenarios designed to train for various system component failures, such as a pump in a hydraulic system or an engine catching fire or suffering severe damage. In certain cases, such as a flight control failure, these failure modes will be well understood and modelled because these conditions would have been flight tested or studied in-depth in the wind tunnel. In others, such as the hydraulic pump failure, the logic of the system in which the failure has occurred will be well documented and thus the software model is likely to be highly representative. However, for some malfunctions, such data may not be readily available and therefore an empirical view would have to be taken on the effect of the malfunction. In these cases, it is prudent to rely less on what the simulator is illustrating especially if it were key to the incident or accident scenario being investigated. A simple example of such a modelling dilemma which is often seen concerns engine relight envelopes. Some operators and simulator manufacturers will model an engine that can only be relit within the engine manufacturer's prescribed relight envelope. Others introduce a 'soft edge' to the relight envelope, allowing for a possible restart outside of the prescribed envelope, but which may be more representative of real life engine to engine variation. Another point to consider is that a typical aircraft's avionics bay is crammed full of electronic boxes but, quite often on the simulator, the replication of these boxes will instead be by lines of software code. Indeed, this software may even be retargeted, as it is known in the industry, to a different processing platform than for which it was originally designed and as such, errors or unexpected side-effects of using different processing hardware can creep in. Often, this type of inaccuracy can be hard to trace, but the simulator manufacturers work tirelessly to ensure the accuracy of their simulators.

It is clear that simulators can enable accident investigators to understand not only what may have happened, but how. Equally, by explaining some of the potential limitations of the technology that is used, the pitfalls of becoming over reliant if the investigator does not take the time to understand how the simulation is working, both from a hardware and a software stance, are evident. Overall, it is important to say that the pace of

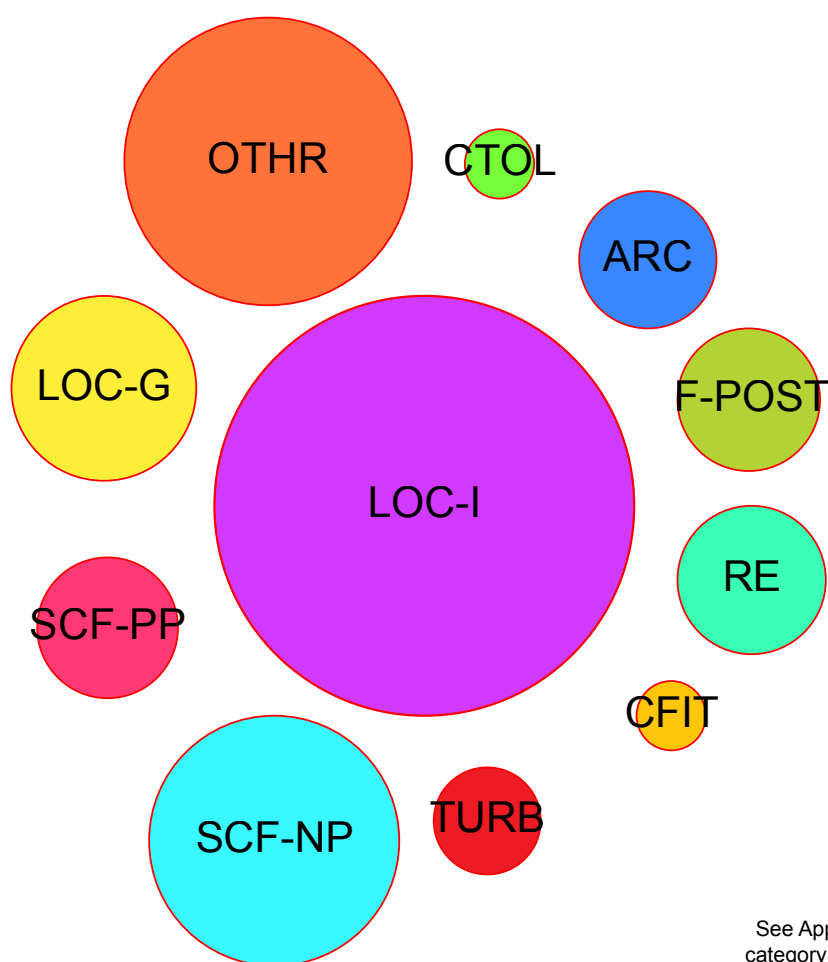
technological change within the simulator industry has always been historically rapid and, some of the limitations that are present in today's simulators will be overcome in the near future. As such, the AAIB continues to see simulators as a key investigative tool.



CICTT Factors on Investigations by the AAIB in 2016

Every occurrence in the UK is recorded on the European Central Repository (ECCAIRS) and is coded using the occurrence taxonomy defined by the CAST/ICAO Common Taxonomy Team (CICTT). This is a worldwide standard taxonomy to permit analysis of data in support of safety initiatives. In the UK the coding of occurrences is carried out by the CAA. It should be noted that they are recorded as multiple factors, for example turbulence (TURB) leading to loss of control in flight (LOC-I).

Field Investigations

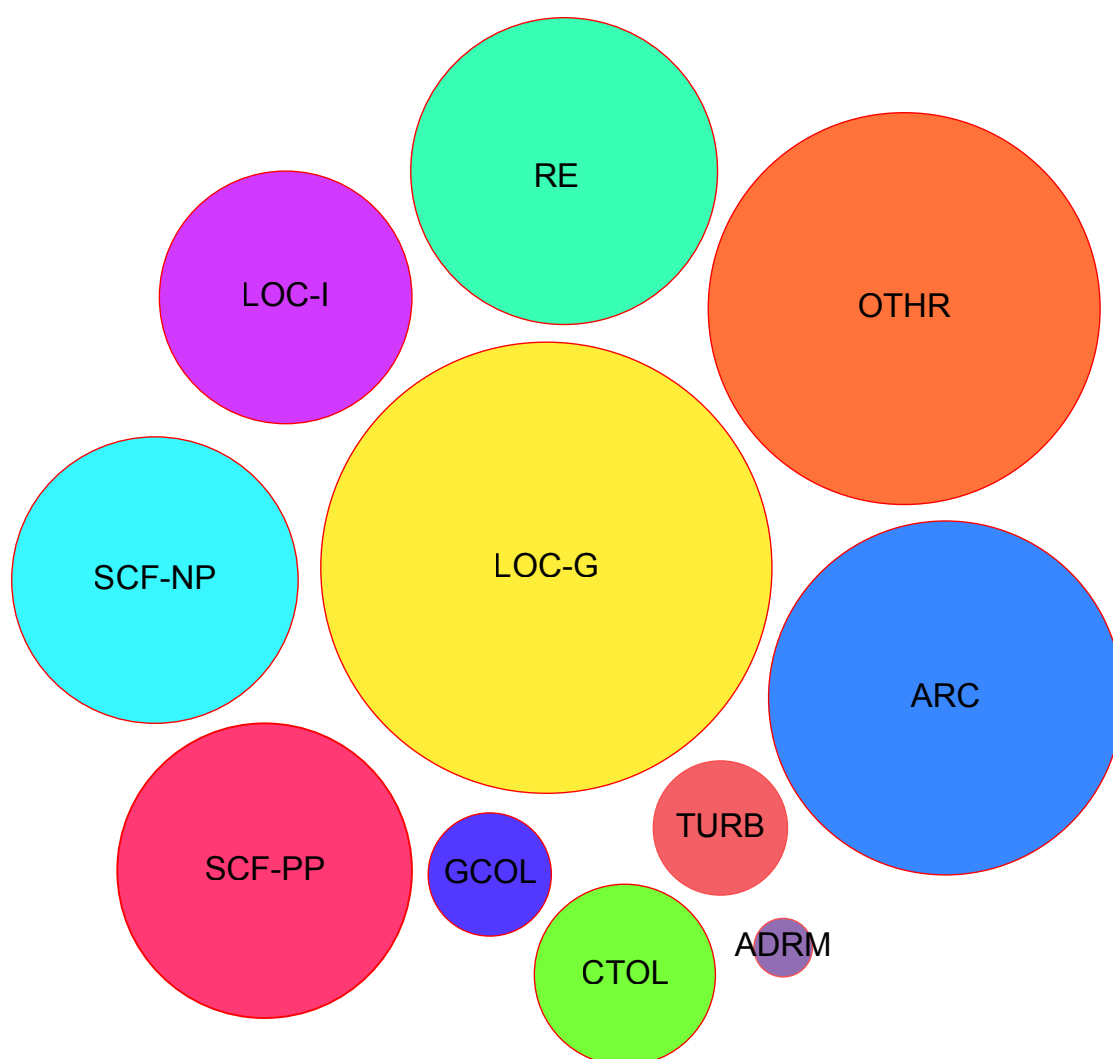


Factors for field investigations reported on by AAIB in 2016

In 2016 the AAIB reported on 36 field investigations, 17 of which involved fatal accidents in the UK and 19 were non-fatal accidents or serious incidents. The analysis of the CICTT factors for each of these reveals that the major factor in fatal accidents reported on in 2016 was LOC-I. Of note, two fatal accidents were attributed to medical incapacitation (MED) and one was caused by a catastrophic structural failure recorded under SCF-NP.

The 19 non-fatal field investigations reported in 2016 concerned mostly serious incidents to commercial air transport (CAT) aircraft. The majority of CAT serious incidents were attributed to system/component failure or malfunction (SCF-NP) followed by power plant failure or malfunction (SCF-PP), runway excursion (RE) and abnormal runway contact (ARC). However in general aviation (GA), the statistics show the most prolific cause of accidents and serious incidents was again LOC-I.

Correspondence Investigations



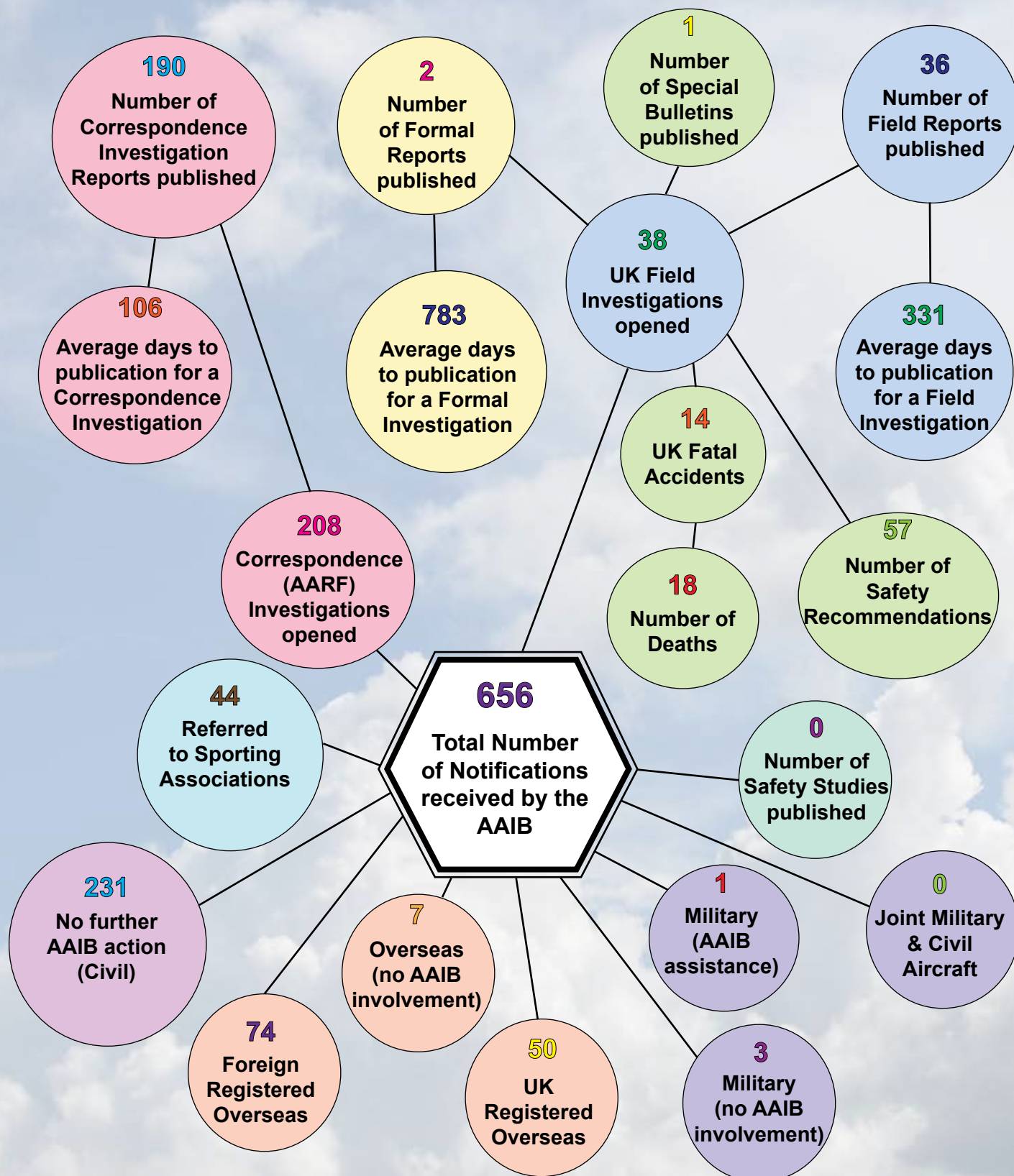
See Appendix 1 for category descriptions

Factors for correspondence investigations reported on by AAIB in 2016

Correspondence investigations are usually conducted on non-fatal accidents on GA aircraft and to some serious incidents on CAT aircraft. The factors in that the majority of these reports were classified as loss of control on the ground (LOC-G), abnormal runway contact (ARC) and powerplant failure (SCF-PP).

Statistics for 2016

An overview of AAIB activity in 2016 can be seen below:



Introduction

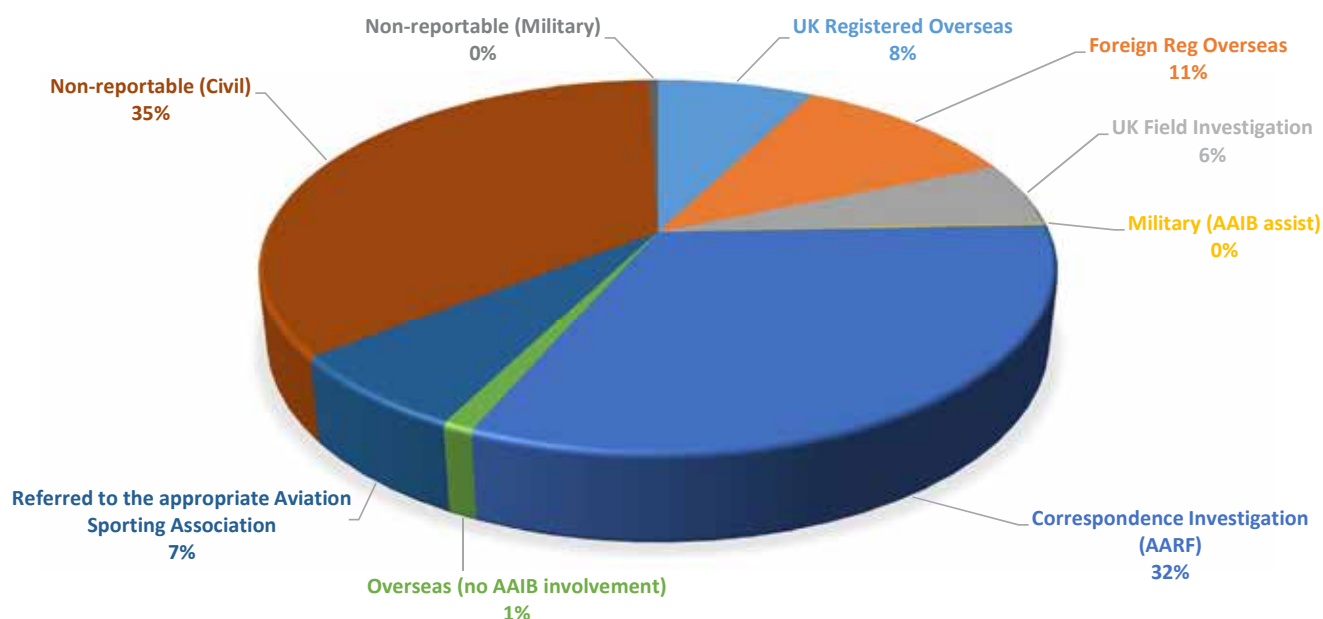
The following pages provide the statistics for 2016, 2015 and 2014, for accidents and serious incidents involving the Air Accidents Investigation Branch.

Category Definition

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

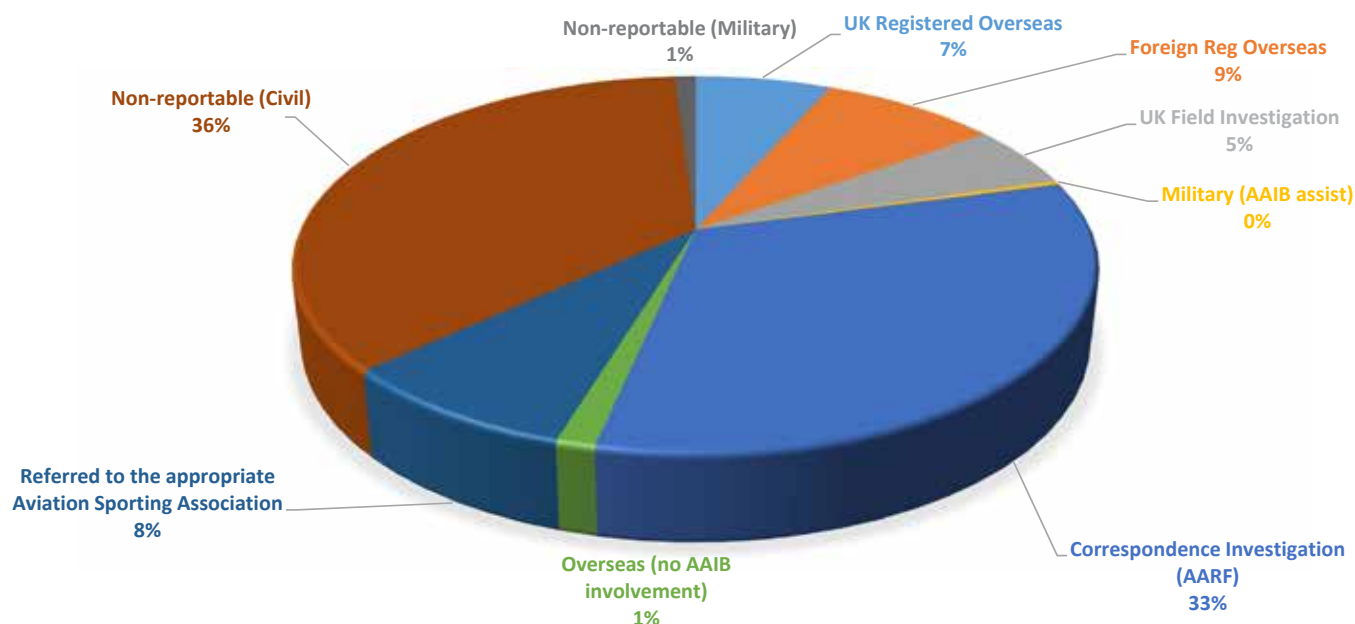
Notifications 2016

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



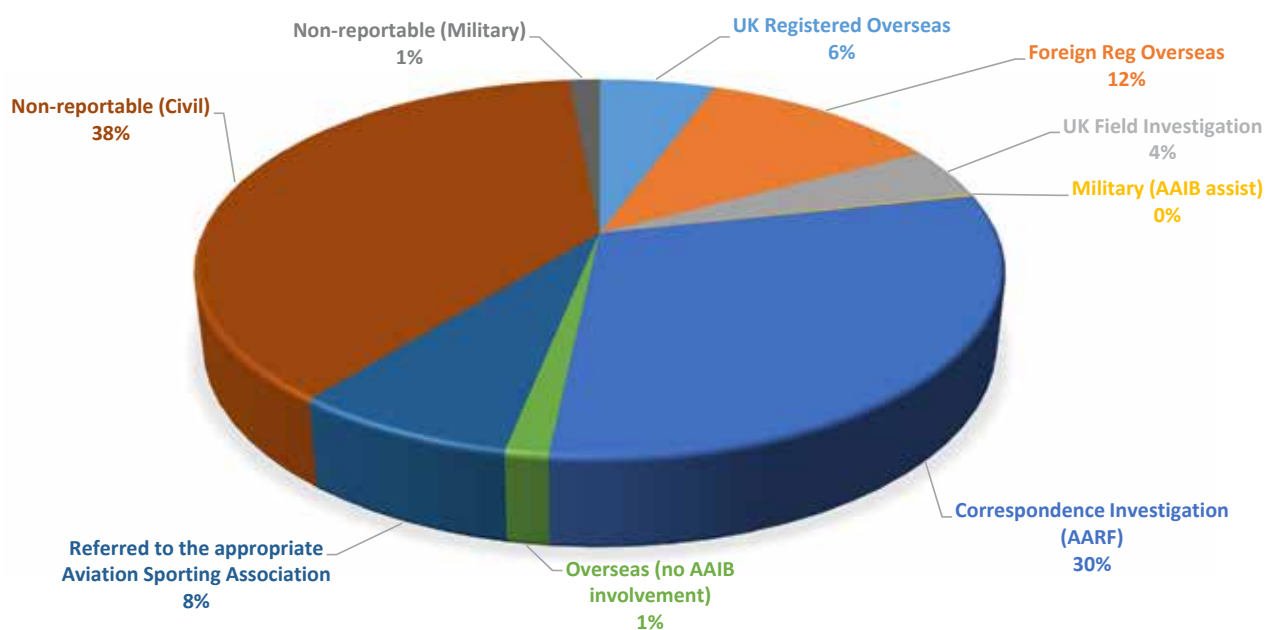
Notifications 2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	4	1	0	1	6	4	10	4	4	1	1	3	39
Foreign Reg Overseas	5	2	4	3	5	4	8	6	4	3	4	3	51
UK Field Investigations	3	1	1	5	1	5	5	4	2	3	3	1	32
Military (AAIB Assistance)	1	0	0	0	0	0	0	0	0	1	0	0	2
Correspondence Investigations (AARF)	11	7	12	24	16	29	24	20	27	12	7	5	194
Overseas (no AAIB involvement)	1	3	0	0	1	0	0	1	1	1	0	0	8
Referred to the appropriate Aviation Sporting Association	0	5	2	1	7	3	11	11	8	2	0	0	50
No further AAIB action (civil)	24	15	15	24	15	13	21	15	26	16	17	13	214
Military (no AAIB involvement)	0	0	1	0	0	2	0	0	1	2	0	0	6
Total	49	34	35	58	51	58	79	61	73	41	32	25	596
UK Fatal accidents	1	0	0	3	1	3	2	3	1	2	1	1	18
Number of deaths	2	0	0	4	2	3	6	13	1	3	4	1	39



Notifications 2014

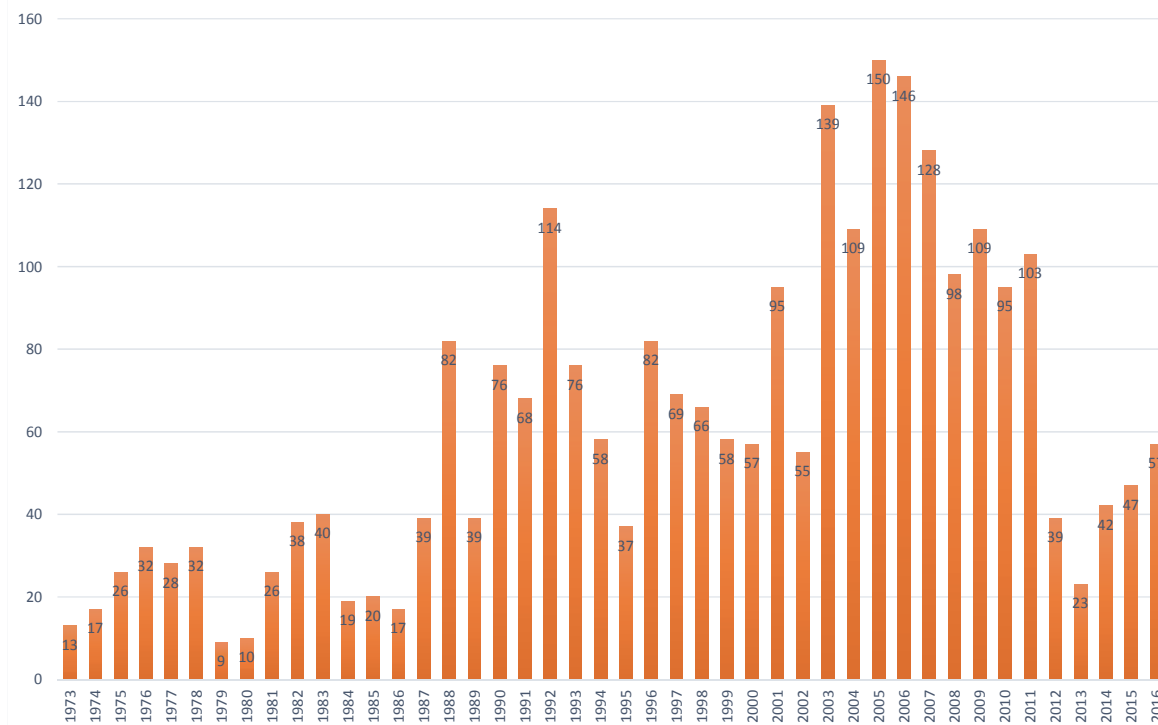
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UK Registered Overseas	1	2	4	5	4	3	2	5	6	1	3	2	38
Foreign Reg Overseas	5	7	9	6	5	4	7	6	8	12	6	4	79
UK Field Investigations	1	0	3	3	3	4	2	4	3	3	1	3	30
Military (AAIB Assistance)	0	1	0	0	0	0	0	0	0	0	0	0	1
Correspondence Investigations (AARF)	10	4	21	21	18	36	30	17	17	10	13	14	206
Overseas (no AAIB involvement)	1	0	0	0	1	1	3	1	0	2	1	0	10
Referred to the appropriate Aviation Sporting Association	1	3	1	1	5	8	9	7	4	2	3	1	52
No further AAIB action (civil)	16	18	25	25	27	41	26	21	15	16	14	20	259
Military (no AAIB involvement)	1	0	1	1	1	3	1	0	0	2	0	0	10
Total	36	35	64	59	64	100	80	61	53	48	41	44	685
UK Fatal accidents	0	0	2	1	1	2	0	2	2	0	0	0	10
Number of deaths	0	0	6	1	1	3	0	2	3	0	0	0	16





Safety Recommendations in 2016

In 2016 the AAIB issued 57 Safety Recommendations from 8 investigations.



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

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

On receipt the AAIB has 60 days in which to assess the response and to inform the addressee on whether it is adequate. If the reply is not adequate or partially adequate the AAIB will provide justification for this assessment to the addressee.

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

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



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

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

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

Of the 57 Safety Recommendations issued in 2016, 19 responses were assessed as adequate, 6 not adequate and 30 partially adequate. At the time this review was published, 31 were closed and 26 remain open.

Each Safety Recommendation is also defined as to whether it is a Safety Recommendation of Union Wide Relevance (SRUR) or a Safety Recommendation of Global Concern (SRGC). Of those issued in 2016, 23 were SRUR and 3 were SRGC.

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

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

Safety Recommendations issued in 2016

Notes: Safety Recommendation classification correct at time of publication.

Safety Recommendations made in AAIB Special Bulletins are also reflected in the final report.

[Safety Recommendation 2016-001](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency introduces a requirement for instrument rated pilots to receive initial and recurrent training in instrument scan techniques specific to the type of aircraft being operated



Not adequate - Closed

[Safety Recommendation 2016-002](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency reviews the existing research into pilot instrument scan techniques, particularly with respect to glass cockpit displays, with a view to addressing shortcomings identified in current instrument scan training methods.



Adequate - Closed

[Safety Recommendation 2016-003](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the Civil Aviation Authority reviews the methods used by UK North Sea helicopter operators for confirming compliance with their Standard Operating Procedures (SOPs), to ensure they are effective



Adequate - Closed

[Safety Recommendation 2016-004](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the Civil Aviation Authority reviews the Standard Operating Procedures of helicopter operators supporting the UK offshore oil and gas industry, to ensure their procedures for conducting Non-Precision Approaches are sufficiently defined



Adequate - Closed

[Safety Recommendation 2016-005](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29) to align them with the Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS 25), with regard to the provision of operational information in Flight Manuals.



Partially adequate - Open

[Safety Recommendation 2016-006](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency requires manufacturers of Large Rotorcraft to develop Flight Crew Operating Manuals for public transport types already in service.



Not adequate - Closed

[Safety Recommendation 2016-007](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the Civil Aviation Authority expedites the requirement for companies operating helicopters in support of the UK offshore oil and gas industry to establish a Helicopter Flight Data Monitoring (HFDM) programme.



Adequate - Closed

[Safety Recommendation 2016-008](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency considers establishing a European Operators Flight Data Monitoring forum for helicopter operators to promote and support the development of Helicopter Flight Data Monitoring programmes.



Adequate - Closed

[Safety Recommendation 2016-009](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency collaborates with National Aviation Authorities and helicopter operators to develop and publish guidance material on detection logic for Helicopter Flight Data Monitoring programmes.



Adequate - Closed

Safety Recommendation 2016-010 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the Civil Aviation Authority, in co-operation with UK offshore helicopter operators, initiates a review of existing Helicopter Flight Data Monitoring programmes to ensure that operating procedures applicable to approaches are compared with those actually achieved during everyday line flights.

 **Partially adequate - Open**

Safety Recommendation 2016-011 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013


It is recommended that the Civil Aviation Authority expedites the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

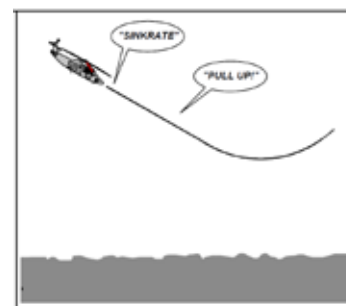
 **Partially adequate - Open**

Safety Recommendation 2016-012 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the Civil Aviation Authority supports the ongoing development of Helicopter Terrain Awareness Warning Systems, following the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

 **Partially adequate - Open**



Safety Recommendation 2016-013 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency requires the installation of Helicopter Terrain Awareness Warning Systems to all helicopters, used in offshore Commercial Air Transport operations, with a Maximum Certificated Take-off Mass (MCTOM) of more than 3,175 kg, or a Maximum Operational Passenger Seating Configuration (MOPSC) of more than nine, manufactured before 31 December 2018.

 **Partially adequate - Open**

[Safety Recommendation 2016-014](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency introduces a requirement for the installation of cockpit image recorders, in aircraft required to be equipped with Flight Data and Cockpit Voice Recorders, to capture flight crew actions within the cockpit environment.



Partially adequate - Open

[Safety Recommendation 2016-015](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency introduces a requirement to install image recorders, capable of monitoring the cabin environment, in aircraft required to be equipped with Flight Data Recorder and Cockpit Voice Recorders.



Not adequate - Closed

[Safety Recommendation 2016-016](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency instigates a research programme to provide realistic data to better support regulations relating to evacuation and survivability of occupants in commercial helicopters operating offshore. This programme should better quantify the characteristics of helicopter underwater evacuation and include conditions representative of actual offshore operations and passenger demographics.



Partially adequate - Open

[Safety Recommendation 2016-017](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that, where technically feasible, the regulatory changes introduced by the European Aviation Safety Agency Rulemaking Task RMT.120 are applied retrospectively by the EASA to helicopters currently used in offshore operations.



Partially adequate - Open

[Safety Recommendation 2016-018](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for rotorcraft (CS 27 and 29) to require the installation of systems for the automatic arming and activation of flotation equipment. The amended requirements should also be applied retrospectively to helicopters currently used in offshore operations.



Partially adequate - Open

[Safety Recommendation 2016-019](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to require the provision of a side-floating capability for a helicopter in the event of impact with water or capsize after ditching. This should also be applied retrospectively to helicopters currently used in offshore operations.



Not adequate - Open

[Safety Recommendation 2016-020](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to ensure that any approved cabin seating layouts are designed such that, in an emergency (assuming all the exits are available), each exit need only be used by a maximum of two passengers seated directly adjacent to it.



Partially adequate - Closed



[Safety Recommendation 2016-021](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for commercial offshore operations, to include minimum size limitations for all removable exits, to allow for the successful egress of a 95th percentile-sized offshore worker wearing the maximum recommended level of survival clothing and equipment.



Partially adequate - Open

Safety Recommendation 2016-022 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for use in commercial offshore operations, to require a common standard for emergency exit opening mechanisms, such that the exit may be removed readily using one hand and in a continuous movement.



Partially adequate - Open

Safety Recommendation 2016-023 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the operational requirements for commercial offshore helicopters to require the provision of compressed air emergency breathing systems for all passengers and crew.

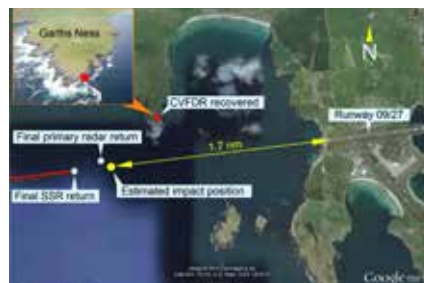


Not adequate - Closed

Safety Recommendation 2016-024 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency (EASA) amends the operational requirements for commercial offshore helicopter operations, to require operators to demonstrate that all passengers and crew travelling offshore on their helicopters have undertaken helicopter underwater escape training at an approved training facility, to a minimum standard defined by the EASA.



Partially adequate - Open

Safety Recommendation 2016-025 made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency amends the design requirements for helicopters to ensure that where liferafts are required to be fitted, they can be deployed readily from a fuselage floating in any attitude.



Partially adequate - Open

[Safety Recommendation 2016-026](#) made on 17 March 2016

G-WNSB AS332L2 on 23 August 2013

It is recommended that the European Aviation Safety Agency requires that, for existing helicopters used in offshore operations, a means of deploying each liferaft is available above the waterline, whether the helicopter is floating upright or inverted.



Partially adequate - Open

[Safety Recommendation 2016-027](#) made on 10 March 2016

G-CGVO PIONEER 400 on 3 January 2015

It is recommended that Alpi Aviation modify the design of the Pioneer 400 to ensure that the manifold pressure exceedance red warning light remains functional, by allowing isolation of electrical power to the turbo wastegate servo control motor without removing power from the Turbo Control Unit.



Partially adequate - Open

[Safety Recommendation 2016-028](#) made on 14 March 2016

G-CGVO PIONEER 400 on 3 January 2015

It is recommended that BRP-Powertrain GmbH & Co. KG amends the Rotax 914 engine Operator's Manual, to clarify the actions required by the pilot following activation of the orange Turbo Control Unit warning light, particularly with regard to isolation of the turbo wastegate servo control motor.



Partially adequate - Open

[Safety Recommendation 2016-029](#) made on 10 March 2016

G-CGVO PIONEER 400 on 3 January 2015

It is recommended that Alpi Aviation incorporate in the Pioneer 400 aircraft operating manual, the manifold air pressure limits and warnings, and pilot actions described in the Rotax 914 engine Operator's Manual, for red and/or orange Turbo Control Unit warning light activation.



Adequate - Closed

[Safety Recommendation 2016-030](#) made on 14 March 2016

G-CGVO PIONEER 400 on 3 January 2015

It is recommended that BRP-Powertrain GmbH & Co. KG reviews the wiring installation design and guidance for the Rotax 914 engine to optimise the routing and protection for wiring looms to minimise the likelihood of damage from chafing.



Not adequate - Closed

[Safety Recommendation 2016-031](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority review and publish guidance that is suitable and sufficient to enable the organisers of flying displays to manage the associated risks, including the conduct of risk assessments.



Adequate - Closed

[Safety Recommendation 2016-032](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority specify the safety management and other competencies that the organiser of a flying display must demonstrate before obtaining a Permission under Article 162 of the Air Navigation Order.



Adequate - Closed

[Safety Recommendation 2016-033](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority introduces a process to ensure that the organisers of flying displays have conducted suitable and sufficient risk assessments before a Permission to hold such a display is granted under Article 162 of the Air Navigation Order.



Adequate - Closed



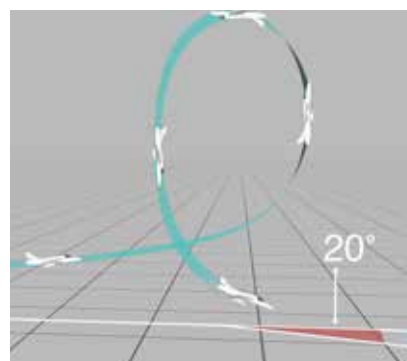
[Safety Recommendation 2016-034](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority specify the information that the commander of an aircraft intending to participate in a flying display must provide the organiser, including the sequence of manoeuvres and the ground area over which the pilot intends to perform them, and require that this be done in sufficient time to enable the organiser to conduct and document an effective risk assessment.



Partially adequate - Closed



[Safety Recommendation 2016-035](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority require operators of Permit to Fly aircraft participating in a flying display to confirm to the organiser of that flying display that the intended sequence of manoeuvres complies with the conditions placed on their aircraft's Permit to Fly.



Adequate - Closed

[Safety Recommendation 2016-036](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority remove the general exemptions to flight at minimum heights issued for Flying Displays, Air Races and Contests outlined in Official Record Series 4-1124 and specify the boundaries of a flying display within which any Permission applies.



Adequate - Closed

[Safety Recommendation 2016-037](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority require that displaying aircraft are separated from the public by a sufficient distance to minimise the risk of injury to the public in the event of an accident to the displaying aircraft.



Adequate - Closed

[Safety Recommendation 2016-038](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority specify the minimum separation distances between secondary crowd areas and displaying aircraft before issuing a Permission under Article 162 of the Air Navigation Order.



Adequate - Closed

[Safety Recommendation 2016-039](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority require the organisers of flying displays to designate a volume of airspace for aerobatics and ensure that there are no non-essential personnel, or occupied structures, vehicles or vessels beneath it.



Superseded - Closed

[Safety Recommendation 2016-040](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority require Display Authorisation Evaluators to have no conflicts of interest in relation to the candidates they evaluate.



Partially adequate - Closed

[Safety Recommendation 2016-041](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority require a Display Authorisation to be renewed for each class or type of aircraft the holder intends to operate during the validity of that renewal.



Adequate - Closed

[Safety Recommendation 2016-042](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority publish a list of occurrences at flying displays, such as 'stop calls', that should be reported to it, and seek to have this list included in documentation relevant to Regulation (EU) No 376/2014.



Partially adequate - Closed

[Safety Recommendation 2016-043](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority introduce a process to immediately suspend the Display Authorisation of a pilot whose competence is in doubt, pending investigation of the occurrence and if appropriate re-evaluation by a Display Authorisation Evaluator who was not involved in its issue or renewal.



Adequate - Closed

[Safety Recommendation 2016-044](#) made on 10 March 2016

G-BXFI HAWKER HUNTER T7 on 22 August 2015

It is recommended that the Civil Aviation Authority establish and publish target safety indicators for United Kingdom civil display flying.



Adequate - Closed

[Safety Recommendation 2016-045](#) made on 5 May 2016

G-TIMM FOLLAND GNAT T MK 1 on 1 August 2015

It is recommended that the Civil Aviation Authority amend its policy on minimum aerobatic heights for pilots of high performance jet aircraft such that authorised minima are appropriate to a pilot's experience and currency.



Adequate - Closed

[Safety Recommendation 2016-046](#) made on 5 May 2016

G-TIMM FOLLAND GNAT T MK 1 on 1 August 2015

It is recommended that the Civil Aviation Authority ensure that the experience and currency requirements contained within CAP 403, Flying Displays and Special Events: A Guide to Safety and Administrative Arrangements, and CAP 632, Operation of 'Permit-to-fly' Ex-military Aircraft on the UK Register, manage the risk of a loss of aircraft control to as low a level as reasonably practicable.



Partially adequate - Open



[Safety Recommendation 2016-047](#) made on 5 May 2016

G-TIMM FOLLAND GNAT T MK 1 on 1 August 2015

It is recommended that the Civil Aviation Authority review the medical examination requirements for pilots displaying high performance aircraft to improve the likelihood that medical conditions are identified which are potentially detrimental to displaying such aircraft safely.



Adequate - Closed

[Safety Recommendation 2016-048](#) made on 7 July 2016

G-CIYA SILENT 2 ELECTRO on 19 October 2015

It is recommended that the Civil Aviation Authority require that Ballistic Parachute Recovery Systems fitted to Single Seat Deregulated Aircraft comply with Article 38 of the Air Navigation Order and that the installation and placarding meet the same requirements as for aircraft operating on a Permit to Fly.



Partially adequate - Closed

[Safety Recommendation 2016-049](#) made on 4 August 2016

G-MAPP CESSNA 402B on 14 January 2016

It is recommended that Textron Aviation informs operators of Cessna 300 and 400-series aircraft of the actions required to ensure that the set screw, which retains the main gear downlock pin, is properly installed in the side brace downlock link and, in addition, amends the aircraft maintenance manuals to include this information.



Response awaited - Open

[Safety Recommendation 2016-050](#) made on 30 August 2016

G-LGNO SAAB 2000 on 15 December 2014

It is recommended that the European Aviation Safety Agency review the design of the Saab 2000 autopilot system and require modification to ensure that the autopilot does not create a potential hazard when the flight crew applies an override force to the flight controls.



Partially adequate - Closed

[Safety Recommendation 2016-051](#) made on 30 August 2016

G-LGNO SAAB 2000 on 15 December 2014

It is recommended that the European Aviation Safety Agency review the autopilot system designs of aircraft certified under part 25 or equivalent regulations and require modification if necessary to ensure that the autopilot does not create a potential hazard when the flight crew applies an override force to the flight controls.

 **Partially adequate - Open**

[Safety Recommendation 2016-052](#) made on 30 August 2016

G-LGNO SAAB 2000 on 15 December 2014

It is recommended that the Federal Aviation Administration review the autopilot system designs of aeroplanes certificated to Federal Aviation Regulation Part 25 and require modification if necessary to ensure that the autopilot does not create a potential hazard when the flight crew applies an override force to the flight controls.

 **Partially adequate - Open**

[Safety Recommendation 2016-053](#) made on 30 August 2016

G-LGNO SAAB 2000 on 15 December 2014

It is recommended that the Federal Aviation Administration amend Advisory Circular 25.1329-1C to ensure that requirement 25.1329(l) can only be met if the autopilot automatically disengages when the flight crew applies a significant override force to the flight controls and the auto-trim system does not oppose the flight crew's inputs.

 **Partially adequate - Open**

[Safety Recommendation 2016-054](#) made on 30 August 2016

G-LGNO SAAB 2000 on 15 December 2014

It is recommended that the European Aviation Safety Agency amend the Acceptable Means of Compliance for Certification Specification 25.1329 to ensure that requirement 25.1329(l) can only be met if the autopilot automatically disengages when the flight crew applies a significant override force to the flight controls and the auto-trim system does not oppose the flight crew's inputs.

 **Partially adequate - Open**



Safety Recommendation 2016-055 made on 6 October 2016

G-BYCP BEECH B200 on 3 October 2015

It is recommended that the European Aviation Safety Agency require all in-service and future turbine aircraft with a Maximum Certificated Takeoff Mass of 5,700 kg or less and with a maximum operational passenger seating configuration of between six and nine passengers to be fitted with, as a minimum standard, a Class B Terrain Awareness and Warning System certified to ETSO-C151b.



Partially adequate - Open

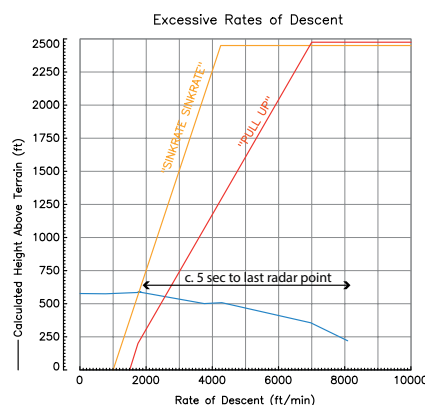
Safety Recommendation 2016-056 made on 6 October 2016

G-BYCP BEECH B200 on 3 October 2015

It is recommended that the International Civil Aviation Organisation revise Annex 6 to the Convention on International Civil Aviation, Part 1 (International Commercial Air Transport – Aeroplanes) to upgrade recommendation 6.15.5 [carriage of TAWS on turbine aeroplanes with a Maximum Certificated Takeoff Mass of 5,700 kg or less and authorised to carry more than five but not more than nine passengers] to a standard.



Partially adequate - Open



Safety Recommendation 2016-057 made on 6 October 2016

G-BYCP BEECH B200 on 3 October 2015

It is recommended that the International Civil Aviation Organisation revise Annex 6 to the Convention on International Civil Aviation, Part 2 (International General Aviation – Aeroplanes) to upgrade recommendation 2.4.11.2 [carriage of TAWS on turbine aeroplanes with a Maximum Certificated Takeoff Mass of 5,700 kg or less and authorised to carry more than five but not more than nine passengers] to a standard.



Partially adequate - Open

Safety Actions from investigations reported on in 2016

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 2016 safety actions directly as a result of AAIB investigations was recorded on two formal investigations, eighteen field investigations and seventeen correspondence investigations.

FORMAL INSPECTOR'S INVESTIGATIONS

AS332L2, G-WNSB on 23 August 2013

Safety Issues – North Sea helicopter operations and passenger safety in emergency situations

The CAA published CAP 1145, Civil Aviation Authority – Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas. In this document the following actions are of relevance to the G-WNSB accident:

The CAA will work with the helicopter operators via the newly established Helicopter Flight Data Monitoring (FDM) User Group to obtain further objective information on operational issues from the FDM programme.

With effect from 1 June 2014, the CAA will require helicopter operators to amend their operational procedures to ensure that Emergency Flotation Systems are armed for all over-water departures and arrivals.

With effect from 1 June 2014, the CAA will prohibit the occupation of passenger seats not adjacent to push-out window emergency exits during offshore helicopter operations, except in response to an offshore emergency, unless the consequences of capsizing are mitigated by at least one of the following:

- a) all passengers on offshore flights wearing Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time;
- b) fitment of the side-floating helicopter scheme in order to remove the time pressure to escape.

With effect from 1 April 2015, the CAA will prohibit helicopter operators from carrying passengers on offshore flights, except in response to an offshore

emergency, whose body size, including required safety and survival equipment, is incompatible with push-out window emergency exit size.

With effect from 1 April 2016, the CAA will prohibit helicopter operators from conducting offshore helicopter operations, except in response to an offshore emergency, unless all occupants wear Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time. This restriction will not apply when the helicopter is equipped with the side-floating helicopter scheme.

The UK Oil and Gas Industry have introduced a new CAA approved Category A Compressed Air Emergency Breathing System (CAEBS). From **1 September 2014**, all UK passengers travelling by helicopter to and from an offshore installation, who are not seated next to an emergency exit will be required to wear this device. From **1 January 2015, ALL** UK passengers on all UK helicopter flights to and from an offshore installation will be required to wear this device.

The operator took action to review and revise its standard operating procedures and promulgated them to its flight crews in July 2014.

Key elements of the changes for the Super Puma fleet were:

All instrument approaches to be flown 4-axes coupled. If 4-axes mode is not available then 3-axes with IAS mode is required.

A specified, pre-briefed, nominated fixed airspeed to be used for onshore approaches below 1,000 aal.

Changes to the stabilised approach definitions and criteria.

When climbing or descending in 3 axis/2 cue¹ without the collective coupled, crews shall couple airspeed, not vertical speed, to the pitch axis.

UK operators in the North Sea took safety action to amend the pre-flight safety briefing video for passengers to include information on the automatic air supply feature.

Action taken to modify Sumburgh Runway 09 slipway to allow a water rescue capability to be provided in all tidal conditions, subject to weather conditions.



Footnote

¹ According to helicopter type.

Saab AB Saab 2000, G-LGNO on 15 December 2014

Safety Issue – Autopilot operation

The aircraft manufacturer published Operations Newsletter No.6, informing Saab 2000 operators of the circumstances of this serious incident, and clarifying the operation of the autopilot.

NOTAC 123/14 was issued to all [the operator's] SAAB 2000 pilots on 23 December 2014 advising to ensure that the autopilot is disconnected in the event of experiencing control abnormalities.

FIELD INVESTIGATIONS

Agusta Bell 206B Jet Ranger III, G-OMDR on 27 June 2014

Safety Issue – Flight manual error

The reference to 'paint stripe(s)' on the driveshaft couplings refers to the configuration of the couplings prior to embodiment of Agusta Mandatory Technical Bulletin 206-219, which replaced the paint stripes with 'TEMP-PLATE' temperature indication stickers. The manufacturer has amended the AB206B flight manual to correct this anomaly.



Sikorsky S-92A, G-VINL on 22 August 2014

Safety Issue – Navigational errors

The operator has tightened its procedures for the positively identify and confirm destination helidecks.

Bombardier DHC-8-402, G-FLBC on 16 December 2014

Safety Issue – Engine component fault leading to fire

Alert Service Bulletin SBA35325. This requires in-situ inspection of the No 4 bearing key washer and the removal from service of engines in which cracked washers are identified.

The manufacturer has used technical records to identify the service lives of key washers and direct action accordingly.

Specific NDT training has been given.

The engine manual has been revised to instruct the replacement of the key washer upon access, and SB 35326 has been issued to instruct replacement of the key washer at engine shop visits, regardless of the reason for engine removal.

The engine manufacturer introduced a new improved key washer in February 2016, per SB 35327.

Gulfstream G200, EC-KRN on 14 January 2015

Safety Issue – Use of antiskid during emergency procedures in the QRH

- The aircraft manufacturer is reviewing the anti-skid QRH procedure to emphasise the operation of the anti-skid during initial and recurring training.
- The aircraft manufacturer has stated that it is considering an AFM revision to clarify the procedure in case of a tyre burst.
- The aircraft operator initiated a process of internal research with the participation of their most experienced G200 pilots to establish suitable mitigation measures.

Raytheon 390, Premier I, G-OOMC on 12 March 2015

Safety Issues – Component quality, loose articles and decision making

The pump manufacturer is taking action to replace the port caps. Service Bulletin 66179-29-486 issued to replace port caps with serial numbers 0057 to 0099 with port caps manufactured under the current process which do not have excessive pitting.



The AAIB highlighted the issue of loose articles beneath the cockpit floor to the aircraft manufacturer's Continued Operational Safety Department and the manufacturer has taken the safety action of adding the issue to the fleet safety monitoring list.

The operator has removed the information on decision making from Operations Manual Part B and incorporated it into Part A of the Operations Manual.

Beech 95-B55 Baron, G-RICK on 3 May 2015

Safety Issue – NDB distances shown on GPS mistaken for DME distances

Amendment of the ATIS broadcast to include the statement:

'Pilots are reminded that the NDB and DME are not co-located'.

A survey will investigate the hazards and potential risks associated with the Dundee instrument approach procedures and the remotely located NDB. Its scope is intended to be broad, but will consider the feasibility of:

- Relocating the remote NDB to within the airport grounds;
- Installing Air Traffic Monitoring in the Visual Control Room;
- Amending the notes section of the Dundee instrument approach charts in the UK-AIP;

- Installing power amplifiers to ‘balance’ the output signal from the Glide Path, in order to remove the warning about localiser and glidepath flag alarms on the instrument approach plate;
- Reviewing the Dundee’s RNAV procedure designs, which were submitted to the CAA for approval in June 2014, with a view to establishing RNAV approaches within a reasonable timescale;
- Using Automatic Dependant Surveillance Broadcasting (ADS-B²) as an ATC situational awareness tool, as well as other administrative and training mitigations.



Airbus A319-111, G-EZAA on 25 June 2015

Safety Issue – Electronic flight bag conformity

The operator has undertaken a number of measures including:

- Establishing a ‘Performance Working Group’ to review all of the associated procedures that they use for performance calculation, data entry and crosschecking in the light of all these events and other available information
- Looking into the retention of recorded EFB information
- Recommending consideration for their FDM Manager to be authorised to report events to the AAIB of any serious incident
- Recommending consideration be given to review and influence future software versions for performance calculations on the EFB
- Evaluation of all changes in FlySmart version L6.0.x prior to its entry into service.

The EFB software manufacturer has confirmed that the anomaly will be corrected in the L6.0.x version of FlySmart.

Airbus A321-231, G-EUXF on 19 July 2015

Safety Issue – Aircraft sub type variances

Additional information and training for flight crew on A321 specific differences, together with a review of current landing training guidance and PM actions during the landing phase.

The operator is considering introducing an experience restriction for co-pilots performing landings on the A321.

Footnote

² ADS-B is a cooperative surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked.

Airbus A320-232, G-EUYE on 27 July 2015

Safety Issue – Premature avionics fan bearing failure

- In March 2005 the fan manufacturer issued a Vendor Service Bulletin, 3454-21-108, to replace the original steel ball bearings with an improved ceramic bearing.
- In August 2013 the fan manufacturer issued a Service Information Letter, 3454HC-21-250, to inform operators that a new overhaul task had been added to the fan Component Maintenance Manual.

Embraer EMB-505 Phenom 300, HZ-IBN on 31 July 2015

Safety Issue – Pilot mental overload

The operator has instituted the following changes since the accident:

1. Since July 31, 2015, all Phenom 300 flights are operated with both a commander and co-pilot.
2. The operator is adopting a Flight Operations Quality Assurance (FOQA) program. The programme was due to be in operation by the end of March 2016.
3. The Stabilized Approach for VMC approach and landings has been amended to 500 ft agl.
4. All pilots have successfully completed Upset Prevention and Recovery Training (UPRT) in order to add an additional layer of safety and combat LOC-I¹⁶.
5. Enhanced Recurrent Training Requirements have been introduced, with training providers be requested to focus on short runway operations.
6. The standardised approach brief now focuses on go-arounds in VMC, to ensure that flight crew are prepared to go around, and set safe margins for landing performance.
7. Mandatory pilot and team meetings have been introduced.



Folland Gnat T Mk 1, G-TIMM on 1 August 2015

Safety Issue – Display SOPs

The operator produced a document, *Gnat Display Team 2-ship Formation Display Procedures/SOPs*, to document in one place the techniques and procedures to be used during flying displays.

British Aerospace 146-200, D-AMGL on 16 August 2015

Safety Issue – Landing gear failure

The operator has put in place a system to record the landings for the bolts on the shock-absorbers.

Beech B200 Super King Air, G-BYCP on 3 October 2015

Safety Issue – Correct use of Tech Logs

The operator has issued a Flight Crew Notice to all crews informing them of the suspension of the 'Engineering Report' email system. The notice instructed them to follow the correct technical log procedures as set out in the operator's Operations Manual Parts A and B, and the relevant aircraft Minimum Equipment List.

Silent 2 Electro, G-CIYA on 19 October 2015

Safety Issue – Ballistic parachute recovery system information

The UK agent of the Silent 2 Electro has advised the AAIB that the aircraft manufacturer has taken action to attach the correct BPRS placards to their aircraft and trailers prior to delivery.

The BGA have also stated that they will act on this report to inform the gliding community of the potential dangers from gliders fitted with BPRS that have been involved in an accident.



Cessna Citation 560XL, SE-RHJ on 29 November 2015

Safety Issue – Quick release fastener security

The maintenance organisation has changed their inspection procedures to ensure that, following installation, the security of engine cowlings is checked by an independent mechanic.

The manufacturer highlighted the three events to their Continued Operational Safety group to assess possible options to minimise occurrences in the future. This includes a proposed video for maintenance agencies to emphasise the importance of ensuring that the quick release fasteners are secure.

Cessna 402B, G-MAPP on 14 January 2016

Safety Issue – Landing gear component mis-assembly

The operator carried out a fleet check to ensure that the set screw in the downlock links fitted to their other aircraft had been correctly fitted.

The operator introduced a new local procedure, following the disturbance of the downlock pin, to ensure that the set screw had been inserted a sufficient distance to lock the pin in place.

BAe ATP, G-BUUR on 26 January 2016

Safety Issue – EGPWS alert SOP and response

- An internal review was carried out and the pilots received further training.
- Changes were made to ATP procedures before the fleet transfer was completed. This included a requirement to check autopilot disengagement switches before each flight.
- The entry for Jersey in the OM Part C was amended to include note of the potential for spurious EGPWS alerts in certain circumstances.
- The procedures required after accidents or incidents are now detailed in the OM Part A.
- Pilots and engineers have been given guidance on deactivation of flight recorders and CVRs.
- Changes were made to pilot training procedures and certain wind limitations for newly qualified pilots have been reduced.



Boeing 747-436, G-CIVX on 30 January 2016

Safety Issue – Landing gear maintenance procedures, training and communication

Updating the TR so that technical management are consulted if more than three rigging shims are used for this task and to include a requirement to fit rig pins and to check that the rig pins can be inserted freely once function checks are completed;

Holding staff briefings to reinforce the requirements to adhere to handover procedures;

Publishing a bulletin to highlight this incident, including the distraction aspect;

Introduction of additional skills training in task card generation.

CORRESPONDENCE INVESTIGATIONS

Airbus A320-214, G-EZTE on 7 January 2015

Safety Issue – Unforeseen risks in automated flight modes

The operator provided a programme of additional ground and simulator training for the flight crew.

An additional procedure has been introduced, which requires the PF to announce the active A/THR mode whenever flight directors are selected off.

Robin DR 400-180, F-GSBM and SAS Wildthing radio-controlled model glider on 30 April 2015

Safety Issue – GA and model aircraft (UAV) possible confliction

Shoreham airport to ensure a message is added to the ATIS broadcast whenever model activity is observed or reported and air traffic controllers pass traffic information on models. The current ATIS message is 'Caution model aircraft operating in the ATZ', but the airport operator intends to add more specific information about the model aircraft's location.

The airport operator has also submitted an AIP amendment to say:

'Caution, model aircraft fly adjacent to the RWY 20 approach on the hills approximately 1 nm from the threshold up to 700 ft amsl.'

Staff at Adur District Council intend to place signs at the Mill Hill Nature reserve which will state the byelaws for the area, so that people will be aware of the 4 kg model aircraft limit and the prohibition on operating powered model aircraft.

The CAA are aware of this serious incident and are considering whether further weight or height restrictions need to be introduced for model/unmanned aircraft operating inside ATZs, or whether there should be a limit on the distance they can be operated from an airport or airfield.



Cessna 172S Skyhawk, G-MEGS on 16 May 2015

Safety Issue – Pilot experience and decision making

The flying club from which the aircraft was hired has introduced more constraining weather and currency requirements for pilots with less than 100 hrs pilot-in-command.

Introduction a cross-country checklist, requiring pilots to complete details of their intended flight and obtain authorisation from an appropriate staff member.

YAK-52, G-CDJJ on 18 June 2015

Safety Issue – Runway markings ill-defined leading to confusion

The airfield operator has repainted the lead-in lines to the displaced threshold on Runway 30 and is planning to repaint the runway closed X markings on the disused paved surface outside the airfield boundary.



Practavia Sprite Series 2, G-BCVF on 30 June 2015

Safety Issue – Canopy opening in flight

The LAA is in the process of updating the Operating Limitations Documents for Practavia Sprite aircraft, to require fitment of a placard which states: 'THIS CANOPY MUST NOT BE OPENED IN FLIGHT.' Additionally, incidents with multiple contributory factors are frequently discussed in the 'Safety Spot' section of the LAA's monthly membership magazine. This incident will be discussed in the December 2015 edition.

Airbus A320-214, G-EZUH on 16 July 2015

Safety Issue – Takeoff performance calculation error

- The Operator will publish an article in its *Flight Safety Bulletin* outlining the severity and the hazards of not crosschecking all performance calculations.
- The operator has added a briefing note on all of its Operational Flight Plans highlighting the importance of crosschecking takeoff performance calculations when changes are made as a result of intersection departures or other last-minute changes to aircraft configuration or takeoff distances.

Boeing 747-400, G-BNLW on 5 October 2015

Safety Issue – Unsafe fitting of ground power connections

The operator has since notified ground staff to be on the lookout for signs of heat damage to the aircraft receptacles and GPU sockets, and to ensure that connectors are correctly aligned when plugging in ground power.

Aeronca C3, G-AEFT on 14 October 2015

Safety Issue – Improved crankshaft crack detection techniques

The LAA have issued Airworthiness Information Leaflets (AIL) No. MOD/ENG/JAP/001 for the JAP engine, and MOD/ ENG/AER/001 for the Aeronca version, effectively mandating a recurrent dye-penetrant inspection on all engines before further flight.



Embraer EMB-145MP, G-CGWV on 5 December 2015

Safety Issue – Wing tip strikes and occurrence reporting

The aerodrome operator has reviewed its guidance to try to ensure any future serious incident which is suspected to have occurred on or adjacent to Newcastle Airport, will be notified to the AAIB without delay.

The aircraft operator has updated its guidance concerning serious incidents and has clarified company procedures in the event of an accident or suspected serious incident.

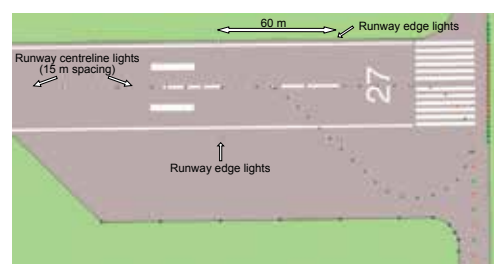
The guidance provided to assist crews to calculate their approach speed has been amended.

Following this accident the aircraft operator intends to include appropriate go- around practice during pilots' recurrent simulator training.

Cessna 525A, Citationjet CJ2, G-TBEA on 9 January 2016

Safety Issue – Loss of situational airfield awareness during taxi

The operator issued an Information Notice, on 15 January 2016, to all its pilots, reminding them that taxiing situational awareness is a critical part of the flight.



Boeing 757-28A, G-OOBE on 1 February 2016

Safety Issue – Aircraft handling procedures

The operator's annual refresher training was modified to include a module to refresh all its Boeing 757 pilots on procedures for go-arounds with both engines operating.

The operator's training department will also be reviewing how it develops the intervention skills of its training pilots.

Reims Cessna F152, G-BFEK on 2 February 2016

Safety Issue – fixed and rotary wing separation on the ground

The airfield operator has modified its airfield procedures to ensure fixed and rotary wing movements and holding points are deconflicted.

Bombardier Global Express BD-700-1A10, N683GA on 25 March 2016

Safety Issue – Airport ramp/apron management

The airport introduced the following:

- ‘1. A systematic review of the process and criteria for approving flights after the normal working hours of the airport, with special emphasis placed on General Aviation operations, should be conducted and used to create a clear policy for this activity.
2. Apron Management Training and annual recurrence is a requirement for all ATC, Ground Handling, Ramp control personnel and Airport Duty Officers and should be strictly enforced.
3. Airport Duty Officers and other ramp personnel must be focused on ensuring the proper placement and subsequent timely removal of Ground Handling Equipment used on aircraft stands.
4. Establishment of a Training course and CIIA approved Operators Certificate for aircraft Marshal and Wing Walkers.’

CZAW SportCruiser, G-OCRZ on 13 April 2016

Safety Issue – Runway identification

White markers are now in place to make the runway outline more obvious to approaching aircraft.

Savannah VG Jabiru(1), G-SAVY on 8 May 2016

Safety Issue – Elevator control rigging leading to component failure

The BMAA is currently surveying other UK-registered Savannah aircraft to determine whether any other examples exhibit the excessive elevator deflections found on G-SAVY, and will notify UK owners of their findings.



Robinson R44 Astro, G-BZGO on 13 June 2016

Safety Issue – Birdstrike risk mitigation

The FAA have convened an Aviation Rulemaking Advisory Committee (ARAC) Rotorcraft Birdstrike Working Group. The working group has been tasked with providing recommendations for enhancing birdstrike protection for Normal category rotorcraft and the helicopter manufacturer has confirmed that they are participating in this initiative.

The NTSB advise that the helicopter manufacturer is investigating tougher windscreen materials to improve occupant protection in the event of a birdstrike.

Zenair CH 601XL Zodiac, G-EXXL on 19 June 2016

Safety Issue - Kite and tethered balloon risks to GA

The CAA has reviewed its current policy pertaining to the issuance of Permissions for kite flying activities. While the CAA can no longer mandate the conspicuity requirements previously described in Rules 52 and 53, it has advised that all future Permissions for kites (and captive balloons) will include a statement that operators:

‘Should have attached to its mooring cable either:

- (a) tubular streamers as specified in paragraph (1) (this relates to the identical marking of captive balloons); or*
- (b) at intervals of not more than 100 metres measured from the lowest part of the kite, streamers not less than 80 centimetres long and 30 centimetres wide at their widest point, marked with alternate bands of red and white 10 centimetres wide’.*

For conspicuity at night, all Permissions for night operations will state (and detail) that the kite should be lit in the manner previously required by Rule 52.

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

Air Accidents Investigation Branch

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2016**