AAIB
Air Accidents Investigation Branch

Annual Safety Report 2015

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This document is also available in electronic (pdf) format at www.aaib.gov.uk

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Chief Inspector's Report

I am pleased to introduce the 2015 AAIB Annual Safety Report which includes information on our 2014 activity and progress on the status of Safety Recommendations that were published in 2014.

Sadly 2014 was dominated by two overseas accidents where 537 people lost their lives in highly unusual circumstances. First in March, Malaysia Airlines flight MH370 was reported missing on a scheduled flight from Kuala Lumpur to Beijing and to date there has been no trace of the aircraft or any of its passengers. The AAIB became involved initially through representing the State of Manufacture of the engines and then more closely through Inmarsat satellite information. This led to the search concentrating in the southern Indian Ocean where the Australian authorities continue to lead the search activity. AAIB support was significant, especially in terms of staff deployed to Malaysia and Australia, and our involvement is expected to increase again once the aircraft is located.

Then in July, Malaysian Airlines flight MH17 was shot down in the eastern part of Ukraine. Again the AAIB became involved as State of Manufacture of the engines and deployed six investigators to Kiev to assist the international team led by the Dutch Safety Board. Specifically we were able to assist the investigation through the successful download of the aircraft's Flight Data and Cockpit Voice Recorders at our laboratory in Farnborough and we continue to support the Dutch Safety Board through to their final report publication.

We also entered the world of Unmanned Aerial Systems by acquiring our own quadcopter which now provides excellent overhead images at most of the accident sites to which we deploy. This enhanced capability has resulted in significant cost savings for the taxpayer as it has largely replaced the need for helicopter surveys. This also gives us additional insight into the operation of Remotely Piloted Aircraft Systems, an area where we undoubtedly will have to focus our investigative skills at some point in the future.

Additionally we used the Farnborough Airshow in 2014 as a backdrop to a new AAIB video which highlights our function and takes the viewer through the process of an accident investigation. This is now streamed on our website www.aaib.gov.uk

On a lighter note we were honoured by two royal visits during 2014, firstly by the Duke of Cambridge and then the Duke of Edinburgh who both shared their many and varied aviation experiences with us. This proved a truly fitting end to our 99th year and we approach our centenary buoyed by Royal acknowledgement of our role in aviation safety.

Keith Conradi

Introduction

The Air Accidents Investigation Branch is the part of the Department for Transport responsible for the investigation of all civil aircraft accidents and serious incidents (collectively referred to as 'accidents' in this document) occurring in or over the United Kingdom, its Overseas Territories and Crown Dependencies. Its authority is enshrined in Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 and the Civil Aviation (Investigation of Air Accidents and incidents) Regulations 1996. Its purpose is 'to improve aviation safety by determining the causes of air accidents and serious incidents and making Safety Recommendations intended to prevent recurrence'. The AAIB reports directly to the Secretary of State for Transport on safety matters.

The Civil Aviation Authority (CAA) Safety and Airspace Regulation Group (SARG) is established to develop the UK's aviation safety environment, in partnership with industry, through continuous improvements in aviation safety in the UK and, in partnership with the European Aviation Safety Agency (EASA), across Europe.

The European Community established the EASA in 2003 with the legal competence to be the rulemaking and standard setting organisation for all aviation safety regulation on behalf of its member states. As a National Aviation Authority however, the CAA SARG retains a statutory duty to exercise full rulemaking and oversight responsibility for all those aspects not being adopted by EASA. Moreover, as a Competent Authority within the new European framework, CAA SARG is required to deliver safety oversight of UK industry against EASA's pan-European rules and standards. The developing European framework for the regulation of aviation safety has at its heart '2 pillars' – EASA and the National Aviation Authorities of the Community member states. Collectively, therefore, a maturing European regulatory system will continue to be focused on seeing that aircraft are properly designed, manufactured, operated and maintained; that airlines operate safely; that flight crews, air traffic controllers and aircraft maintenance engineers are suitably skilled; that licensed aerodromes are safe to use and that air traffic control services and general aviation activities meet the required safety standards.

Accident investigation and safety regulation are clearly different and the two functions are deliberately kept independent from each other. However, the evaluation of the findings of an accident investigation and the determination of the need for and the initiation of, appropriate action to maintain and enhance safety is an important part of safety regulation. Thus a good working relationship between the AAIB, the CAA and the EASA is essential, while in no way jeopardising the independence of accident investigation.

Effective liaison has been maintained between the AAIB, the CAA and the EASA, which has been particularly useful in the immediate aftermath of any accident. However, the formal procedure by which the AAIB identifies and conveys to the CAA, the EASA or other bodies, matters which it believes require action is by means of Safety Recommendations.

Safety Recommendations can be made at any stage as the AAIB investigation progresses. Both the CAA and the EASA have formal procedures for the receipt and evaluation of such recommendations and initiation of necessary action.

The CAA is informed of all AAIB Safety Recommendations and has, until recently, responded to the AAIB, in the form of a Follow-up Action on Occurrence Report (FACTOR), on all Safety Recommendations, regardless of whether they were the action addressee. The CAA now only formally responds to the AAIB with a FACTOR if a Safety Recommendation is specifically addressed to them. They have assured the AAIB, however, that they will continue to react appropriately to any Safety Recommendation if they believe it is in the interests of UK aviation safety.

Until September 2004, responses to the Air Accidents Investigation Branch's recommendations were published by the Civil Aviation Authority in their annual Progress Report on AAIB recommendations under the cover of a Civil Aviation Publication (CAP). With the shift of responsibilities, however, it has become more appropriate for the AAIB to take responsibility for

reporting on the responses to its recommendations regardless of the target authority or organisation. The first AAIB progress report was published in March 2006.

This eleventh report, which is titled the AAIB's 'Annual Safety Report', contains additional information concerning accident statistics and the activities of the AAIB. The bulk of the report contains the responses received to AAIB Safety Recommendations made up to and including 31 December 2014.

Statistics

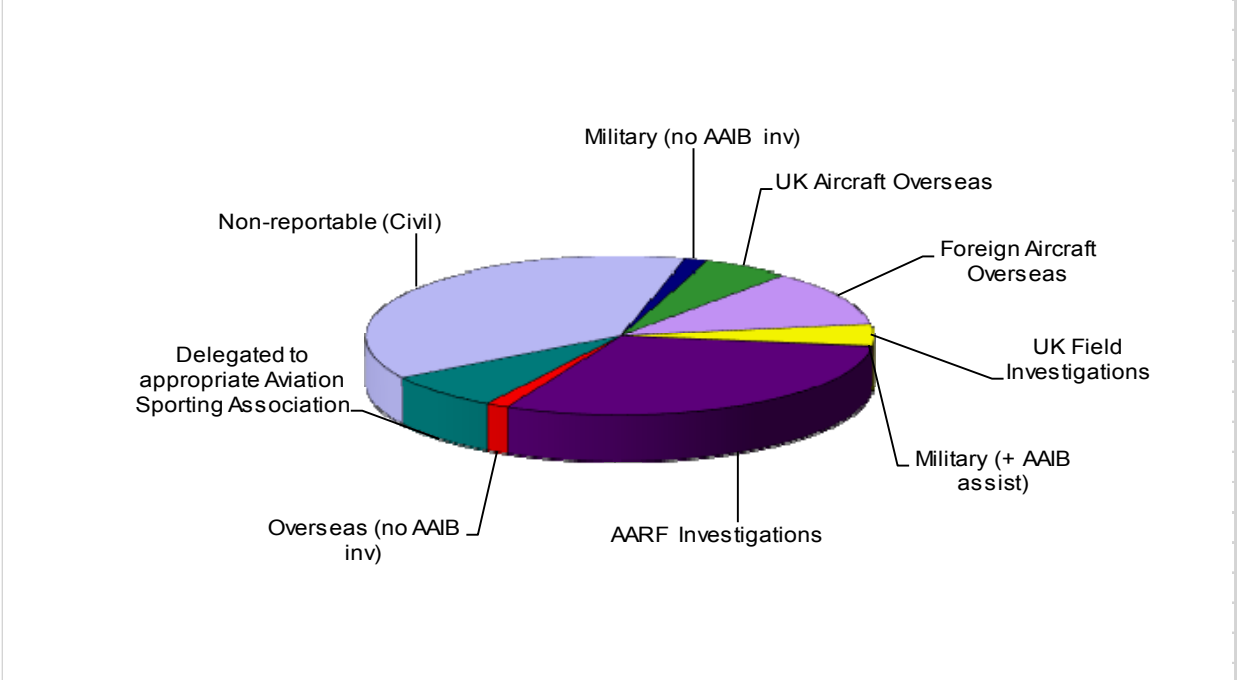
The following pages provide the statistics for 2014, 2013 and 2012, for accidents and serious incidents involving the Air Accidents Investigation Branch.

An explanation of the categories is as follows:

Category	Definition
UK Aircraft Overseas	Investigations involving UK registered aircraft, or aircraft registered in one of the UK Overseas Territories or Crown Dependencies, occurring in a Foreign State where the AAIB has participated in the capacity as the Accredited Representative representing the State of Registry 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.
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 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.

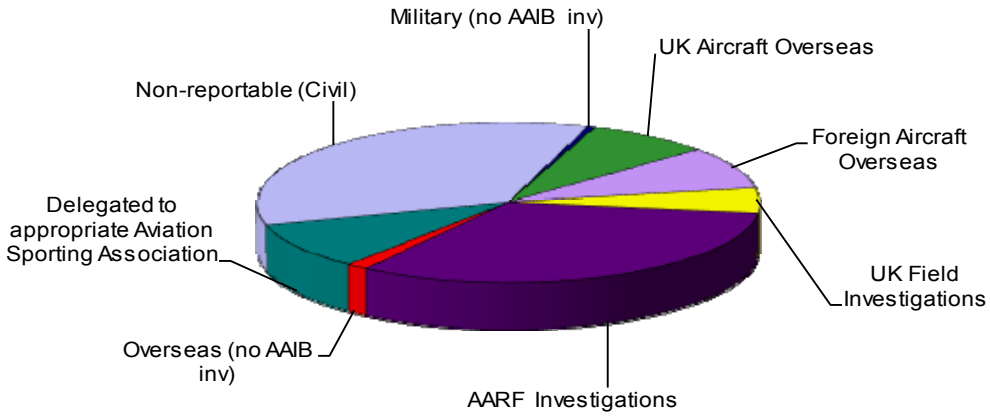
AAIB Notifications 2014

	J	F	M	A	M	J	J	A	S	O	N	D	Total
UK Aircraft Overseas	1	2	4	5	4	3	2	5	6	1	3	2	**38**
Foreign Aircraft 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 assist)	0	1	0	0	0	0	0	0	0	0	0	0	**1**
AARF Investigations	10	4	21	16	18	36	30	17	17	10	13	14	**206**
Overseas (no AAIB inv)	1	0	0	0	1	1	3	1	0	2	1	0	**10**
Delegated to the appropriate Aviation Sporting Association	1	3	1	8	5	8	9	7	4	2	3	1	**52**
Non-reportable (Civil)	16	18	25	20	27	41	26	21	15	16	14	20	**259**
Military (no AAIB inv)	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**
No of DEATHS	**0**	**0**	**6**	**1**	**1**	**3**	**0**	**2**	**3**	**0**	**0**	**0**	**16**



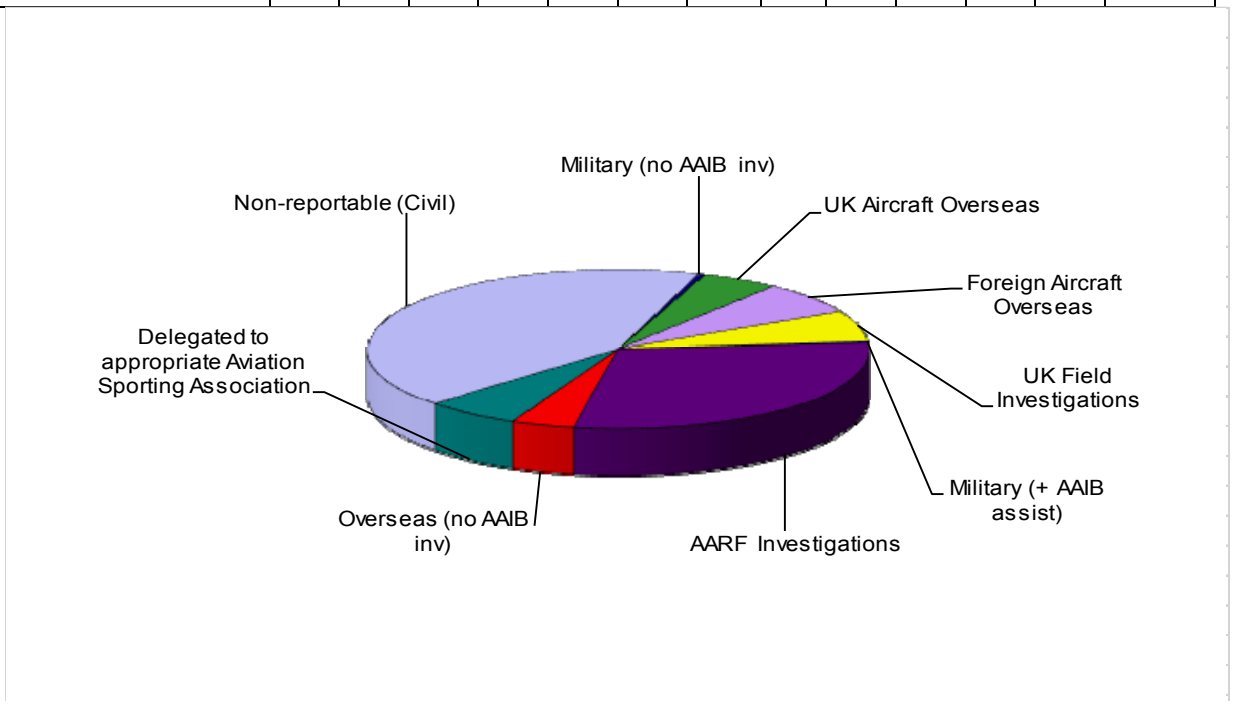
AAIB Notifications 2013

	J	F	M	A	M	J	J	A	S	O	N	D	Total
UK Aircraft Overseas	2	1	3	4	10	6	7	7	5	3	2	2	**53**
Foreign Aircraft Overseas	1	7	5	1	9	3	6	4	7	6	3	4	**56**
UK Field Investigations	3	0	1	2	3	2	3	5	2	3	5	3	**32**
Military (+ AAIB assist)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
AARF Investigations	8	11	10	17	20	23	33	37	15	19	11	9	**213**
Overseas (no AAIB inv)	2	0	3	0	0	0	0	0	1	3	0	0	**9**
Delegated to the appropriate Aviation Sporting Association	2	4	3	4	11	8	6	11	7	3	0	3	**62**
Non-reportable (Civil)	18	15	13	26	25	20	21	19	19	16	10	24	**226**
Military (no AAIB inv)	1	0	0	0	0	0	0	1	0	1	0	0	**3**
Total	**37**	**38**	**38**	**55**	**78**	**62**	**76**	**84**	**56**	**54**	**31**	**45**	**654**
UK FATAL ACCIDENTS	**1**	**0**	**0**	**1**	**1**	**0**	**2**	**3**	**2**	**1**	**2**	**0**	**13**
No of DEATHS	**2**	**0**	**0**	**1**	**1**	**0**	**3**	**7**	**3**	**1**	**12**	**0**	**30**



AAIB Notifications 2012

	J	F	M	A	M	J	J	A	S	O	N	D	Total
UK Aircraft Overseas	2	0	2	2	4	8	4	6	2	3	1	3	**37**
Foreign Aircraft Overseas	2	2	3	4	3	4	5	4	7	9	3	4	**50**
UK Field Investigations	3	4	5	7	5	1	6	8	3	3	1	1	**47**
Military (+ AAIB assist)	1	0	0	0	0	0	1	0	0	0	0	0	**2**
AARF Investigations	11	15	19	14	28	13	29	26	26	16	10	10	**217**
Overseas (no AAIB inv)	6	2	2	4	6	2	2	2	0	2	2	0	**30**
Delegated to the appropriate Aviation Sporting Association	3	3	2	5	6	2	6	9	2	5	1	0	**44**
Non-reportable (Civil)	23	21	35	26	39	26	40	25	30	22	19	8	**314**
Military (no AAIB inv)	1	0	0	1	0	0	0	0	0	1	0	0	**3**
Total	**52**	**47**	**68**	**63**	**91**	**56**	**93**	**80**	**70**	**61**	**37**	**26**	**744**
UK FATAL ACCIDENTS	**3**	**0**	**0**	**2**	**1**	**0**	**2**	**3**	**1**	**0**	**0**	**1**	**13**
No of DEATHS	**4**	**0**	**0**	**2**	**2**	**0**	**2**	**4**	**1**	**0**	**0**	**1**	**16**



Safety Recommendations Report

This is the eleventh annual Progress Report on Safety Recommendations submitted to the Secretary of State by the Air Accidents Investigation Branch (AAIB). It contains all the recommendations made by the AAIB in 2014 including the responses to those recommendations received up to and including 30 June 2015 and those recommendations categorised as open from previous years where significant additional information has been received.

The recommendations are grouped into eight sections:

1. Aeroplanes - 5,700kg MTWA and above
2. Aeroplanes - above 2,250kg and below 5,700kg MTWA
3. Aeroplanes - 2,500kg MTWA and below
4. Microlights
5. Rotorcraft - 5,700kg MTWA and above
6. Rotorcraft - above 2,250kg and below 5,700kg MTWA
7. Rotorcraft - 2,500kg MTWA and below
8. Others

Safety Recommendation responses are assessed in accordance with Article 18 of EU 996/2010. The AAIB assess the responses and classify them with one of the following:

1. **Adequate – Closed**.

   The response to the Safety Recommendation was deemed adequate and the recommendation has been closed.

2. **Partially Adequate – Open**.

   The response goes some way to addressing the intent and some action is taking place or is intended to take place for which further follow up is expected. As a result the recommendation remains Open.

3. **Partially Adequate – Closed**.

   The response goes some way to addressing the intent of the recommendation or safety issue. However, there is little or no likelihood of any further action by the addressee, so the recommendation is Closed.

4. **Not Adequate – Open**.

   The response does not address the intent of the Safety Recommendation and identified safety issue. However, the addressee is encouraged to review their response and further follow up is expected, therefore the recommendation remains Open.

5. **Not Adequate – Closed**.

   The response does not address the intent of the Safety Recommendation and identified safety issue. If it is unlikely that the addressee will carry out any further action, the Safety Recommendation is Closed.

Whilst a response from addressee to a Safety Recommendation is awaited, the recommendation is classified as:

Response Awaited – Open.

If no response has been received from an addressee over a period exceeding two years, it is assumed that the Addressee will not act on the Safety Recommendation. The Safety Recommendation is closed for administrative purposes and classified as:

Response Awaited – Closed.

Note – responses received subsequently are assessed.

If the recommendation has been superseded it is classified as: **Superseded – Closed**.

Statistics

Recommendations made in 2014 and status:

Number	Status Category							
	Adequate Closed	Partially Adequate Open	Partially Adequate Closed	Not Adequate Open	Not Adequate Closed	Response Awaited Open	Response Awaited Closed	Withdrawn
42	22	14	1		0	3	0	1
% of total	52.38	33.33	2.38	2.38	0	7.14	0	2.38

88.09% of recommendations receiving a response were considered Adequate or Partially Adequate

Recommendations within 2015 report by Addressee

Addressee	Number
Airbus	3
ASTM International	1
Boeing	3
Britten-Norman Aircraft Limited	1
CAA	11
Cayman Islands Airport Authority	1
Civil Aviation Authority of the Cayman Islands	1
Department for Transport	3
Eurocopter Group	1
European Aviation Safety Agency	27
Federal Aviation Administration	16
JAA	2
Scottish Government	1
Siemens	1
Survitec Group Limited	1

Aeroplanes > 5,700kg MTWA or above

Challenger	Birmingham Airport	4 January 2002	Accident

AAIB Formal: AAR 5/2004
FACTOR: F39/2004

Synopsis

Immediately after takeoff from Runway 15 at Birmingham International Airport the aircraft began a rapid left roll, which continued despite the prompt application of full opposite aileron and rudder. The left winglet contacted the runway shoulder, the outboard part of the left wing detached and the aircraft struck the ground inverted, structurally separating the forward fuselage. Fuel released from ruptured tanks ignited and the wreckage slid to a halt on fire; the Airport Fire Service was in attendance less than 1 minute later. The accident was not survivable.

Numerous possible causes for the uncontrolled roll were identified but all except one were eliminated. It was concluded that the roll had resulted from the left wing stalling at an abnormally low angle of attack due to flow disturbance resulting from frost contamination of the wing. A relatively small degree of wing surface roughness had a major adverse effect on the wing stall characteristics and the stall protection system was ineffective in this situation. Possible asymmetric de-icing by the Auxiliary Power Unit (APU) exhaust gas during pre-flight preparations may have worsened the wing-drop tendency.

N90AG's pilots should have been aware of wing frost during pre-flight preparations but the aircraft was not de-iced and the ice detector system would not have alerted them. It was considered that the judgement and concentration of both pilots may have been impaired by the combined effects of a non-prescription drug, jet-lag and fatigue.

Possible contributory factors were: the inadequate warnings on the drug packaging, Federal Aviation Administration (FAA) guidance material suggesting that polished wing frost was acceptable and melting of the frost on the right wing by the APU exhaust gas.

The investigation identified the following causal factors:

1. The crew did not ensure that the aircraft's wings were clear of frost prior to takeoff.
2. Reduction of the wing stall angle of attack, due to the surface roughness associated with frost contamination, to below that which the stall protection system was effective.
3. Possible impairment of crew performance by the combined effects of a non-prescription drug, jet-lag and fatigue.

SAFETY RECOMMENDATION – 2003-060

It is recommended that the Federal Aviation Administration and Joint Airworthiness Authority review the current procedural approach to the pre takeoff detection and elimination of airframe ice contamination and consider requiring a system that would directly monitor aircraft aerodynamic surfaces for ice contamination and warn the crew of a potentially hazardous condition.

Response

Mandating the installation of a system which monitors aircraft aerodynamic surfaces for ice contamination in the frame of on-ground pre-takeoff detection is not envisaged by the EASA. Indeed, available, or under development, sensor technologies are not deemed suitable as they cannot monitor all sensitive aerodynamic surfaces of the aeroplane, and therefore the existing methods of inspection would still be needed. These technologies are rather adapted to monitor

a limited area and therefore can be used in-flight to detect icing conditions, or first signs of ice accretion, to support the activation of ice protection systems.

The Agency has decided to launch a rulemaking task RMT.0118 (previously designated as 25.074) with the objective to propose new Certification Specifications for Large Aeroplanes (CS-25) provisions which will require applicants to perform an analysis of the on-ground wings contamination effect on takeoff performance degradation.

The applicant would have to demonstrate that the effect on takeoff performance degradation is not hazardous. If a hazardous effect is possible, then measures shall be put in place to alleviate the risk, which may include a system that monitors the aircraft aerodynamic surfaces.

Status – Adequate – Closed

Fokker F28 Mark 0100	**Manchester Airport parked on 66L**	**1 April 2002**	**Serious Incident**

AAIB Bulletin: 3/2003
FACTOR: F07/2003

Synopsis

During taxi for takeoff at Manchester International Airport, the aircraft passenger cabin filled with smoke and an emergency evacuation of the aircraft was carried out. The evacuation was carried out expeditiously, but the cabin crew had difficulty opening the Galley Service Door and some passengers using the overwing escape hatches were unsure of how to descend to the ground. The smoke had originated from a damaged Auxiliary Power Unit (APU), which had allowed oil from the unit to leak into the bleed air system.

SAFETY RECOMMENDATION – 2002-042

The CAA and the JAA should review the design, contrast and conspicuity of wing surface markings associated with overwing emergency exits on all relevant Public Transport aircraft, with the aim of ensuring that the route to be taken from the wing to the ground is marked unambiguously.

Response

The Agency examined this event and another event subject to the same safety recommendation (Embraer ERJ 190-200 LR, G-FBEH, 01/08/2008).

The two AAIB reports highlighted that some passengers were confused because they expected to find a slide at the wing trailing edge.

In addition, the Agency considered the report dated Dec 2009 of 'Study on CS-25 Cabin Safety Requirements' (Project EASA.2008.C18), a study commissioned by the Agency. The aim of this study was to identify both current Cabin Safety threats as experienced in aircraft accidents and future threats that may result from changes in technology. Recommendations have been made on potential changes to airworthiness requirements and research areas. The report did not identify any issue concerning the markings of overwing emergency exits.

Based on this analysis, the Agency could not justify changing the existing specifications of CS25.810(c) on markings of overwing emergency exits.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2002-043

The CAA and JAA should review the requirements for passenger safety cards to ensure that, for aircraft with overwing exits, the safety card is required to clearly depict the emergency escape route(s) from the cabin, via the wing, to the ground.

Response

This safety recommendation is being considered within the framework of rulemaking tasks RMT.0516 and RMT.0517 'Updating Authority Requirements (Part-ARO) and Organisation requirements (Part-ORO)', as indicated in issue 2 of the associated Terms of Reference, which were published on 06 October 2014.

Status – Adequate – Closed

Airbus A320-231	**On approach to Addis Ababa, Ethiopia**	**31 March 2003**	**Serious Incident**

AAIB Formal: AAR 6/2010
FACTOR: N/A

Synopsis

A British Mediterranean Airbus A-320 aircraft, registration G-MEDA operating as flight number LAJ 6711 on a flight from Alexandria (Bourg-el-Arab), Egypt, to Addis Ababa, Ethiopia, carried out two approaches using the Addis Ababa VHF Omni-Directional Radio Range beacon (ADS VOR) and associated Distance Measuring Equipment (DME). On the second approach the aircraft crossed over a ridge of high ground in Instrument Meteorological Conditions (IMC) and came within 56 ft of terrain at a location 5 nm to the northeast of the airport. As the aircraft crossed the ridge the crew, alerted a few seconds earlier by a radio altimeter (RA) height callout, carried out a go-around; at the same time the Enhanced Ground Proximity Warning System (EGPWS) generated a 'TOO LOW TERRAIN' aural alert.

The investigation determined that the antenna of the ADS VOR had suffered water ingress and was not functioning correctly. The correct maintenance procedures for the ADS VOR/DME and its associated monitoring equipment were not followed.

The aircraft received erroneous information from the ADS VOR which was fed to the flight deck VOR display, the Flight Management System (FMS), the navigation displays and the EGPWS computer with its associated Terrain Awareness Display (TAD). A single common position source error thus adversely affected all these apparently independent navigation/situational awareness systems.

The existing certification standards for the aircraft navigation systems were met but were not sufficient to protect against this problem.

SAFETY RECOMMENDATION – 2010-023

It is recommended that the European Aviation Safety Agency and the Federal Aviation Administration review and revise the existing TAWS certification requirements with a view to ensuring that they protect against common mode failures that could induce a CFIT accident. Furthermore the minimum requirements for the navigational accuracy of sources used for TAWS should be tightened to reflect the needs of the system to perform its function. These revised standards should then be applied retrospectively to all aircraft required to be fitted with TAWS.

Response

The function of the Terrain Awareness Warning System (TAWS) is to provide information and alert to the flight crew in order to detect a potentially hazardous terrain situation and take effective action to avoid a Controlled Flight Into Terrain (CFIT).

Although the TAWS is able to check that the signal received from navigational sources, like a ground station (Very High Frequency Omni-Directional Radio Range = VOR), is within a reasonable range, the certification policy assumes that the signal value is correct when it is validated, and ground stations are adequately monitored and controlled by the responsible bodies [airport and Air Traffic Control (ATC)].

The Agency reviewed its database that is synchronised with the accident and statistical information collected by the International Civil Aviation Organization (ICAO). We found no other accidents or serious incidents caused by similar VOR malfunctions.

It is reminded that

- TAWS is not part of the aircraft navigation systems and therefore shall not be used as mitigation means to detect navigation system / data problems or to set navigational data accuracy requirements.
- During this event, some indications were available to the pilots showing that there was a VOR signal problem: First approach: unexpected large heading correction when passing over Addis Ababa (ADS) VOR; VOR beam bar fluctuations during the descent; the Automatic Direction Finder (ADF) indication showing the aircraft to the right of the approach course; the VOR beam bar disappeared. Second approach: height callouts not consistent with the theoretical approach profile.

Status – Not Adequate – Open

Avro 146-RJ100	Approach to Paris	18 March 2005	Incident

AAIB Bulletin: 4/2006
FACTOR: F14/2005

Synopsis

During the winter of 2004/2005, UK-based airline operators experienced numerous incidents of restricted elevator and aileron controls on their Avro 146-RJ100 fleets. One operator also reported occurrences of restricted elevator controls on its Embraer 145 and Bombardier DHC-8 aircraft. These aircraft types are similar in having non-powered flight controls. Other European operators of Avro 146/RJ-series aircraft also reported flight control restriction events during the same period.

Many of these events were found to be associated with residues of 'thickened' de-icing fluids that had accumulated in the aerodynamically 'quiet' areas of the elevator and aileron controls. These residues rehydrate on exposure to precipitation and can freeze at altitude, with the potential for restricting control movement. In most of these incidents, the control forces returned to normal after the aircraft had descended into warmer conditions. Despite recent industry efforts at addressing the problems posed by such residues, an effective solution remains to be found.

This bulletin reiterates the Safety Recommendations issued in a recent AAIB bulletin, which stated that the build-up of such residues must be avoided through a tightly controlled regime of inspection and cleaning, and that new types of thickened fluids must be developed, whose residues do not cause flight control restrictions on aircraft with non-powered flight controls.

SAFETY RECOMMENDATION – 2005-148

It is recommended that prior to the European Aviation Safety Agency assuming responsibility for operational matters within Europe, they consider the future need for the training and licencing of companies who provide a de/anti-icing service, so that anti-icing fluids are applied in an appropriate manner on all aircraft types, but specifically to ensure that the entry of such fluids into flight control mechanisms and control surfaces is minimised.

Response

If de/anti-icing is provided by the operator or its contractor, training and procedural aspects are addressed in CAP.OP.MMPA.250 of Commission Regulation (EU) No 965/2012 (Air Operations) and the associated guidance material. This includes references to technical publications and international standards for addressing for example training on de-anti-icing methods and fluids to be used. The operator is therefore responsible for ensuring that de/anti-icing fluids are applied in an appropriate manner and this should include minimising entry of de/anti-icing fluids into the flight control mechanisms and control surfaces.

However, EASA is not in a position to regulate (eg. Mandate certification) de-icing service providers directly, as ground handling services are outside the scope of regulation (EC) No 216/2008 (The Basic Regulation).

Nevertheless, to assess the areas where other actions within EASA's legal remit could be taken in order to maximise the safety of operations related to ground de/anti-icing, EASA initiated a research project and the report was published in 2011 (EASA.2009/4 Regulation of ground de-icing and anti-icing services in the EASA Member States). As a follow-up, EASA organised a ground De-icing Workshop which took place in 2012. In addition, a Safety Conference on de-icing and anti-icing issues (Icing conditions on ground and in flight) took place in Cologne on 15-16 October 2013 to promote awareness on the subject. The documentation related to the above-mentioned study, workshop and conference are published on the EASA website.

The EASA published the Advanced Notice of Proposed Amendment (A-NPA) No 2007-11 in order to address the issue of residues from the application of de-icing and anti-icing fluids. The outcome of this A-NPA will be used in order to define an EASA action plan to address this issue.

Status – Adequate – Closed

Airbus A320-214	Gatwick	15 July 2005	Accident

AAIB Bulletin: 10/2005
FACTOR: N/A

Synopsis

The left nosewheel detached from the aircraft during the takeoff from London (Gatwick) Airport. Airport staff saw the wheel fall off and the flight crew were notified by Air Traffic Control (ATC). After holding for two hours, to burn off fuel and reduce the landing weight, the aircraft landed safely at Gatwick. The nosewheel detached as the result of the partial seizure of the outer wheel bearing, most probably caused by water contamination of the grease in the bearing.

SAFETY RECOMMENDATION – 2005-074

For newly manufactured aircraft, the European Aviation Safety Agency should require that no single electrical bus failure terminates the recording on both cockpit voice recorder and flight data recorder.

Response

This safety recommendation is considered within the framework of EASA rulemaking task RMT.0249 entitled "Recorders installation and maintenance thereof - certification aspects", whose Terms of Reference were published on 18 September 2014 on the EASA website.

RMT.0249 is dealing with new or revised aircraft certifications specifications (i.e. applicable to new designs). The general objective of this rulemaking task is to improve the availability and quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. One of the specific objectives is to "increase the robustness of flight recorders to a loss of power supply".

Regarding potential requirements applicable to existing designs, this will be considered in the framework of EASA rulemaking task RMT.0308 entitled "Amendment of requirements for data recorders II".

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2005-075

For newly manufactured aircraft, the European Aviation Safety Agency should require that the cockpit voice recorder and cockpit area microphone are provided with an independent 10 minute back-up power source, to which the cockpit voice recorder and cockpit area microphone are switched automatically, in the event that normal power is interrupted.

Response

Regarding backup power for the Cockpit Voice Recorder (CVR), the more flexible concept of 'alternate power source' has been recognised by flight recorder experts and it has replaced the concept of 'recorder independent power supply' in both EUROCAE Document 112A (performance specifications for crash-protected airborne recorders) and ICAO Annex 6 Part I (International commercial air transport operations with aeroplanes).

This safety recommendation is considered within the framework of EASA rulemaking task RMT.0249 entitled "Recorders installation and maintenance thereof - certification aspects", whose Terms of Reference were published on 18 September 2014 on the EASA website.

RMT.0249 is dealing with new or revised aircraft certifications specifications (i.e. applicable to new designs). The general objective of this rulemaking task is to improve the availability and quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. One of the specific objectives is to "increase the robustness of flight recorders to a loss of power supply".

Regarding potential requirements applicable to existing designs, this will be considered in the framework of EASA rulemaking task RMT.0308 entitled "Amendment of requirements for data recorders II".

Status – Partially Adequate – Open

Boeing 777-236	**Short of threshold to RWY 27L, London Heathrow Airport**	**17 January 2008**	**Accident**

AAIB Formal: AAR 1/2010
FACTOR: N/A

Synopsis

Whilst on approach to London (Heathrow) from Beijing, China, at 720 feet agl, the right engine of G-YMMM ceased responding to autothrottle commands for increased power and instead the

power reduced to 1.03 Engine Pressure Ratio (EPR). Seven seconds later the left engine power reduced to 1.02 EPR. This reduction led to a loss of airspeed and the aircraft touching down some 330 m short of the paved surface of Runway 27L at London Heathrow. The investigation identified that the reduction in thrust was due to restricted fuel flow to both engines.

It was determined that this restriction occurred on the right engine at its Fuel Oil Heat Exchanger (FOHE). For the left engine, the investigation concluded that the restriction most likely occurred at its FOHE. However, due to limitations in available recorded data, it was not possible totally to eliminate the possibility of a restriction elsewhere in the fuel system, although the testing and data mining activity carried out for this investigation suggested that this was very unlikely. Further, the likelihood of a separate restriction mechanism occurring within seven seconds of that for the right engine was determined to be very low.

The investigation identified the following probable causal factors that led to the fuel flow restrictions:

1. Accreted ice from within the fuel system released, causing a restriction to the engine fuel flow at the face of the FOHE, on both of the engines.

2. Ice had formed within the fuel system, from water that occurred naturally in the fuel, whilst the aircraft operated with low fuel flows over a long period and the localised fuel temperatures were in an area described as the 'sticky range'.

3. The FOHE, although compliant with the applicable certification requirements, was shown to be susceptible to restriction when presented with soft ice in a high concentration, with a fuel temperature that is below -10°C and a fuel flow above flight idle.

4. Certification requirements, with which the aircraft and engine fuel systems had to comply, did not take account of this phenomenon as the risk was unrecognised at that time.

SAFETY RECOMMENDATION – 2009-030

It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency conduct a study into the feasibility of expanding the use of anti-ice additives in aviation turbine fuel on civil aircraft.

Response

As noted in a previous response dated April 17, 2014, the European Aviation Safety Agency (EASA) and the FAA initiated a study in January 2012 to assess and review the potential for increased usage of fuel system icing inhibitors or anti-ice additives in civil aviation aircraft. The study included a literature review of fuel anti-ice additives, analysis from the literature review, and an assessment of increased usage based on input from users and stakeholders in the aviation industry.

The study was completed in July 2012 and reviewed by the FAA and EASA during a United Kingdom Ministry of Defence Aviation Fuel Committee meeting on March 19-20, 2014. EASA is in the process of conducting their final review and will issue the final report once completed.

The FAA agrees with the intent of Safety Recommendations 09.047 and expects to provide a final response by March 1, 2016.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2009-095

It is recommended that the Federal Aviation Administration amend their requirements for landing gear emergency loading conditions to include combinations of side loads.

Response

As noted in their letter dated August 5, 2014, the FAA planned to revise Title 14, Code of Federal Regulations Section 25.721(a), to require consideration of side loads in addition to upward and aft loads. On October 2, 2014, the FAA issued the final rule for § 25.721, Harmonization of Airworthiness Standards- Miscellaneous Structures Requirements (78 FR 13835), which became effective on December 1, 2014. The final rule can be found at the following web site:

https://federalregister.gov/a/2014-23373

The revised rule states, "The landing gear system must be designed so that when it fails due to overloads during takeoff and landing, the failure mode is not likely to cause spillage of enough fuel to constitute a fire hazard. The overloads must be assumed to act in the upward and aft directions in combination with side loads acting inboard and outboard.

'The accompanying FAA Advisory Circular (AC) 25-30, fuel Tank Strength in Emergency Landing Conditions, issued on October 7. 2014. States, “Failure of the landing gear due to overload should be considered, assuming the overloads act in any reasonable combination of vertical and drag loads…” AC 25-30 can be found at the following web site:

http://rgl.faa.gov/REGULATORY_AND_GUIDANCE_LIBRARY/RGADVISORYCIRCULAR.NSF/0/81BD3117524854b286257d6b00703c07/$FILE/AC_25-30.pdf

The revised rule and guidance provided in the new AC will ensure that failure of the landing gear due to a primarily vertical overload (side-loads) will be considered in the design of future transport category airplanes.

Status – Adequate – Closed

Bombardier BD700 Global Express	**Luton Airport**	**29 January 2008**	**Accident**

AAIB Bulletin: 12/2008
FACTOR: N/A

Synopsis

Following an extended period of heavy rain, the aircraft took off from a dry runway for a long range flight to London Luton Airport. During the subsequent landing roll, the left inboard main landing gear tyre suffered a slide-through failure resulting from an initially locked wheel. This tyre failure caused extensive damage to the flight control system. Although the aircraft landed safely, the investigation revealed a significant flight safety risk.

SAFETY RECOMMENDATION – 2008-074

It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency review the certification requirements for automatically stopping flight recorders within 10 minutes after a crash impact, with a view to including a specific reference prohibiting the use of ‘g’ switches as a means of compliance as recommended in ED112 issued by EUROCAE Working Group 50.

Response

EUROCAE Document 112 revision A (entitled "Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems") was published in September 2013. The provisions of this standard regarding the use of "g" switches to stop a recorder after an accident have been updated. Instead of completely banning its use, ED-112A recommends that this type of sensor shall not be used as sole means of detection. EASA intends to propose amending the applicable regulations accordingly.

Concerning new designs, EASA rulemaking task RMT.0249, entitled "Recorders installation and maintenance thereof - certification aspects", will propose new or revised Certification Specifications. The Terms of Reference of RMT.0249 were published on 18 September 2014 on the EASA website, and refer to this safety recommendation. The general objective of this rulemaking task is to improve the availability and quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. One of the specific objectives is to "prevent premature termination of recording due to the triggering of a negative acceleration sensor".

Status – Partially Adequate – Open

ERJ 190-200 LR	**40 nm NW of Wallasey**	**1 August 2008**	**Serious Incident**

AAIB Bulletin: 6/2010
FACTOR: N/A

Synopsis

The aircraft was operating a scheduled passenger transport flight with the No 2 air conditioning pack inoperative, as permitted by the Minimum Equipment List (MEL). Whilst en route, a failure of the No 1 Air Cycle Machine (ACM) occurred, releasing smoke and fumes into the aircraft. A MAYDAY was declared and an expeditious diversion was carried out. After donning oxygen masks the pilots had great difficulty communicating with each other, ATC and cabin crew, because of technical problems with the masks. During the emergency evacuation the right overwing emergency exit door became jammed and unusable. Passengers who evacuated via the left overwing exit were unaware of how to get from the wing down to the ground.

SAFETY RECOMMENDATION – 2010-007

It is recommended that the European Aviation Safety Agency review the design, contrast and conspicuity of wing surface markings associated with emergency exits on Public Transport aircraft, with the aim of ensuring that the route be taken from wing to ground is marked unambiguously.

Response

The Agency examined this event and another event subject to the same safety recommendation (Fokker F28, G-UKFI, 01/04/2002).

The two AAIB reports highlighted that some passengers were confused because they expected to find a slide at the wing trailing edge.

The Agency considered the report dated Dec 2009 entitled 'Study on CS-25 Cabin Safety Requirements' (Project EASA.2008.C18), a study commissioned by the Agency. The aim of this study was to identify both current Cabin Safety threats as experienced in aircraft accidents, and future threats that may result from changes in technology. Recommendations have been made on potential changes to airworthiness requirements and research areas. The report did not identify any issue concerning the markings of overwing emergency exits.

Based on this analysis, the Agency could not justify changing the existing specifications of CS 25.810(c) on markings of overwing emergency exits.

Status – Adequate – Closed

Airbus A330-243	Montego Bay, Jamaica	28 October 2008	Serious Incident

AAIB Bulletin: 11/2009
FACTOR: N/A

Synopsis

Due to an error in the takeoff performance calculations, incorrect takeoff speeds were used on departure. On rotation, the aircraft initially failed to become airborne as expected, causing the commander to select TOGA power. The aircraft then became airborne and climbed away safely. Whilst the investigation could not identify the exact source of the error, deficiencies were revealed in the operator's procedures for calculating performance using their computerised performance tool.

A study of previous takeoff performance events showed that the number and potential severity is sufficient to warrant additional safeguards to be identified by industry and to be required by regulators.

SAFETY RECOMMENDATION – 2009-080

It is recommended that the European Aviation Safety Agency develop a specification for an aircraft takeoff performance monitoring system which provides a timely alert to flight crews when achieved takeoff performance is inadequate for given aircraft configurations and airfield conditions.

Response

A EUROCAE Working Group (WG-94) was convened in 2012, at the request and with the participation of EASA, with the aim to undertake preparative work to establish the feasibility of the development of (a) EUROCAE standard(s) defining the requirements for a Take Off Performance Monitoring System (TOPMS) that will provide a timely alert to flight crew when the achieved take off performance is inadequate for the given aircraft configuration and aerodrome conditions.

WG-94 issued their report in February 2015, concluding that the development of standards to define performance requirements and operational conditions for TOPMS is not possible at the moment. This is due to a multitude of factors, including the maturity of the technology, a lack of real-time data (e.g. environmental parameters, runway conditions, airport databases, etc) and/or suitable aeroplane performance models, a lack of consensus in design criteria and testing methods. WG-94 activity is therefore terminated. However, it is recognised that the industry will continue investigating technical solutions and this will be monitored. A reactivation of this WG or a new activity may be launched at a later date.

Nevertheless, other actions have been launched to mitigate the safety risk of using or computing wrong aeroplane take-off performance data.

First, concerning the operational approval of Electronic Flight Bags, the Acceptable Means of Compliance (AMC) 20-25 dated 09 February 2014 includes detailed guidelines for the operational evaluation which will improve the protection against the risk of take-off performance calculation errors.

Paragraph D.3.2 of Appendix D to AMC 20-25, entitled 'Performance applications and mass & balance calculations' has different provisions to maximise the clarity of data input and output, and to minimise the risk of errors. For example, a paragraph is dedicated to the risk of errors which exists when making modifications to a previous performance calculation:

"The user should be able to modify performance calculations easily, especially when making last minute changes.

Calculation results and any outdated input fields should be deleted:

i. When modifications are entered;

ii. When the EFB is shut down or the performance application is closed;

and

iii. When the EFB or the performance application have been in a standby or 'background' mode long enough, i.e. such that is likely that when it is used again the inputs or outputs are outdated"

Finally, another potential means which can contribute to mitigate take-off performance data errors is the concept of on board weight and balance system (OBWBS). After a positive feasibility study, a EUROCAE Working Group (WG-88), with participation of EASA, is now working to prepare Minimum Operational Performance Specifications (MOPS). When the MOPS is delivered, the Agency aims to launch a rulemaking activity to propose mandating the installation of OBWBS.

Status – Partially Adequate – Closed

Boeing 737-73V	West of Norwich, Norfolk	12 January 2009	Serious Incident

AAIB Bulletin: 9/2010
FACTOR: N/A

Synopsis

A flight control manual reversion check was being conducted as part of a post-maintenance check flight. During the check, the aircraft pitched rapidly nose-down, descending approximately 9,000 ft before control was recovered. A number of maintenance and airworthiness check issues were identified and six Safety Recommendations were made.

SAFETY RECOMMENDATION – 2010-071

It is recommended that Boeing review their published B737 flight test schedules to improve their clarity and suitability for use by pilots conducting such tests.

Response

Boeing's reference letter outlined their participation in the Flight Safety Foundation's (FSF) Functional Check Flight symposium held in early 2011 and that they would evaluate the FSF's recommendations once they were published. Following the symposium, detailed guidance on how to safely conduct a Functional Check Flight was developed with input from Airbus, Boeing, Bombardier and Embraer. This guidance is available through the Flight Safety Foundation's web site. Called the Functional Check Flight Compendium, this document outlines the best practices used to reduce the risk associated with functional flight tests.

In addition, Boeing developed a course in the conduct of functional check flights; this course has been available to operators since mid-2013. This course provides specific guidance for the different airplane models in the development of flight test profiles. They are also aware that the FSF is working to create a flight test profile for operators, regulators, and leasing companies to use as an industry-accepted standard.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2010-074

It is recommended that Boeing develop an Aircraft Maintenance Manual procedure to identify mis-rigging of the B737 elevator tab control system and amend the Aircraft Maintenance Manual tab adjustment procedure to limit the amount of trim adjustment on any one maintenance input.

Response

Boeing's reference letter provided a response which cited various actions taken over the years to mitigate a mis-rigged tab including a simplified methodology of instructions in the maintenance manual and the development of special tooling. Since that time, they have been monitoring operator communications for improvements and issues. Based on operator input, they have made some further clarifying changes to the instructions and will continue to do so in the future.

Status – Not Adequate – Closed

Cessna 680	**During climb, after departure from London Luton Airport**	**30 September 2010**	**Serious Incident**

AAIB Bulletin: 8/2011
FACTOR: N/A

Synopsis

The crew experienced an uncommanded transfer of fuel from the right to the left fuel tank after following the checklist procedures for a left main electrical bus fault indication. The aircraft subsequently became left wing heavy and exceeded the lateral imbalance limits. It returned to Luton Airport where a flapless landing was completed without further incident. As a result of this incident, Special Bulletin S1/2010 was published on 8 October 2010, containing two Safety Recommendations. The investigation established that the isolation of the left main bus had caused a false fuel cross-feed command which resulted in the uncommanded fuel transfer. The aircraft manufacturer has published a temporary flight crew procedure to mitigate the effects of a recurrence and has also issued a service bulletin to incorporate a design solution.

Eight further Safety Recommendations were made in this bulletin, relating to aircraft certification processes and flight recorder documentation.

SAFETY RECOMMENDATION – 2011-027

It is recommended that the European Aviation Safety Agency review their certification requirements, guidance and procedures to ensure that controlled documentation, sufficient to satisfy operator flight data recorder documentation requirements, are explicitly part of the type certification and supplemental type certification processes where flight data recorder installations are involved.

Response

As a temporary measure, the Agency updated Safety Information Bulletin (SIB) 2009-28, Flight Data Recorder and Cockpit Voice Recorder Systems Serviceability (Revision 1, published on 08 January 2015). SIB 2009-28 Revision 1 recommends that 'the TC or STC Holder should provide the necessary information to convert FDR raw data into flight parameters expressed in engineering units.'

In addition, SIB 2009-28 Revision 1 recommends that National Aviation Authorities transmit to the Agency reports from aircraft operators of cases where a TC or STC holder fails to provide the information needed by an aircraft operator to comply with Commission Regulation

(EU) No 965/2012. Annex IV to this Regulation requires in paragraph CAT.GEN.MPA.195 that the aircraft operator 'keeps and maintains up-to-date documentation that presents the necessary information to convert FDR raw data into parameters expressed in engineering units.'

Furthermore, this safety recommendation is considered within the framework of EASA rulemaking task RMT.0249 entitled "Recorders installation and maintenance thereof - certification aspects", whose Terms of Reference were published on 18 September 2014 on the EASA website.

The general objective of this rule making task is to improve the availability and quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. One of the specific objectives is "optimise data recovery and analysis process by adding provisions to clearly establish the (Supplemental) Type Certificate applicant's obligation to provide the necessary information to convert FDR raw data into engineering units, as well as maintenance procedures".

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2011-029

It is recommended that the European Aviation Safety Agency provides guidance detailing the standards for the flight data recorder documentation required for the certification of systems or system changes associated with flight data recorders.

Response

The Agency accepted to improve the certification specifications to better indicate that the TC (or STC) holder has to provide adequate FDR documentation to the operator or owner of the aircraft.

This subject is part of rulemaking task RMT.0249 entitled "Recorders installation and maintenance thereof - certification aspects", whose Terms of Reference were published on 18 September 2014 on the EASA Website.

In this framework, the Agency will also review the existing FDR documentation standards and will provide guidance in the Certification Specifications. A reference to this safety recommendation has been included in the Terms of Reference of RMT.0249.

Status – Adequate – Closed

Britten-Norman Islander	John A. Osborne Airport, Montserrat	17 April 2011	Accident

AAIB Bulletin: 2/2012
FACTOR: N/A

Synopsis

After a normal landing the right brake failed. The pilot used the left brake to steer the aircraft into the grass to the left side of the runway to avoid the steep drop at its end. After departing the side of the runway the aircraft hit a raised embankment. The loss of right braking was attributed to trapped air in the hydraulic lines which was probably introduced during a right brake O-ring seal replacement prior to the accident flight. Following this repair work the right brakes had not been bled in accordance with the aircraft maintenance manual (AMM). The investigation also revealed that the aircraft manufacturer and some engineering organisations used a different brake bleeding procedure from that published in the AMM.

SAFETY RECOMMENDATION – 2011-093

Britten-Norman Aircraft Limited should review the different brake bleeding procedures for the Islander and Trislander aircraft including those used by engineering organisations, determine the most effective procedure and publish it in the aircraft maintenance manuals.

Response

Britten-Norman Aircraft has reviewed the current published brake bleeding procedures for each of the Islander/Trislander aircraft types and accept there are detail differences between them, despite the brake systems being very similar but not identical. Britten-Norman Aircraft has, however, concluded that they are effective providing that they are followed correctly. Notwithstanding the AAIB report alluding to operator criticism of the published procedures, Britten-Norman Aircraft has not received any recent feedback from operators to this effect nor are they currently aware of any historical criticism.

Status – Adequate – Closed

Airbus A330-343	**Shortly after takeoff from London Gatwick Airport**	**16 April 2012**	**Accident**

AAIB Formal Report: 1/2014
FACTOR: N/A

Synopsis

The aircraft was operating a flight from London Gatwick Airport to McCoy International Airport in Orlando, USA with three flight crew, 10 cabin crew and 304 passengers on board including three infants. Early in the flight the crew received a series of smoke warnings from the aft cargo hold and the commander elected to return to London Gatwick. The crew carried out the appropriate emergency drills, including the discharge of the fire extinguishers in the aft cargo hold, but the smoke warnings continued. The aircraft landed safely, the crew brought it to a halt on the runway and endeavoured to establish the extent of any fire. This produced conflicting evidence and, with smoke warnings continuing, the commander ordered an emergency evacuation.

The passengers all left the aircraft within 90 seconds but two injuries, classed as 'Serious', were incurred. Subsequent examination of the aircraft and its systems showed that the smoke warnings had been spurious.

The investigation identified that injuries were sustained during the evacuation of the aircraft. The evacuation was initiated based on the commander's assessment of the available sources of information, including the repetitive and intermittent nature of the aft cargo smoke warnings.

The investigation identified the following causal factor for the intermittent cargo smoke warnings:

i. A latent fault on the T1 thermistor channel of smoke detector 10WH, in combination with a CAN Bus fault and possible high levels of humidity in the cargo compartment due to the carriage of perishable goods, provided circumstances sufficient to generate multiple spurious aft cargo compartment smoke warnings.

The investigation identified the following contributory factors for the intermittent cargo smoke warnings:

The thermal channel fault in 10WH was not detected prior to the event by the internal smoke detector temperature monitoring.

i. The thermal channel fault in 10WH was not detected prior to the event by the internal smoke detector temperature monitoring.

ii. The proximity of the fire extinguisher nozzles to the smoke detectors.

SAFETY RECOMMENDATION – 2014-005

It is recommended that the European Aviation Safety Agency amend AMC1 CAT.OP.MPA.170, 'Passenger briefing', to ensure briefings emphasise the importance of leaving hand baggage behind in an evacuation.

Response

This safety recommendation is being considered within the framework of rulemaking tasks RMT.0516 and RMT.0517 'Updating Authority Requirements (Part-ARO) and Organisation Requirements (Part-ORO)', as indicated in issue 2 of the associated Terms of Reference, which were published on 06 October 2014.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-006

It is recommended that the European Aviation Safety Agency develops recommendations on the content of visual aids such as safety briefing cards or safety videos to include information on how passengers, including those with young children, should use the escape devices.

Response

This safety recommendation is being considered within the framework of rulemaking tasks RMT.0516 and RMT.0517 'Updating Authority Requirements (Part-ARO) and Organisation Requirements (Part-ORO)', as indicated in issue 2 of the associated Terms of Reference, which were published on 06 October 2014.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-007

It is recommended that Airbus determine the causes of erroneous Controller Area Network (CAN) Bus faults and implement solutions to eliminate such faults.

Response

Airbus launched a test program that combines laboratory and flight test surveys to determine the causes of spurious CAN BUS FAULTs. A further review of Airbus in-service records indicates that the rate of reported occurrences of a spurious CAN BUS FAULT is lower than what was initially assessed during the investigation. This low occurrence rate has prevented Airbus from capturing an occurrence within the frame of the test program.

In addition to being remote, spurious CAN BUS FAULTs have a limited duration:

- Without specific crew or maintenance action, normal operation will be recovered at the next electrical power-up sequence.

- Operators may earlier restore normal operating logic by resetting the SDF in case of maintenance status SMOKE associated with CAN BUS FAULT. This information has been communicated to all involved Operators with TFU 26.10.00.016. This reset is also given in the TSM.

Nevertheless, the test program that Airbus has put in place to determine the causes of erroneous CAN BUS FAULTs will be maintained active.

Given:

- New information not known at the time of publication, i.e. remote probability and limited duration of spurious CAN BUS FAULTs,
- Reset advice given to Operators,
- And the active test program,

Airbus considers that appropriate actions have been implemented.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-008

It is recommended that Airbus amend the dispatch criteria for aircraft with single Controller Area Network (CAN) Bus faults, until such time as the causes of erroneous CAN Bus faults have been identified and addressed.

Response

Spurious smoke detection is being addressed with the introduction of enhanced multi-criteria smoke detectors P/N PMC1103-03 and PMC3101-01.

A further review of Airbus in-service records indicates that the rate of reported occurrences of a spurious CAN BUS FAULT is lower than what was initially assessed during the investigation. Which combined with a spurious smoke detection leads to an even lower occurrence rate of spurious smoke alarms. As a matter of fact, the G-VSXY occurrence is a unique reported case to date.

Exposure to spurious CAN BUS FAULT is limited:

- Without specific crew or maintenance action, normal operation will be recovered at the next electrical power-up sequence.
- Operators may earlier restore normal operating logic by resetting the SDF in case of maintenance status SMOKE associated with CAN BUS FAULT. This information has been communicated to all involved Operators with TFU 26.10.00.016.

Given the remote probability and the limited duration of spurious CAN BUS FAULTs, plus the possibility to reset the FAULT, Airbus considers that addressing the root cause by retrofitting the Smoke Detectors is more appropriate than reviewing the dispatch criteria.

AAIB reassessed this Recommendation response as ‘Adequate – Closed’ on 14 August 2014. This was based on further information from Airbus on their revised risk assessments of the likelihood of CAN BUS failures and their active retrofit programme for the Smoke Detectors units within the fleet.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-009

It is recommended that Siemens amend the Component Maintenance Manual procedures for multi-criteria smoke detectors returned for overhaul, or issue a service letter, to improve fault detection of thermal channel hardware failures which can lead to inaccurate temperature measurement.

Response

In order to comply with this recommendation, Siemens has issued a Service Information Letter (SIL): Appendix SIL PMC-26-001 Rev 0. The SIL has been dispatched to repair stations having repair capacity for concerned multi-criteria smoke detectors. The aim of the SIL is to detect any

previous thermal channel failure by reading the failure event memory and to preventively repair the unit if the failure condition is confirmed during the shop inspection test.

In addition to the Safety Recommendation, the AAIB Report mentions a Safety Action, recalled hereafter, to be deployed by Siemens in order to preventively improve multi-criteria smoke detector manufacturing process.

Safety action by smoke detector manufacturer:

The smoke detector manufacturer identified a number of process improvements, supported by new tooling, in order to reduce the likelihood of any mechanical stresses or unexpected shocks being applied to thermistors during assembly, storage or transportation.

Improvements have been implemented into manufacturing process with two main goals:

- To limit as far as possible thermistors handling during product assembly.
- To prevent thermistors from any unexpected shocks or mechanical stresses which could occur during inappropriate handling, storage or transportation.

Three assembling tools have been deployed in the production line and multi-criteria smoke detector manufacturing procedures have been updated accordingly:

a) One tool used for soldering of thermistors. This tool enables better positioning of board and thermistors during soldering process without handling from the operator.

b) The other tool, which is a kind of additional cover, protects thermistors during board move and intermediate storage between the different workstations on shop floor.

c) The last one, which maintains thermistors and performs positioning when the metallic grid is inserted onto the labyrinth during housing closure step. This is the best solution for saving thermistors handling.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-010

It is recommended that Airbus introduce a maintenance requirement so that, following an activation of the Lower Deck Cargo Compartment (LDCC) fire extinguishing system in an aircraft equipped with multi-criteria smoke detectors, all smoke detectors in the affected cargo compartment are removed for examination and overhaul.

Response

A330 AMM task 26-23-00-200-808-A – “Restoration of the LDCC fire extinguishing system after activation” has been revised with January 2014 revision to request the cleaning of the smoke detectors, which have been exposed to halon discharge (refer to subtask 26-23-00-160-050-A).

This amendment has been, or will also be, incorporated in the AMM for other aircraft families and for all types of detectors installed per the following revisions: A300/A300-600/A310 (June 2014), A320 family (February 2014), A340 (July 2014), and A380 (February 2014).

A350 smoke detectors are located in cavities separated from the fire extinguishing nozzle; therefore they are protected from damage upon discharge.

Appendices:

- Updated AMM task for A330 (involved aircraft type, other AMM references similar).
- A330 versus A350 installations.

AAIB reassessed this Recommendation response as ‘Adequate – Closed’ on 14 August 2014. This was based on further information from Airbus on their change of maintenance requirements that will require the removal and examination of all Smoke Detectors units in an

affected compartment following an activation of the Lower Deck Cargo Compartment (LDCC) fire extinguishing system.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-011

It is recommended that the European Aviation Safety Agency review the certification requirements for the location of fire extinguisher nozzles in relation to the smoke detectors, on aircraft equipped with multi-criteria smoke detectors, in order to minimise the adverse effects associated with activation of the fire extinguishing system.

Response

The Agency is reviewing this event and will determine if any action is needed. Further information will be provided as soon as available.

Status – Not Adequate – Open

Boeing 747-4H6	**On approach to Runway 09R at London Heathrow Airport**	**17 August 2012**	**Serious Incident**

AAIB Bulletin: 4/2014
FACTOR: N/A

Synopsis

Significant vibration was noted on the No 2 engine during departure from London Heathrow Airport. The engine subsequently failed and was shut down by the crew who elected to jettison fuel and return to Heathrow Airport. During the approach for a planned autoland, all three autopilots disengaged, the cockpit displays and lights flickered and a series of fault messages were displayed. The resulting electrical failures culminated in a loss of power to one of the electrical AC buses, and many of the systems powered by this bus were lost or degraded. The commander continued the approach, manually flying the aircraft to a safe landing.

The investigation determined the flickering cockpit displays and lights resulted from a series of failures within the aircraft electrical system, primarily caused by a latent mechanical failure in a Bus Tie Breaker. The effect of this latent failure only became apparent when the aircraft electrical system automatically reconfigured for the planned autoland.

SAFETY RECOMMENDATION – 2014-012

It is recommended that Boeing Commercial Airplanes notify all B747-400 and B747-8 operators of the characteristics of the bus tie breaker mechanical failure on 9M-MPL and nuisance difference current protection trips, emphasising the maintenance actions required if repetitive difference current protection trips occur.

Response

Safety Recommendation 14.054 was assigned to the FAA Aircraft Certification Office, Transport Airplane Directorate (TAD). TAD is evaluating the safety recommendation and working with Boeing to determine the best course of action. The FAA will provide the AAIB with an update on TAD's progress by March 31, 2015. As a result, Safety Recommendation 14.054 will remain classified as open.

Status – Partially Adequate – Open

Boeing 787-8	London Heathrow Airport	12 July 2013	Serious Incident

AAIB Formal Report: AAR 2/2015
FACTOR: N/A

Synopsis

On the afternoon of Friday 12 July 2013 the Air Accidents Investigation Branch (AAIB) was notified of a ground fire in a parked and unoccupied Boeing 787-8 on Stand 592 at London Heathrow Airport.

The aircraft suffered extensive heat damage in the upper portion of the aircraft's rear fuselage, in an area coincident with the location of the Emergency Locator Transmitter (ELT). The absence of any other aircraft systems in this area containing stored energy capable of initiating a fire, together with evidence from forensic examination of the ELT, led the investigation to conclude that the fire originated within the ELT.

The ground fire was initiated by the uncontrolled release of stored energy from the lithium-metal battery in the ELT. It was identified early in the investigation that ELT battery wires, crossed and trapped under the battery compartment cover-plate, probably created a short-circuit current path which could allow a rapid, uncontrolled discharge of the battery. Root Cause testing performed by the aircraft and ELT manufacturers confirmed this latent fault as the most likely cause of the ELT battery fire, most probably in combination with the early depletion of a single cell.

Neither the cell-level nor battery-level safety features prevented this single-cell failure, which propagated to adjacent cells, resulting in a cascading thermal runaway, rupture of the cells and consequent release of smoke, fire and flammable electrolyte. The trapped battery wires compromised the environmental seal between the battery cover-plate and the ELT, providing a path for flames and battery decomposition products to escape from the ELT. The flames directly impinged on the surrounding thermo-acoustic insulation blankets and on the composite aircraft structure in the immediate vicinity of the ELT. This elevated the temperature in the fuselage crown to the point where the resin in the composite material began to decompose, providing further fuel for the fire. As a result, slow-burning fire became established in the fuselage crown and this fire continued to propagate from the ELT location, even after the energy from the battery thermal event was exhausted.

Fourteen Safety Recommendations have been made during the course of the investigation. In addition the ELT manufacturer carried out several safety actions and is redesigning the ELT unit taking into account the findings of this investigation. Boeing and the FAA have also undertaken safety actions.

The following causal factors were identified in the ground fire:

a) A thermal runaway failure of the lithium manganese dioxide battery in the ELT resulted in the uncontrolled release of stored energy within the battery cells.

b) The location and orientation of the ELT, and the compromised seal on the battery cover-plate, allowed the resulting hot gas, flames and battery decomposition products to impinge directly on the aircraft's composite fuselage structure, providing sufficient thermal energy to initiate a fire in the rear fuselage crown.

c) The resin in the composite material provided fuel for the fire, allowing a slow-burning fire to become established in the fuselage crown, which continued to propagate from the ELT location even after the energy from the battery thermal runaway was exhausted.

d) The Navigation Radio System safety assessment conducted in support of the ELT certification, did not identify any ELT battery failure modes which could represent a hazard to the aircraft, and therefore these failure modes were not mitigated in the ELT design or the B787 ELT installation.

The following factors most likely contributed to the thermal runaway of the ELT battery:

a) The trapped ELT battery wires created a short-circuit condition, providing a current path for an unplanned discharge of the ELT battery.

b) The ELT battery may have exhibited an unbalanced discharge response, resulting in the early depletion of a single cell which experienced a voltage reversal, leading to a thermal runaway failure.

c) The Positive Temperature Coefficient (PTC) protective device in the battery did not provide the level of external short-circuit protection intended in the design.

d) There was no evidence that the reset behaviour, and the implications of the variable switching point of the PTC, had been fully taken into account during the design of the ELT battery.

e) The absence of cell segregation features in the battery or ELT design meant the single-cell thermal runaway failure was able to propagate rapidly to the remaining cells.

SAFETY RECOMMENDATION – 2013-017

It is recommended that the Federal Aviation Administration, in association with other regulatory authorities, conduct a safety review of installations of Lithium-powered Emergency Locator Transmitter systems in other aircraft types and, where appropriate, initiate airworthiness action.

Response

The FAA requested a complete list of lithium battery installations (including installations of ELTs with lithium batteries) on transport category airplanes from several Type Certificate (TC) and Supplemental Type Certificate (STC) design approval holders. For each lithium battery installation, the FAA requested each TC or STC holder to describe its cell type, size, chemistry, power capacity, location, intended function, and installation characteristics intended to protect the airplane from battery failure hazards. The FAA also requested specific information regarding the safety assessments conducted in accordance with Title 14, Code of Federal Regulation Section 25.1309, Equipment, Systems, and Installations, that were required for TC and STC approval. The FAA will use the data to determine if airworthiness directives need to be issued.

The FAA expect to provide an updated response to FAA Safety Recommendation 14.009 (AAIB 2013-017) by July 31. 2016.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-020

It is recommended that the Federal Aviation Administration develop enhanced certification requirements for the use of lithium-metal batteries in aviation equipment, to take account of current industry knowledge on the design, operational characteristics and failure modes of lithium-metal batteries.

Response

Status – Response Awaited - Open

SAFETY RECOMMENDATION – 2014-021

It is recommended that the Federal Aviation Administration require that electrical performance and design-abuse certification tests for lithium-metal batteries are conducted with the battery installed in the parent equipment, to take account of battery thermal performance.

Response

Status – Response Awaited – Open

SAFETY RECOMMENDATION – 2014-022

It is recommended that the Federal Aviation Administration work with industry to determine the best method to force a lithium-metal cell into thermal runaway and develop a design-abuse test that subjects a single cell within a lithium-metal battery to thermal runaway in order to demonstrate the worst possible effects during certification testing.

Response

The FAA plans to request that the Radio Technical Commission for Aeronautics (RTCA) task Special Committee 225, Rechargeable Lithium Batteries and Battery Systems, to revise and update RTCA Document Number DO-227, Minimum Operational Performance Standards for Lithium Batteries, for non-rechargeable lithium metal batteries. The revision would include methods to force lithium metal cells into thermal runaway and develop design abuse testing that would subject a single cell within a lithium metal battery to thermal runaway conditions.

The tasking would include exploring the mitigation of the worst possible effects of this condition during certification testing. The FAA plans to include evaluation criteria to ascertain pass/fail criteria under these test conditions.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-023

It is recommended that the Federal Aviation Administration require equipment manufacturers wishing to use lithium-metal batteries to demonstrate (using the design-abuse testing described in Safety Recommendation 2014-022) that the battery and equipment design mitigates all hazardous effects of propagation of a single-cell thermal runaway to other cells and the release of electrolyte, fire or explosive debris.

Response

Status – Response Awaited – Open

SAFETY RECOMMENDATION – 2014-024

It is recommended that the Federal Aviation Administration review whether the Technical Standard Order (TSO) process is the most effective means for the certification of lithium-metal batteries installed in aircraft equipment, the actual performance of which can only be verified when demonstrated in the parent equipment and the aircraft installation.

Response

The FAA believes a Technical Standard Order (TSO) is effective in approving the design and production of an article to meet the Minimum Performance Standards. A TSO alone is not sufficient for certification approval. In order to complete a certification of a lithium metal battery installed in aircraft equipment, an airworthiness regulation approval is required. The airworthiness regulation must be complied with during the Type certification, and Supplemental Type certification (including their respective amendments).

Status – Partially Adequate – Closed

Boeing 737-300	Owen Roberts International Airport, Grand Cayman	15 January 2014	Serious Incident

AAIB Bulletin: 10/2014
FACTOR: N/A

Synopsis

Following an unstable approach to a wet runway, the aircraft was flared for landing but floated along the runway. The commander extended the speed brakes to cause the aircraft to touch down and applied maximum reverse thrust and braking. Reverse thrust was cancelled at a groundspeed of 22 kt with 139 m of runway remaining.

SAFETY RECOMMENDATION – 2014-036

It is recommended that the Civil Aviation Authority of the Cayman Islands review whether accidents and serious incidents are being reported in accordance with the requirements of the Civil Aviation Act 1982 (Overseas Territories) Order 2001 and the Cayman Islands Civil Aviation (Investigation of Air Accidents and Incidents) Regulations.

Response

The Civil Aviation Authority of the Cayman Islands states that the recommended review has been carried out and it is agreed that, in this instance, the required reporting chain was not observed. But for other circumstances, this serious incident may have gone unreported.

The necessity of reporting Accidents and Serious Incidents directly to the AAIB has already been addressed with the Airline and the Airport Authority and an additional release is being drafted for promulgation on the CAACI Web Site and in the quarterly, electronic news bulletin.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-037

It is recommended that the Cayman Islands Airport Authority satisfy itself that it can be confident in the reliability and accuracy of the Automated Weather Observing System installed at Owen Roberts International Airport.

Response

In view of the AAIB findings and recommendations related to the above incident, the Cayman Islands Airports Authority has taken steps to mitigate the reliability and accuracy of wind information passed to aircraft by relocating both the Windsock and AWOS for Runway 08 from its location on the south side of the runway to an obstacle free location on the north side of the Runway adjacent to the Touchdown Zone.

The new location of the AWOS system for Runway 08 in addition to the AWOS for Runway 26 provides the ATCO with the most accurate representation of wind speed and direction of the touchdown zone for each runway and by comparing the readings from both systems the ATCO can be confident in the reliability and accuracy of the information displayed.

Status – Adequate – Closed

Jetstream 3102	Doncaster Airport, Yorkshire	15 August 2014	Accident

AAIB Bulletin: 7/2015
FACTOR: N/A

Synopsis

The aircraft's left main landing gear failed shortly after it landed on Runway 20 at Doncaster Sheffield Airport. The left main landing gear detached from its mounts and the aircraft slid along the runway on its remaining landing gear, left wingtip and baggage pannier, before veering off the runway and coming to rest on the adjacent grass. The single passenger and the flight crew vacated the aircraft without injury. The failure occurred as a result of stress corrosion cracking in the forward pintle housing, at the top of the left landing gear cylinder.

The same aircraft, operating under a different registration, was involved in a similar accident in 2012 during which the right main landing gear failed in the same location, also due to stress corrosion cracking.

This investigation determined that a design solution implemented by the aircraft manufacturer following the 2012 accident, which introduced a protective washer on the forward pintle housing, had not met its original design intent. A fouling condition, not identified when the design solution was first implemented, caused rotational movement of the protective washer on G-GAVA resulting in degradation of the surface protection on the forward pintle housing. This created conditions conducive to the formation of corrosion pits, from which a stress corrosion crack initiated and propagated to failure.

SAFETY RECOMMENDATION – 2014-038

It is recommended that the European Aviation Safety Agency take action to assure the continued airworthiness of those BAE Systems Jetstream 31 main landing gear legs that are manufactured from DTD 5094 aluminium alloy and have SB 32-JM7862 embodied.

Response

The issue is linked to the special washer addressed in SB 32-JM7862. A new inspection Service Bulletin (SB) 32-A-JA140940 is being prepared that will describe the inspection of the special washer installation (as previously mandated by SB 32-JM7862 and Airworthiness Directive (AD) 2013-0206), the actions to take in case of incorrect installation, and the position/condition of the washer, post return to service. Furthermore SB 32-JM7862 will be revised to improve the installation of the special washer. EASA will issue an AD, superseding AD 2013-0206, mandating the above.

Furthermore, SB 32-JM7862 has been revised to improve the installation of the special washer. This improvement was also mandated by the same AD.

AAIB Supplemental Note: The new Service Bulletin (SB) 32-A-JA140940 and revision 3 of SB 32-JM7862 were published by BAE Systems on 3 October 2014. AD 2014-0239 was issued by EASA on 3 November 2014 to mandate these requirements.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-039

It is recommended that the European Aviation Safety Agency take action to mandate an effective inspection regime for the Jetstream 31 that will detect cracking and prevent failure of the yoke pintle of main landing gear legs manufactured from DTD 5094 aluminium alloy.

Response

EASA is working with British Aerospace (BAe) Systems to review and improve the inspection regime required by the Service Bulletin (SB) 32-A-JA851226 and mandated by the Airworthiness Directive (AD) 2013-0208. In the short term, the new SB, that is being produced to check the correct installation of the special washer and thus prevent the stress corrosion, together with the inspections of SB 32-A-JA851226 are deemed to provide an acceptable level of safety. In recognition of the on-going AAIB investigation, due consideration will be given to any and all future findings from the investigation.

AAIB Supplementary Note: The new Service Bulletin (SB) 32-A-JA140940 and revision 3 of SB 32-JM7862 were published by BAE Systems on 3 October 2014. AD 2014-0239 was issued by EASA on 3 November 2014 to mandate these requirements. No change has been made to the method of crack detection using eddy current testing.

Status – Partially Adequate – Open

Aeroplanes <> 2,250 kg and 5,700kg MTWA

BN2A Mk.III-2 Trislander	**27 nm north-east of Alderney, Channel Islands**	**27 March 2012**	**Serious Incident**

AAIB Bulletin: 4/2013
FACTOR: N/A

Synopsis

The aircraft was on a scheduled flight from Alderney Airport, Channel Islands to Southampton International Airport. Shortly after levelling in the cruise, the pilot heard a "very loud bang" and the aircraft experienced severe vibration, which the pilot subsequently identified as a failure of the No. 2 tail-mounted engine. The propeller of the inoperative engine could not initially be feathered, and the pilot was unable to maintain altitude, so he declared an emergency. The propeller blades eventually moved to the feather position and the pilot performed an uneventful landing back at Alderney Airport. The No 2 cylinder on the No 2 engine was subsequently found to have released from the crankcase.

SAFETY RECOMMENDATION – 2013-002

It is recommended that the European Aviation Safety Agency, in collaboration with the UK Civil Aviation Authority, conduct a risk-based assessment of the Britten-Norman BN2 MKIII Series Trislander and BN2 Series Islander aircraft, with respect to one engine inoperative performance and the hazard and probability of an associated failure to feather of the affected engine's propeller.

Response

Britten-Norman (BN) in collaboration with EASA and the UK Civil Aviation Authority has completed a risk assessment which considered the hazard and the probability of a propeller failing to feather after an engine failure and continuing to windmill. The current safety assessment guidance, namely Advisory Circular (AC) 23.1309 (as referenced in CS 23.1309), has been used as guidance. Given that there are insufficient events/flight hours to determine the probability of the event accurately, only its principles of balancing the likely consequences of a hazard against the probability of that hazard occurring have been used.

In terms of consequences of the hazard, BN has shown that in the vast majority of the cases, the aircraft would be able to make a safe landing thus the hazard would be minor. There can be a combination of factors which might result in the inability of the airplane to maintain altitude and ultimately to perform a safe landing. It was not required that such a combination of factors be considered in the requirements in the certification basis of the aircraft, and this remains the case in the current requirements for this class of aircraft.

It is not possible to make a quantitative measurement of the corresponding probability, but the data available supports a qualitative conclusion that the risk associated with the propeller failing to feather after engine failure (and with no further failures) is acceptable.

The relevant events that occurred during the service life of the Islander and Trislander fleet, showing a deficiency of the design or of the maintenance instructions, have been addressed by means of Airworthiness Directives or other appropriate measures. In the case of the event object of the investigation, behind this Safety Recommendation, a Service Letter (SL 121) has been issued addressing maintenance aspects of the engine stud.

Status – Adequate – Closed

OV-10B Bronco	Cotswold (Kemble) Airport, Gloucestershire	10 July 2012	Accident

AAIB Bulletin: 1/2014
FACTOR: F1/2014

Synopsis

The pilot was performing a display practice during which he attempted a barrel roll. Approaching the inverted position, at the top of the manoeuvre, the nose of the aircraft dropped below the horizon and the aircraft entered a steep descent. The pilot had reduced the rate of roll, thinking that it was too fast, but the aircraft continued to pitch through the vertical. The aircraft struck the ground in an approximately wings level, upright attitude with a high rate of descent. There was an immediate post impact fire but the RFFS were on standby and reached the aircraft rapidly. The pilot was assisted from the aircraft having suffered serious injuries.

The investigation identified areas of concern in the granting of regulatory approvals and authorisations, and subsequent related audits.

SAFETY RECOMMENDATION – 2014-001

It is recommended that the Civil Aviation Authority revise Civil Aviation Publication 403, Flying Displays and Special Events: A Guide to Safety and Administrative Arrangements, to ensure that the requirements in Form SRG 1301, Display Pilot Authorisation Application, for an initial application for a display authorisation, also apply to an application to extend the privileges of a display authorisation.

Response

The CAA accepts this recommendation. Civil Aviation Publication 403 Flying Displays and Special Events: A Guide to Safety and Administrative Arrangements is currently under review and will be amended to reflect this recommendation. The application form SRG 1302 will be amended to reflect the change for Display Authorisation upgrades. This action is planned to be completed by December 2014.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-002

It is recommended that the Civil Aviation Authority extend the requirement in Civil Aviation Publication 403, Flying Displays and Special Events: A Guide to Safety and Administrative Arrangements, for mentoring, as required during the application process for an initial Display Authorisation, to apply to the application process to extend those privileges.

Response

The CAA accepts this recommendation. Civil Aviation Publication 403 Flying Displays and Special Events: A Guide to Safety and Administrative Arrangements will be amended to reflect this recommendation. The application forms SRG1301 and SRG 1302 will be amended to include the requirement for mentoring during the initial and upgrade process for Display Authorisations. This action is planned to be completed by December 2014.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-003

It is recommended that the Civil Aviation Authority revises its procedures for granting or amending approvals under Civil Aviation Publication 632 and Civil Aviation Publication 553, Chapter A8-20, to ensure consultation takes place between the Flight Operations and Airworthiness capability teams of the Safety and Airspace Regulation Group.

Response

The CAA accepts this recommendation. Civil Aviation Publication 632; Operation of "Permit to Fly" Ex-Military Aircraft on the UK register will be reviewed and amended to reflect this recommendation.

Additionally, the CAA is in the process of transitioning organisations approved in accordance with Civil Aviation Publication 553 Chapter A8-20 to revised approvals in accordance with new Chapters A8-23, A8-24 and A8-25. As part of this process the CAA will review and amend the procedures supporting these approvals to reflect this recommendation. The CAA has put in place action to support industry to transition to the new approvals by 31 January 2016.

Furthermore, the consultation element of the recommendation will also be addressed by the formation of the Safety and Airspace Regulation Group's General Aviation Unit. This Unit will be responsible for all the approvals referenced in this recommendation that were previously granted separately by the SARG Flight Operations and Airworthiness Capability Teams.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-004

It is recommended that the Civil Aviation Authority revises its procedures for auditing approvals which have been granted under Civil Aviation Publication 632 and Civil Aviation Publication 553, Chapter A8-20, to ensure that the audits completed by the Flight Operations and Airworthiness capability teams of the Safety and Airspace Regulation Group are conducted in a coordinated manner, so that all aspects of the operation and maintenance are adequately assessed.

Response

The CAA accepts this recommendation. Civil Aviation Publication 632; Operation of "Permit to Fly" Ex-Military Aircraft on the UK register will be reviewed and amended to reflect this recommendation.

Additionally, the CAA is in the process of transitioning organisations approved in accordance with Civil Aviation Publication 553 Chapter A8-20 to revised approvals in accordance with new Chapters A8-23, A8-24 and A8-25. As part of this process the CAA will review and amend the procedures supporting these approvals to reflect this recommendation. The CAA has put in place action to support industry to transition to the new approvals by 31 January 2016.

Furthermore, the audit co-ordination element of the recommendation will also be addressed by the formation of the Safety and Airspace Regulation Group's General Aviation Unit. This Unit will be responsible for all the approvals referenced in this recommendation that were previously granted separately by the SARG Flight Operations and Airworthiness Capability Teams.

Status – Adequate – Closed

Cessna 525A CJ2+	**5.7 nm north-west of Coventry, Warwickshire**	**31 December 2013**	**Accident**

AAIB Bulletin: 1/2015
FACTOR: N/A

Synopsis

As the aircraft approached its cruising altitude of FL430, the pilot was not monitoring the indicated airspeed and the aircraft stalled, departing from controlled flight in a series of five 360° rolls to the right. The pilot briefly regained control before the aircraft stalled again and in the following recovery, the aircraft's wings were damaged in overload. The pilot made a successful landing and examination of the aircraft's recorded data revealed that the angle of attack (AOA) sensing system had 'stuck' in flight and the aircraft's stall warning system did not operate prior to the stall onset.

SAFETY RECOMMENDATION – 2014-041

It is recommended that the Federal Aviation Administration requires the Cessna Aircraft Company, as the Type Certificate holder for the Citation CJ2+ aircraft, to conduct a survey of recorded flight data from Safe Flight Instrument Corporation model C-12717-1 angle-of-attack vane units, to determine the frequency of 'sticking' (static) angle-of-attack data.

Response

These safety recommendations have been assigned to the FAA's Wichita Aircraft Certification Office (ACO). The ACO has requested Textron Aviation to investigate the areas discussed by these Recommendations and review the appropriateness of implementation.

The FAA expects to provide an updated response to safety recommendations 15.028 and 15.029 by July 31, 2015.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-042

It is recommended that the Federal Aviation Administration requires the Cessna Aircraft Company, as the Type Certificate holder for the Citation CJ2+ aircraft, to use the results of their survey (Safety Recommendation 2014-041) of recorded flight data from Safe Flight Instrument Corporation model C-12717-1 angle-of-attack vane units to amend the safety assessment of the aircraft's stall warning system.

Response

These safety recommendations have been assigned to the FAA's Wichita Aircraft Certification Office (ACO). The ACO has requested Textron Aviation to investigate the areas discussed by these Recommendations and review the appropriateness of implementation.

The FAA expects to provide an updated response to safety recommendations 15.028 and 15.029 by July 31, 2015.

Status – Partially Adequate – Open

Aeroplanes = or < 2,250 kg MTWA

Breezer B600	**Membury Airfield, Berkshire**	**25 June 2011**	**Accident**

AAIB Bulletin: 5/2012
FACTOR: N/A

Synopsis

Shortly after takeoff the engine stopped due to a loss of fuel pressure and the pilot made a forced landing which resulted in a heavy touchdown. The engine stoppage was probably caused by a fuel restriction when a placard blocked the fuel tank outlet. The fuel tank outlet was not fitted with a strainer or filter as none was required by the regulations for a 'Light Sport Aeroplane' (LSA). The aircraft manufacturer has taken safety action to install a fuel strainer at the fuel tank outlet of all new aircraft and is offering the same modification for retrofit.

SAFETY RECOMMENDATION – 2012-021

It is recommended that ASTM International amend the 'Standard Specification for Design and Performance of a Light Sport Airplane' (ASTM F2245) to require the installation of a strainer at the fuel tank outlet, to reduce the risk of foreign objects in the fuel tank restricting the fuel supply.

Response

Technical committee F37 on Light Sport Aircraft has completed the consensus process work to include the recommended amendment. All of the changes described herein were approved in the 2012d revision and remain active.

Both the United States Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) participated in the development of the revised language now published in the standard. The US FAA accepted these revisions in June 2013. On the 29th of July 2013, EASA issued CS-LSA Amendment 1 which mandates usage of the updated standard for any future type certification.

The following revisions were approved:

1. Both a fuel strainer and filter are now required to be installed, both accessible for inspection, cleaning or replacement. The old standard required installation of a strainer or a filter, without further detailing.

2. The strainer must satisfy specific design requirements, and must be installed inside each fuel tank to reduce the risk of foreign objects or contamination.

3. The filter is required to be between the tank outlet and the engine.

For the specific language of the revised requirements, please review the complete copy of F2245.

Status – Adequate – Closed

Microlights

No Safety Recommendations were made in this section.

Rotorcraft > 5,700kg MTWA or above

EC225 LP	**The ETAP Central Production Facility Platform in the North Sea**	**18 February 2009**	**Accident**

AAIB Formal: AAR 1/2011
FACTOR: F9/2009

Synopsis

The Helicopter departed Aberdeen Airport at 1742 hrs on a scheduled flight to the Eastern Trough Area Project (ETAP). The flight consisted of three sectors with the first landing being made, at night, on the ETAP Central Production Facility platform. Weather conditions at the platform deteriorated after the aircraft departed Aberdeen; the visibility and cloud base were estimated as being 0.5 nm and 500 ft respectively. At 1835 hrs the flight crew made a visual approach to the platform during which the helicopter descended and impacted the surface of the sea. The helicopter remained upright, supported by its flotation equipment which had inflated automatically. All those onboard were able to evacuate the helicopter into its life rafts. Both air and maritime Search and Rescue (SAR) assets were used to recover the survivors.

The investigation identified the following causal factors:

1. The crew's perception of the relative position and orientation of the helicopter to the platform during the final approach was erroneous. Neither crew member was aware that the helicopter was descending towards the surface of the sea. This was probably due to the effects of oculogravic and somatogravic illusions combined with both pilots being focussed on the platform and not monitoring the flight instruments.

2. The visual picture was possibly confused by a reflection of the platform in the sea.

3. The two radio altimeter based height alert warnings did not activate. The fixed 100 ft alert failed to activate due to a malfunction of the Terrain Awareness and Warning System (TAWS) and the selectable 150 ft alert would also have failed to activate for the same reason, had it not already been suspended by the crew. The pilots were not aware of the TAWS malfunction.

4. There was no specified night visual approach profile on which the crew could base their approach and minimum heights, and stabilised approach criteria were not specified.

SAFETY RECOMMENDATION – 2011-063

It is recommended that the European Aviation Safety Agency, in conjunction with the Federal Aviation Administration, defines standards governing the content, accuracy and presentation of obstacles in the Terrain Awareness and Warning System obstacle database for helicopters operating in the offshore environment.

Response

EASA has issued European Technical Standard Order (ETSO) C194 Helicopter Terrain Awareness and Warning System (HTAWS) in amendment 7 of Certification Specifications for European Technical Standard Orders (CS-ETSO) applicable since 05 July 2012 for new designed HTAWS. ETSO-C194 endorses Radio Technical Commission for Aeronautics (RTCA) Document DO-309, Minimum Operational Performance Standards (MOPS) for HTAWS Airborne Equipment, dated 13 March 2008, as the applicable requirements for the Terrain Awareness and Warning System obstacle database and refers further to EUROCAE ED-76/RTCA DO-200A, Standards for Processing Aeronautical Data, as the applicable standard for the processing of such database. The standard is giving the responsibility to the equipment manufacturer to demonstrate that the accuracy and resolution of the obstacle database is

suitable for the intended operation [DO-309 2.4.3.4.b]. EASA considers that the standards to define accuracy and presentation of obstacles in the database of the equipment are adequate. These requirements are passed along the database supply chain. This is facilitated through the EUROCAE ED-76/RTCA DO-2001 process standard.

Regarding the updating of the Terrain and Obstacle Databases, in order to ease the oversight of the database supply chain EASA is offering the voluntary Letter of Acceptance process based on EASA opinion 1/2005, which can be used for aeronautical data published by states. With Opinion 02/2015 'Technical requirements and operating procedures for the provision of data to airspace users for the purpose of air navigation' EASA is proposing to the Commission to mandate organisation oversight for aeronautical database providers instead of the current voluntary process oversight.

The data quality requirements on the interface between states and database providers for obstacle data are defined in EUROCAE ED-98/RTCA DO-276 'User Requirements for Terrain and Obstacle Data'. Annex 15 of the Chicago Convention establishing the International Civil Aviation Organization (ICAO) requires states to publish obstacle data. Additionally, European Commission Regulation (EU) No 73/2010 lays down requirements on the quality of aeronautical data and aeronautical information for the single European sky.

The operator is responsible for ensuring that the aeronautical database used is adequate for the intended operation. With Opinion 02/2015 it is proposed to the Commission to amend Commission Regulation (EU) No 965/2012 CAT.IDE.H.355 and further guidance material is developed to ensure controlled handling of state published obstacle data along the database chain.

In case the state is not publishing obstacle data of sufficient quality or coverage, but such data is identified to be needed either by the equipment manufacturer or the operator, the proposed regulation in Opinion 02/2015 has provisions to allow data enhancement along the data chain.

EASA considers that all elements are in place, to govern the issuance and use of obstacle data in respect to content, accuracy and presentation of obstacles in the Terrain Awareness and Warning System for helicopters including the operating in offshore environment.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2011-067

It is recommended that the Federal Aviation Administration modifies Technical Standard Order (TSO) C70a to include a requirement for multi-seat life rafts, that do not automatically deploy their Sea Anchor, to include a label, visible from within the inflated raft, reminding the occupants when to deploy the Sea Anchor.

Response

The FAA's Aircraft Certification Service, Design, Manufacturing, and Airworthiness Division published TSO-C70b, Life Rafts, on August 4, 2014. TSO-C70b can be found at the following Web site:

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgTSO.nsf/0/E85891F0E71796E486257D2B005782D5?OpenDocument

The revised TSO's minimum performance standard includes the Society of Automotive Engineers Aerospace Standard (AS) 1356, Life Rafts. AS 1356 contains the following new requirement in paragraph 8.3.8:

A Sea Anchor that is not automatically deployed shall be stowed in a readily accessible location that is clearly marked and visible from within the inflated life raft, including instructions for Sea Anchor use.

Status – Adequate – Closed

AS332L2	**11 nm NE of Peterhead, Scotland**	**1 April 2009**	**Accident**

AAIB Formal: AAR 2/2011
FACTOR: F9/2011

Synopsis

The helicopter was operating a return scheduled passenger flight from Aberdeen to the Miller Oil Platform, situated in the North Sea approximately 145 nm north-east of Aberdeen. When it arrived from its previous flight to the Bruce Platform, approximately 190 nm north-east of Aberdeen, a 'rotors running' crew change was carried out. The helicopter was serviceable except for a deferred defect affecting a part of its ice detection system. The daily in-flight checks had already been completed satisfactorily by the off-going crew. The helicopter was refuelled, the passengers boarded, and it lifted off at 1040 hrs. The helicopter landed on the Miller platform, after an uneventful flight, at 1149 hrs, where it was refuelled again with the rotors-running. When the refuelling was complete, fourteen passengers boarded the helicopter for the return flight to Aberdeen. The weather conditions were benign with light south to south-easterly winds, good visibility with generally clear skies but with occasional broken cloud at 5,000 to 6,000 ft. Flying conditions were reported as smooth and the sea was calm.

The helicopter lifted from the Miller Platform at 1203 hrs and climbed to 2,000 ft, tracking inbound towards Aberdeen. Recorded information on the combined Cockpit Voice and Flight Data Recorder (CVFDR) shows that the crew were engaged in routine cockpit activities and there were no operational abnormalities. At 1254 hrs the co-pilot made a routine call on the company operating frequency stating that the helicopter was serviceable and the ETA was 1314 hrs. Twelve seconds later, one of the pilots made a brief MAYDAY call on the ATC frequency. This was followed by a similar call that included some position information, from the other pilot. The radar controller at Aberdeen acknowledged the MAYDAY call and tried unsuccessfully to contact the crew. He then asked the crew of another helicopter, outbound on a similar routing, to examine the sea in the area of the last radar position.

Recorded radar information showed the helicopter flying inbound towards Aberdeen at 2,000 ft, climbing momentarily to 2,200 ft and then turning right and descending rapidly. Surface visibility was good and an eye witness, working on a supply vessel approximately 2 nm from the accident site, heard the helicopter and saw it descend rapidly before it hit the surface of the sea. Immediately after impact he saw the four main rotor blades, still connected at their hub, strike the water. Around this time, he also heard two bangs close together. He immediately raised the alarm and the ship turned towards the accident site, which by now was marked by a rising column of grey then black smoke. The ship launched a fast rescue boat whilst making way towards the scene. The crew of this boat and the helicopter arrived promptly on the scene to discover an area of disturbed water, roughly 150 m in diameter containing debris from the helicopter. Other search and rescue vessels, aircraft and helicopters arrived on scene within 40 minutes. All persons on board were fatally injured.

SAFETY RECOMMENDATION – 2011-045

It is recommended that the European Aviation Safety Agency require the 'crash sensor' in helicopters, fitted to stop a Cockpit Voice Recorder in the event of an accident, to comply with EUROCAE ED62A.

Response

This safety recommendation is considered within the framework of EASA rulemaking task RMT.0249 entitled "Recorders installation and maintenance thereof - certification aspects", whose Terms of reference were published on 18 September 2014 on the EASA website.

RMT.0249 is dealing with new or revised aircraft certifications specifications (ie applicable to new designs). The general objective of this rulemaking task is to improve the availability and

quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. One of the specific objectives is to "prevent premature termination of recording due to the triggering of a negative acceleration sensor".

Regarding potential requirements applicable to existing designs, this will be considered in the framework of EASA rulemaking task RMT.0308 entitled "Amendment of requirements for data recorders II".

Status – Partially Adequate – Open

EC225 LP	**20m E of Aberdeen**	**10 May 2012**	**Accident**
EC225 LP	**Approx 32nm SW of Sumburgh, Shetland Islands**	**22 October 2012**	**Accident**

AAIB Formal: AAR 2/2014
FACTOR: N/A

Synopsis

While operating over the North Sea, in daylight, the crews of G-REDW and G-CHCN experienced a loss of main rotor gearbox oil pressure, which required them to activate the emergency lubrication system. This system uses a mixture of glycol and water to provide 30 minutes of alternative cooling and lubrication. Both helicopters should have been able to fly to the nearest airport; however, shortly after the system had activated, a warning illuminated indicating that the emergency lubrication system had failed. This required the crews to ditch their helicopters immediately in the North Sea. Both ditchings were successful and the crew and passengers evacuated into the helicopter's liferafts before being rescued. There were no serious injuries.

The loss of oil pressure on both helicopters was caused by a failure of the bevel gear vertical shaft in the main rotor gearbox, which drives the oil pumps. The shafts had failed as result of a circumferential fatigue crack in the area where the two parts of the shaft are welded together.

On G-REDW the crack initiated from a small corrosion pit on the countersink of the 4 mm manufacturing hole in the weld. The corrosion probably resulted from the presence of moisture within the gap between the PTFE plug and the countersink. The shaft on G-REDW had accumulated 167 flying hours since new.

On G-CHCN, the crack initiated from a small corrosion pit located on a feature on the shaft described as the inner radius. Debris that contained iron oxide and moisture had become trapped on the inner radius, which led to the formation of corrosion pits. The shaft fitted to G-CHCN had accumulated 3,845 flying hours; this was more than any other EC225 LP shaft.

The stress, in the areas where the cracks initiated, was found to be higher than that predicted during the certification of the shaft. However, the safety factor of the shaft was still adequate, providing there were no surface defects such as corrosion.

The emergency lubrication system operated in both cases, but the system warning light illuminated as a result of an incompatibility between the helicopter wiring and the pressure switches. This meant the warning light would always illuminate after the crew activated the emergency lubrication system.

A number of other safety issues were identified concerning emergency checklists, the crash position indicator and liferafts.

Ten Safety Recommendations were made. In addition, the helicopter manufacturer carried out several safety actions and is redesigning the bevel gear vertical shaft taking into account the findings of the investigation. Other organisations have also initiated a number of safety actions as a result of this investigation.

The following causal factors were identified in the ditching of both helicopters:

a) A 360º circumferential high-cycle fatigue crack led to the failure of the main gearbox bevel gear vertical shaft and loss of drive to the oil pumps.

b) The incompatibility between the aircraft wiring and the internal configuration of the pressure switches in both the bleed-air and water/glycol (Hydrosafe 620) supplies resulted in the illumination of the MGB EMLUB caption.

The following factors contributed to the failure of the EC225 LP main gearbox bevel gear vertical shafts:

a) The helicopter manufacturer's Finite Element Model underestimated the maximum stress in the area of the weld.

b) Residual stresses, introduced during the welding operation, were not fully taken into account during the design of the shaft.

c) Corrosion pits were present on both shafts from which fatigue cracks initiated:

   i On G-REDW the corrosion pit was located at the inner countersink in the 4.2 mm hole and probably resulted from the presence of moisture within the gap between the PTFE plug and the countersink.

   ii On G-CHCN the corrosion pit was located at the inner radius and probably resulted from moisture trapped within an iron oxide deposit that had collected in this area.

SAFETY RECOMMENDATION – 2014-013

It is recommended that the European Aviation Safety Agency provide Acceptable Means of Compliance (AMC) material for Certification Specification (CS) 29.1585, in relation to Rotorcraft Flight Manuals, similar to that provided for Aeroplane Flight Manuals in AMC 25.1581 to include cockpit checklists and systems descriptions and associated procedures.

Response

An amendment of the Acceptable Means of Compliance where EASA would take into account the specificity of helicopter type and intended operations is under consideration.

An update will be provided as soon as any progress is available.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-014

It is recommended that the liferaft manufacturer, Survitec Group Limited, revises the Component Maintenance Manual for the Type 18R MK3 liferaft to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when packing the liferaft.

Response

The CMM for the 18R Mk3 Heliraft (RFD 25-60-96) has been updated to Revision 5. This version includes clearer instruction on the packing procedures and routing of the mooring and equipment lines. The update was released to all registered holders of the CMM on 11th July 2014.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-015

It is recommended that the aircraft manufacturer, Eurocopter Group, revise the Super Puma Aircraft Maintenance Manual Task 25-66-01-061 'Removal-Installation of the Liferaft Assembly' to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when installing the liferaft.

Response

Airbus Helicopters has considered this Safety Recommendation and the Aircraft Manual Task 25-66-01-061 will be revised to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when installing the liferaft.

A copy of the revised instruction will be provided to the AAIB as soon as available.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-016

It is recommended that the European Aviation Safety Agency review the installation of the Type 18R MK3 liferaft in the EC225 sponson to ensure that there is a high degree of deployment reliability in foreseeable sea conditions.

Response

In cooperation with Airbus Helicopters, EASA has initiated a review of the installation of the Type 18R MK3 liferafts in the sponsons of the EC225 helicopter with the aim of checking the actual degree of deployment reliability of the liferafts for the current certificated sea conditions. As part of this review, consideration will be given to liferaft deployment service experience on EC225 and other equivalent Super-Puma helicopters.

The outcome of the review will be provided when available.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-017

It is recommended that the European Aviation Safety Agency develop certification requirements for externally mounted liferafts fitted to offshore helicopters which ensure a high degree of deployment reliability in foreseeable sea conditions.

Response

The drafting group of rulemaking task RMT.0120 is currently considering a broad range of helicopter ditching, water impact and survivability issues, with the objective of reviewing existing rules and ensuring that they are and remain appropriate to meet identified hazards. A review of existing equipment standards (ETSOs) forms part of this task, including those related to life rafts (ETS0-2C70b and ETS0-2C5O5). The drafting group is aware that neither of these standards was developed specifically with external mounting in mind, and therefore do not contain specific test provisions to ensure correct, effective and reliable deployment in all foreseeable sea conditions and fuselage attitudes. This safety recommendation is therefore taken into account.

The drafting group is also working to identify other shortcomings with the existing standards from previous accident investigations.

Once the overall review is complete, the drafting group will propose adequate changes to equipment standards and also possibly to rotorcraft certification specifications (CS-27 and CS-29).

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-018

It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that the long mooring line on liferafts fitted to offshore helicopters is long enough to enable the liferaft to float at a safe distance from the helicopter and its rotor blades.

Response

The drafting group of rulemaking task RMT.0120 is currently considering a broad range of helicopter ditching, water impact and survivability issues, with the objective of reviewing existing rules and ensuring that they are and remain appropriate to meet identified hazards.

The issue mentioned in this safety recommendation is already known and taken into account by the drafting group, and it will form part of its proposed changes to the design requirements.

Status – Partially Adequate – Open

SAFETY RECOMMENDATION – 2014-019

It is recommended that the European Aviation Safety Agency commission research into the fatigue performance of components manufactured from high strength low alloy steel. An aim of the research should be the prediction of the reduction in service-life and fatigue strength as a consequence of small defects such as scratches and corrosion pits.

Response

In 2012 EASA commissioned a research project, Engine Rotor Material Damage Tolerance (EROMDAT), addressing damage resistance and fatigue tests for high-strength materials used for engine rotating parts.

A final project meeting is planned with the engine manufacturers involved in the project in September 2014.

EASA will take the opportunity of this meeting to discuss with the participants about the applicability of proposed test methods on other metallic materials (low alloy steel) used for rotorcraft main gearbox design.

Status – Partially Adequate – Open

Rotorcraft <> 2,250 kg and 5,700kg MTWA

MD 900	**Leeds Bradford Airport**	**29 July 2011**	**Accident**

AAIB Bulletin: 5/2012
FACTOR: N/A

Synopsis

Approximately one minute after landing, and whilst stationary on the ground, the forward cross tube of the helicopter's skid landing gear fractured, damaging the helicopter but not causing any injuries to the crew onboard. The forward cross tube had failed due to a fatigue crack beneath the right side stop clamp. It was determined that although the clamp had not been removed from the cross tube during scheduled maintenance, as required by the Rotorcraft Maintenance Manual, the maintenance instructions were ambiguous regarding the requirement to inspect of the area of the forward cross tube beneath the side stop clamps.

SAFETY RECOMMENDATION – 2012-004

It is recommended that the Federal Aviation Administration require MD Helicopters to determine a suitable inspection method and interval for periodic detailed examination of the landing gear cross tubes on the MD900 helicopter.

Response

The FAA agrees with both recommendations (2012-004 and 2012-042). On July 23, 2012, MD Helicopters, Inc. (MDHI) issued Service Bulletin (SB) 900-119. This specifies a one-time inspection of the forward and aft cross tubes. The SB recommends that inspection results be sent to MDHI. This data will be used to determine the repetitive inspection interval of the cross tubes that will be added as a revision to the maintenance manual.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2012-005

It is recommended that the Federal Aviation Administration require that MD Helicopters amend the MD900 Rotorcraft Maintenance Manual to require visual examination of the area of forward and aft cross tube, exposed when the forward and aft side stop clamps are removed, as part of the periodic maintenance schedule.

Response

The FAA agrees with both recommendations (2012-004 and 2012-042). On July 23, 2012, MD Helicopters, Inc. (MDHI) issued Service Bulletin (SB) 900-119. This specifies a one-time inspection of the forward and aft cross tubes. The SB recommends that inspection results be sent to MDHI. This data will be used to determine the repetitive inspection interval of the cross tubes that will be added as a revision to the maintenance manual.

Status – Adequate – Closed

Sikorsky S-76C	Peasmarsh, East Sussex	3 May 2012	Serious Incident

AAIB Bulletin: 12/2014
FACTOR: 1/2015

Synopsis

The helicopter descended towards the tops of trees following a discontinued night approach to a private landing site in conditions of reduced visibility and low cloud, when no go-around procedure or routing was available or briefed.

SAFETY RECOMMENDATION – 2014-035

It is recommended that the Civil Aviation Authority review the regulations that permit a helicopter engaged in public transport operations to descend below MSA for the purpose of landing, when flying in instrument meteorological conditions but not on a published approach procedure.

Response

The CAA accepts this recommendation and has reviewed the regulations associated with public transport helicopter operations that permit descent below MSA for the purpose of landing when in instrument meteorological conditions. The CAA intends to liaise with industry by March 2015 and develop amendments to the Rules of the Air that address the minimum heights for aircraft flying under the Instrument Flight Rules. As these regulations are now covered by the Standardised European Rules of the Air (SERA), the CAA will make any proposals to EASA for consideration of change under their rule making process. When the amendments have been developed, the CAA will consider issuing a Safety Directive to implement the necessary changes.

The CAA have had initial liaison with industry through the BHA and subsequently have identified, from the AAIB recommendation SR 2014-35 and emerging findings following another recent helicopter accident, that a broader and deeper review of IFR flying outside controlled airspace in general is advised. It is intended that a multi-disciplined review be initiated, potentially involving industry participation, to review the whole subject and produce recommendations and suggested courses of action. Target date for completion is now 1 October 2015.

Status – Adequate – Closed

Rotorcraft = or < 2,250 kg MTWA

Bell 206B Jet Ranger III	Priors Park Wood, 5nm south of Taunton, Somerset	22 January 2005	Accident

AAIB Bulletin: 1/2006
FACTOR: F8/2006

Synopsis

The pilot had planned to fly with some friends from Staverton Airport, near Gloucester, to a private landing site in the Torbay area but, due to deteriorating weather, landed at Topsham to the south of Exeter Airport. After a period of several hours, the weather had not improved so the pilot decided to return to Staverton. Although on the outbound trip he had routed south via the Bristol Channel and the M5 corridor, an area of low lying terrain, he elected to return to Staverton via Sidmouth, and communicated this to Exeter ATC, advising them that he would be flying at an altitude of 900 ft. As he approached Sidmouth, he then informed Exeter that he was going to go north towards Wellington and Taunton. This route would take the helicopter over the Blackdown Hills, which rise to a height of some 1,000 ft amsl. Witnesses in an area approximately 5nm south of Taunton generally heard, but did not clearly see, a low flying helicopter and one heard a 'bang'. A subsequent search and rescue effort failed to locate the helicopter, due to very poor weather conditions, and it was found by a dog walker the following morning. All four occupants had received fatal injuries in the accident. No pre-accident defects were found during the wreckage examination.

SAFETY RECOMMENDATION – 2005-101

The European Aviation Safety Agency should promote the safety benefits of fitting, as a minimum, cockpit voice recording equipment to all aircraft operated for the purpose of commercial air transport, regardless of weight or age.

Response

The Agency's rulemaking tasks RMT.0271 and RMT.0272 [former MDM.073 (a) and (b)] 'In-flight recording for light aircraft' were launched on 25 July 2014 with the publication of the associated Terms of Reference.

This safety recommendation is being considered within the framework of these tasks.

Status – Partially Adequate – Open

Robinson R22 Beta	Ely, Cambridgeshire	6 January 2012	Accident

AAIB Bulletin: 2/2013
FACTOR: N/A

Synopsis

The Robinson R22 helicopter was flying from Manston to Fenland. Near Ely, witnesses on the ground saw it pitch and roll rapidly, the two main rotor blades separated from the rotor head and the aircraft fell to the ground. The pilot was fatally injured.

SAFETY RECOMMENDATION – 2012-038

The European Aviation Safety Agency should amend the requirements in Certification Specification Part 27 to reduce the risk of 'loss of main rotor control' accidents in future light helicopter designs.

Response

EASA launched a study entitled 'Regulatory Impact Assessment (RIA) to support future rulemaking on single engine helicopters with increased pilot intervention times following power failure'. It was completed and its final report published on EASA website in April 2014.

The final outcome can be summarised as follows:

1. From a safety standpoint alone, the study proposed that moving to a 2 second time delay (all flight conditions) would be desirable.

2. Both existing and new technologies are available or being developed that could achieve the desired time delay, but come with a weight/cost penalty. For example, adding a stored energy device or electric motor, would add approximately the same weight as additional blade tip-weights.

3. The cost/benefit analysis shows an imbalance between safety benefit and the associated costs. Safety data has been key in this study. With very few accidents identified (2 accidents + 1 fatality / year) that can be attributed to failure to enter autorotation, any safety enhancement will not exceed the associated costs.

In view of these study findings, the Agency has no immediate plan to launch a rulemaking activity to amend CS-27. However, it should be noted that the Agency is currently looking to introduce FAA Special Federal Aviation Regulation (SFAR) No. 73 as part of Operational Suitability Data (OSD) for the Robinson R22 and R44. Providing enhanced training to ensure an increased level of pilot proficiency and experience will increase operational safety. Furthermore, safety reports are continuously being monitored and analysed for adverse trends. Any change in the current level of safety may trigger further actions in the future.

Status – Partially Adequate – Closed

Agusta A109E	**Near Vauxhall Bridge, Central London**	**16 January 2013**	**Accident**

AAIB Formal: AAR 3/2014
FACTOR: F2/2014

Synopsis

The helicopter was flying to the east of London Heliport when it struck the jib of a crane, attached to a building development at St George Wharf, at a height of approximately 700 ft amsl in conditions of reduced meteorological visibility. The pilot, who was the sole occupant of the helicopter, and a pedestrian were fatally injured when the helicopter impacted a building and adjacent roadway.

The investigation identified the following causal factors:

1. The pilot turned onto a collision course with the crane attached to the building and was probably unaware of the helicopter's proximity to the building at the beginning of the turn.

2. The pilot did not see the crane or saw it too late to take effective avoiding action.

The investigation identified the following contributory factor:

1. The pilot continued with his intention to land at the London Heliport despite being unable to remain clear of cloud.

SAFETY RECOMMENDATION – 2014-025

It is recommended that the Civil Aviation Authority require UK Air Navigation Service Providers to assess the effect of obstacles, notified through the UK Aeronautical Information Regulation and Control cycle, on operational procedures relating to published VFR routes near those obstacles, and modify procedures to enable pilots to comply simultaneously with ATC instructions, and the Air Navigation Order and Commission Implementing Regulation (EU) 923/2012 as applicable.

Response

The CAA has written directly to all ANSPs reminding them of their enduring responsibility that their ATM procedures remain safe and fit for purpose and that in that context, they should ensure that they "have suitable arrangements in place for monitoring the effect of obstacles in proximity to VFR routes within Control Zones and Control Areas or a Visual Reference Point outside controlled airspace". Where a new obstacle is identified, service provision practices will be reviewed to minimise the risk of an ATC clearance potentially leading a pilot to contravene the requirements of Rule 5.

ANSPs have been asked to confirm completion of the review along with any service provision practice adjustments are complete by 5 February 2015. The arrangements for monitoring and review, along with the procedures to provide safe services to helicopters using the London VFR Helicopter Routes along the River Thames, will be monitored through routine oversight.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-026

It is recommended that the Civil Aviation Authority require UK Air Navigation Service Providers to assess the effect of obstacles, notified through the UK Aeronautical Information Regulation and Control cycle, on operational procedures for controlling non-IFR flights within the Control Areas and Control Zones surrounding UK airports, and modify procedures to enable pilots to comply simultaneously with ATC instructions, and the Air Navigation Order and Commission Implementing Regulation (EU) 923/2012 as applicable.

Response

The CAA has written directly to all ANSPs reminding them of their enduring responsibility that their ATM procedures remain safe and fit for purpose and that in that context, they should ensure that they "have suitable arrangements in place for monitoring the effect of obstacles in proximity to VFR routes within Control Zones and Control Areas or a Visual Reference Point outside controlled airspace". Where a new obstacle is identified, service provision practices will be reviewed to minimise the risk of an ATC clearance potentially leading a pilot to contravene the requirements of Rule 5.

ANSPs have been asked to confirm completion of the review along with any service provision practice adjustments are complete by 5 February 2015. The arrangements for monitoring and review, along with the procedures to provide safe services to helicopters using the London VFR Helicopter Routes along the River Thames, will be monitored through routine oversight.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-027

It is recommended that the Department for Transport implement, as soon as practicable, a mechanism compliant with Regulation (EU) 73/2010 and applicable to the whole of the UK for the formal reporting and management of obstacle data, including a requirement to report data relating to newly permitted developments.

Response

The Department accepts this recommendation. The Department is working with the Civil Aviation Authority (CAA) to implement electronic terrain and obstacle data (eTOD), which will be compliant with the data standards in Regulation (EU) 73/2010.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-028

It is recommended that the Department for Transport remind all recipients of the Office of the Deputy Prime Minister Circular 01/2003 that they are requested to notify the Civil Aviation Authority:

1. Whenever they grant planning permission for developments which include an obstacle.
2. About obstacles not previously notified.
3. About obstacles previously notified that no longer exist.

Response

The Department accepts the recommendation and a letter will be shortly sent to all recipients of Circular 01/2003.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-029

It is recommended that The Scottish Government remind all recipients of Planning Circular 2/2003 that they are requested to notify the Civil Aviation Authority:

1. Whenever they grant planning permission for developments which include an obstacle.
2. About obstacles not previously notified.
3. About obstacles previously notified that no longer exist.

Response

In relation to Recommendation 2014-029, the Scottish Government issued a letter from the Chief Planner to the Heads of Planning at all Scottish local authorities on 9 September 2014. The letter was published on the Planning Guidance / Publications section of the Scottish Government web site on 10 September 2014. The page can be viewed at http://www.scotland.gov.uk/Topics/Built-Environment/planning/Roles/Scottish-Government/Guidance

In addition, the Scottish Government published an e-alert on 1 October 2014 which included details of the Chief Planner's letter. The e-alert issued to over 10,000 people who have registered to receive such alerts.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-030

It is recommended that the Department for Transport implement measures that enable the Civil Aviation Authority to assess, before planning permission is granted, the potential implications of new en-route obstacles for airspace arrangements and procedures.

Response

This Recommendation raises a number of questions with regards to planning law and process that falls under the ownership of the Department for Communities and Local Government and Devolved Administrations. The Department is therefore consulting with both Department for Communities and Local Government and Devolved Administrations to understand what the potential implications are of implementing this recommendation. It should be noted that an objection from the CAA to a planning application would not necessarily lead to permission being withheld for any new en-route obstacles that are not currently located in safeguarded areas. The Department is also liaising with the CAA to take into account developing work to implement Regulation 73/2010 in the UK. The data collection policy that will be required under this Regulation provides the prospect of incorporating a mechanism by which the CAA and airspace users can be made aware of potential en-route obstacles and enable appropriate measures to be taken.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-031

It is recommended that the Civil Aviation Authority review Federal Aviation Regulations Part 135 Rules 135.615, VFR Flight Planning, and 135.617, Pre-flight Risk Analysis, to assess whether their implementation would provide safety benefits for those helicopter operations within the UK for which it is the regulatory authority.

Response

The CAA accepts this Recommendation and has reviewed Federal Aviation Regulations (FAR) Part 135 Rules 135.615, VFR Flight Planning, and 135.617, Pre-flight Risk Analysis, to assess whether their implementation would provide safety benefits for those helicopter operations within the UK for which it is the regulatory authority. In consultation with EASA, the CAA has determined that the elements of the new FARs are broadly covered within the current and future UK and European regulation sets under the requirements for Public Transport and Commercial Air Transport operators to ensure that their operating procedures for planning and executing flights are properly documented in operations manuals and for aircraft commanders to ensure that flights are conducted safely. However, the CAA intends to issue a Safety Notice (SN) to operators by the end of November 2014 reminding them of their responsibilities and highlighting elements of the FARs as appropriate. Additionally the SN will provide an introduction and link to the European Helicopter Safety Team (EHEST) developed 'Pre-departure Risk Assessment Check List' encouraging operators to consider adopting and adapting this tool for their use.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-032

It is recommended that the European Aviation Safety Agency review Federal Aviation Regulations Part 135 Rules 135.615, VFR Flight Planning, and 135.617, Pre-flight Risk Analysis, in advance of the scheduled regulatory standardisation programme, to assess whether their immediate implementation would provide safety benefits for helicopter operations within Europe.

Response

The Agency understands that, based on the type of operation performed, this safety recommendation is related to Commercial Air Transport (CAT) operations. Whilst it is acknowledged that the aircraft involved in the accident was operating under UK national

legislation, it should be noted that EU regulations for CAT operations, published in 2012, shall be applied by EASA Member States by 28 October 2014 at the latest.

The Agency has assessed Federal Aviation Regulation FAR 135.615 'VFR flight planning' and concluded that the safety elements therein are already covered by Commission Regulation (EU) No 965/2012, as last amended ('air operations regulation'), and Commission Implementing Regulation (EU) No 923/2012 ('rules of the air regulation'), as follows:

- ORO.GEN.110 Operator responsibilities, which requires operators to establish procedures for safe operations, and to establish checklist systems;
- CAT.OP.MPA.135 Routes and areas of operation - general, where route specifications are included;
- SERA.5001 Visual Meteorological Conditions (VMC) visibility and distance from cloud minima, defining lowest values for flight visibility, cloud base and distance to clouds;
- SERA.5005 Visual flight rules, establishing minimum safe flight altitudes;
- CAT.OP.MPA.145 Establishment of minimum flight altitudes, which ensure a method to establish the altitudes;
- CAT.OP.MPA.245 Meteorological conditions - all aircraft, ensuring evaluation of weather reports;
- CAT.OP.MPA.270 Minimum flight altitudes, requiring adherence to the above paragraphs;
- SERA.5010. Special Visual Flight Rules (VFR) in control zones, which defines weather minima for such operations;
- CATGEN.MPA.105 Responsibilities of the commander, related to responsibility for safe operations in accordance with the aircraft flight manual.

The Agency has also assessed FAR 135.617 'pre-flight risk analysis' and concluded that the requirements on the operator are covered by the above-mentioned air operations regulation, as follows:

- ORO.GEN.200(a)(3) provides for a hazard identification and risk management process;
- ORO.GEN.110(i) covers flight planning procedures.

The EU rules do not specify in detail the pre-flight risk analysis, to be performed by the commander, or its format. This specification is the duty of the operator in line with the paragraphs cited above. In addition, as mentioned in the accident investigation report, the European Helicopter Safety Team (EHST) has also promulgated checklists to support operators and pilots in the implementation of these rules.

In summary, the Agency finds that the safety benefits to be derived from implementation of the above-mentioned FARs are already captured through the existing EU Regulation.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-033

It is recommended that the Civil Aviation Authority assess whether mandating the use of Helicopter Terrain Awareness and Warning Systems compliant with Technical Standard Order C194 or European Technical Standard Order C194 would provide safety benefits for helicopter operations within the UK for which it is the regulatory authority.

Response

The CAA accepts this Recommendation in so far as it will, following consultation with EASA, liaise and support a wider European assessment on whether mandating the use of Helicopter Terrain Awareness and Warning Systems compliant with Technical Standard Order C194 or European Technical Standard Order C194 would provide safety benefits for Public Transport or

Commercial Air Transport helicopter operations within the UK and Europe. This work will be conducted under an EASA future rule making task, which the CAA will support, and is expected to be complete by the end of 2015; however, this will be subject to the rule making programme schedule. The Terms of Reference for this task may initially concentrate on the merits of HTAWS for flight under IFR or at night but the CAA will encourage the consideration for all commercial operations including day VFR.

Status – Adequate – Closed

SAFETY RECOMMENDATION – 2014-034

It is recommended that the European Aviation Safety Agency assess whether mandating the use of Helicopter Terrain Awareness and Warning Systems compliant with Technical Standard Order C194 or European Technical Standard Order C194 would provide safety benefits for helicopter operations within Europe.

Response

The Agency understands that, based on the type of operation performed, this Safety Recommendation is related to Commercial Air Transport (CAT) operations. Whilst it is acknowledged that the aircraft involved in the accident was operating under UK national legislation, it should be noted that EU regulations for CAT operations, published in 2012, shall be applied by EASA Member States by 28 October 2014 at the latest.

The Agency considers that Commission Regulation (EU) No 965/2012, as last amended ('air operations regulation'), together with the basic flying skills that are instructed in accordance with Commission Regulation (EU) No 1178/2011 ('aircrew regulation'), already provide operational and flight crew training mitigation against the risk collision with the ground or obstacles.

The additional safety benefits from the use of Helicopter Terrain Awareness and Warning Systems will be assessed for each type of helicopter operation within the framework of a future rulemaking task.

Status – Adequate – Closed

Others

No Safety Recommendations were made in this section.

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GLOSSARY OF ABBREVIATIONS

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

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Air Accidents Investigation Branch