

REVIEW OF AVIATION SAFETY PERFORMANCE IN IRELAND

DURING 2016





Front Cover: A Ryanair aircraft taxis to stand at Dublin airport. Photographer Izabela Wojtasik.
This Page: The Breitling Wingwalkers Boeing Stearman spinner at the Abbeyshrule Airshow in Co. Longford, May 2015.
Photographer: Jason Phelan.

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An Aer Lingus aircraft at Dublin airport being prepared for its next departure. Photograph by Artisan Photography.



Aer Lingus

Foreword



Welcome to the IAA's 2016 Annual Safety Performance Review (ASPR). Safety is something the aviation industry continuously strives to improve and in which all stakeholders have a role to play. The ASPR provides information on how the aviation system in Ireland is performing, highlights emerging safety trends and raises awareness of safety in the aviation sector. This year's addition of the ASPR covers almost all aspects of the aviation industry, I hope you find it informative.

During 2016 there was two fatal accidents involving the General Aviation (GA) community and in March 2017, while operating on a Search and Rescue mission, CHC Ireland DAC experienced a fatal accident off the coast of Ireland. The staff of the IAA extends our deepest sympathies to the families of the deceased. These accidents are under investigation by the Air Accident Investigation Unit, whose purpose is to determine the reasons for the accident so that similar occurrences can be prevented. As they occurred during 2016 both GA accidents are included within this report. The accident that occurred during the Search and Rescue operation will be included in the 2017 ASPR as it took place during 2017.

There were a small number of non-fatal accidents and serious incidents involving aircraft on the Irish aircraft register, airports under the IAAs safety remit and the GA community. Statistics and other information on these occurrences are contained within this publication. The IAA will continue to use all available avenues to work with the aviation community to address the safety issues these occurrences have highlighted. We will also continue to contribute to safety at an international level by leading and participating in new safety initiatives where appropriate.

A handwritten signature in black ink, appearing to read 'R James', with a long, horizontal, slightly wavy line extending from the end of the signature.

Ralph James
Director Safety Regulation Division



Over 6,300 drones have been registered with the IAA. This one has been fitted with a gyro stabilised aerial camera so that it may be used for aerial photography and cinematography. Image supplied by Aerial Photography Ireland.

Executive Summary

On 31st December 2016 there were 726 aeroplanes engaged in Commercial Aviation Transport (CAT) on the Irish aircraft register. This is very close to the number on the Irish Aircraft Register at the end of 2014, but is a slight decrease over the previous 12 month period. During 2016 these aeroplanes were involved in 14 serious incidents and 2 non-fatal accidents.

The Irish AOC holders operating fixed-wing aircraft are Aer Lingus, ASL Ltd., CityJet, Galway Aviation Services (trading as Aer Arann Islands), National Flight Centre, Norwegian Air International, Ryanair and Stobart Air. During 2016 these AOC holders submitted 7,530 MORs and conducted over 889,258 flights. Over 94% of MORs described incidents where all the safety barriers were effective and there was no safety risk to the aircraft or those on-board.

On 31st December 2016 there were 13 helicopters providing CAT, Search and Rescue, Helicopter Emergency Medical Services or Specialised Operations on the Irish aircraft register. These helicopters were not involved in any accidents or serious incidents during 2016.

At the close of 2016 the Operators conducting these types of missions under a Permission and / or Approval and / or Authorisation issued by SRD were Babcock Mission Critical Services (Ireland) (formerly Bond Air Services Ireland), CHC Ireland DAC (formerly CHC Ireland) and Executive Helicopters. They conducted 6,752 flights and submitted 28 MORs during 2016, none of which were risk bearing.

Corporate aviation services describes one mode of unscheduled commercial flights. In Ireland it is conducted under an AOC issued by the IAA and there are currently three operators who provide this type of service: Airlink Airways, WestAir Aviation and, since 31st August 2016, Gain Jet Ireland. These Operators have a number of different types of aircraft within their fleet. During 2016 they were not involved in any accidents or serious incidents and submitted 21 MORs to the IAA, none of which were risk-bearing.

There are two types of licenced aerodrome in Ireland, those that are licenced for public use, of which there are 13, and those that are licenced for private use, of which there are 11. During 2016 there were 274,058 arrivals and departures at the aerodromes that are licenced for public use and at which an Air Traffic Control (ATC) service is provided. This is the fifth consecutive year during which the number of movements rose. During 2016 there were no accidents, however there were 3 serious incidents involving CAT at these aerodromes. During 2016 ATC services at these airports submitted 1,299 MORs, 93% of which were not associated with any safety risk.

General Aviation (GA) covers all civil aviation other than CAT or Aerial Work. At the end of 2016 there were 469 aircraft used for GA activity on the Irish aircraft register. During 2016 aircraft engaged in GA were involved in 8 accidents, and tragically 2 of these resulted in fatal injuries. Aircraft engaged in GA activity were also involved in 2 serious incidents.

Small Unmanned Aircraft (SUA), also called drones, have become increasingly prevalent in Ireland over the last two years. Under SI 563 of 2015 'Small Unmanned Aircraft (Drones) and Rockets Order, 2015' all drones and model aircraft over 1 kg, including the weight of the battery and all attached equipment, must be registered with the IAA by their owner. Owners of drones that weigh less than 1 kg may also register their aircraft with the IAA; however there is no regulatory requirement to do so. On 31st Dec 2016 there were 6,313 drones on the Irish drone register.



CHC Ireland DAC conducts High Risk Specialised Operations (SPO), Helicopter Emergency Medical Services (HEMS) and Search and Rescue (SAR) operations. Photographer Rory O'Connor.

Irish Air Transport: Fixed-Wing Commercial Air Transport Industry

Accidents

Between 2012 and 2016 CAT fixed-wing aircraft on the Irish Aircraft Register were involved in 22 accidents, 2 of which occurred during 2016. The categories most commonly applied by the investigating Safety Investigation Authority (SIA) were:



Ground handling



Ground collision



System failure of malfunction

Serious Incidents

There were 86 serious incidents between 2012 and 2016, 14 of which occurred during 2016. The categories most commonly applied by an SIA to serious incidents were:



System failure of malfunction



Airprox / near midair collision



Fire / smoke (non-impact)

Mandatory Occurrence Reports

During 2016 the Irish AOC holders submitted 7,530 MORs. The categories most commonly applied by SRD Inspectors to risk-bearing MORs were:



Airprox / near midair collision



Ground handling



Shining of lasers at aircraft

Between 2012 and 2016 they submitted 22,810 MORs and the categories most commonly applied by SRD Inspectors to risk-bearing MORs were:



Human factors crew



Airprox / near midair collision



Shining of laser at aircraft

Irish Aerodromes and Air Navigation Services

Between 2012 and 2016 there were 5 non-fatal accidents involving Commercial Air Transport at aerodromes licenced for public use in Ireland, none of which occurred in 2016. There were 13 serious incidents over the same period, 3 of which occurred during 2016.

Air Traffic Services at Public Aerodromes in Ireland

The ATS providers submitted 1,299 MORs during 2016. The three occurrences categories most commonly assigned by SRD Inspectors were:



Air traffic management



System failure
or malfunction



Human factors crew

Accidents and Serious Incidents at Public Aerodromes in Ireland

The Aerodrome managers submitted 308 MORs during 2016. The three most commonly assigned occurrences categories were:



Ground handling



System failure
or malfunction



Aerodromes



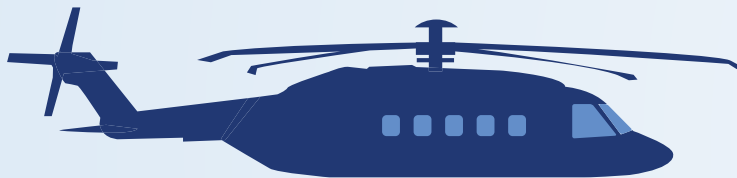


View of Terminal 2 and 400 gates, as seen from the airfield. Copyright Leo Hillier and Lagan Clare JV.



Irish Air Transport: Helicopters

These figures refer to helicopter operators who conduct some or all of the following types of operation: CAT, HEMS, SPO and SAR.



- Between 2012 and 2016 operators conducting these types of experienced 1 non-fatal accident and 2 serious incidents. The accident was categorised as ‘Abnormal runway contact’, both serious incidents were categorised as ‘Other’ by the investigating Safety Investigation Authority.
- Over the same timeframe these helicopter operators submitted 323 MORs. Only 1 of these was risk bearing and it was classified as ‘Human factors crew’ applied by an SRD Inspector.
- 28 of the 323 MORs were submitted during 2016. The categories most commonly applied to these MORs applied by SRD Inspectors were ‘Shining of lasers at aircraft’ and ‘System failure or malfunction’.

Irish Air Transport: Corporate Aviation



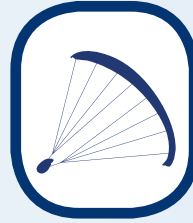
- Between 2012 and 2016 the AOC holders providing corporate aviation services were not involved in any accidents or serious incidents.
- Between 2012 and 2016 they submitted 79 MORs, none of which were risk-bearing. The occurrence categories most commonly applied by SRD Inspectors to the MORs were ‘System failure or malfunction’, ‘Birdstrike’, ‘Incident during maintenance’ and ‘Other’.

General Aviation



Aeroplanes under 2,250 kg

3 Fatal Accidents
19 Non-Fatal Accidents
5 Serious Incidents



Paragliders, Powered Paragliders and Powered Parachutes

1 Fatal Accident
3 Non-Fatal Accidents
0 Serious Incidents



Aeroplanes over 2,250 kg

1 Fatal Accident
2 Non-Fatal Accidents
0 Serious Incidents



Sailplanes and Powered Sailplanes

0 Fatal Accidents
0 Non-Fatal Accidents
1 Serious Incident



Helicopters under 2,250 kg

0 Fatal Accidents
4 Non-Fatal Accidents
2 Serious Incidents



Gyrocopters

0 Fatal Accidents
1 Non-Fatal Accident
1 Serious Incident



Helicopters over 2,250 kg

0 Fatal Accidents
0 Non-Fatal Accidents
0 Serious Incidents



Hot Air Balloons

0 Fatal Accidents
0 Non-Fatal Accidents
0 Serious Incidents



Microlight

0 Fatal Accidents
8 Non-Fatal Accidents
1 Serious Incident



Ryanair operated at least 350 Boeing 737 aeroplanes every day during 2016 and they each travelled an average of 382,605 km a day. Photographer Izabela Wojtasik.



SECTION A

Safety in the Irish Aviation Industry



Cockpit view of Dublin airport during 2015's Storm Desmond.
Photographer: Michael Kelly.

The Irish Aviation Authority

The Irish Aviation Authority (IAA) is a limited liability company wholly owned by the Irish State. The Safety Regulation Division (SRD) of the IAA is responsible for Ireland's regulatory and safety oversight functions within the civil aviation industry. As part of its role as a regulator IAA SRD analyses and monitors the safety of organisations and aircraft under its remit. One of the ways SRD fulfils this aspect of its role is through analysing safety occurrences involving stakeholders under its remit. The stakeholders include aerodromes operating within Ireland, owners / operators of the aircraft on the Irish aircraft register, commercial bodies operating under an Air Operators Certificate (AOC) or airworthiness approvals issued by the IAA.

Mandatory Occurrence Reports

Since 15th November 2015, occurrence reporting in civil aviation in Europe has been subject to Regulation (EU) 376/2014. This regulation includes provisions for persons involved in civil aviation to submit Mandatory Occurrence Reports (MORs) to the competent authority in their State either directly or through their approved organisation's Safety Management System. The European Commission has listed types of occurrences that must be mandatorily reported to the competent authority of each EU Member State in Commission Implementing Regulation (EU) 2015/1018. All of the commercial stakeholders under the IAA's remit have taken steps to ensure they are compliant with the legislation and the IAA is responsible for ensuring an appropriate investigation into these incidents has taken place and suitable follow-up actions were implemented. For further information see <https://www.iaa.ie/commercial-aviation/safety-reporting-1>.

The statistics provided in this report on MORs have been compiled using the IAA's internal database. During 2016 the IAA received over 8,800 MORs from all sectors of the aviation industry. The risk associated with all of these occurrences has been assessed and in over 94% of occurrences the safety barriers were effective. To facilitate this analysis the IAA's MOR database was 'frozen' on the 1st February 2017. This means a copy of the database was made and the copy was analysed. The original database is a live database and MORs may be updated as the investigation yields further information. Future editions of the ANSP will capture changes made after the 1st February. The methods of risk assessment are described later in this section.

Categorisation of MORs

Once an MOR is submitted to the IAA an SRD Inspector uses the CAST/ICAO occurrence reporting taxonomy to categorise the report. The purpose of the taxonomy is to group events under standardised descriptors to improve the aviation community's capacity to focus on common safety issues. The definitions and usage notes for the Common Taxonomy can be found at: <http://www.intlaviationstandards.org/Documents/OccurrenceCategoryDefinitions.pdf>.

ARMS Methodology

The primary method the IAA's SRD Inspectors use to assess the safety risk associated with an occurrence is the Airline Risk Management Solutions (ARMS) methodology. Its purpose is to identify occurrences associated with an elevated safety risk so that the area may be targeted.

The ARMS matrix assigns a risk score by assessing the effectiveness of the remaining barriers between what transpired and the most credible accident outcome if the incident had escalated. All types of potential outcomes are considered, from those with no potential injury to those on-board, to those with no potential damage to the aircraft, to those with multiple fatalities or the loss of the aircraft. Figure A.1 demonstrates how a score is assigned.

The risk matrix assigns 1 of 13 risk scores between 1 and 2,500 to the occurrence. A score of between 1 and 10 indicates there was a low safety risk, a score of between 20 and 102 indicates there was an elevated safety risk and a score of 500 or over indicates it was a high risk occurrence.

Figure A.1: The ARMS matrix quantifies risk associated with safety occurrences

Question 1				Question 2	
What was the effectiveness of the remaining barriers between this event and the most credible accident outcome?				If this event had escalated into an accident outcome what would have been the most credible outcome?	
Effective	Limited	Minimal	Not effective		
50	102	502	2,500	Catastrophic accident	Loss of aircraft or multiple fatalities (3 or more)
10	21	101	500	Major accident	1 or 2 fatalities, multiple serious injuries, major damage to aircraft
2	4	20	50	Minor injuries or damage	Minor injuries, minor damage to aircraft
1				No accident outcome	No potential damage or injury could occur

Safety Investigation Authorities

Safety Investigation Authorities (SIAs) are responsible for investigating aviation accidents and serious incidents. The purpose of their investigation is to ascertain the reason(s) the occurrence took place so that similar events can be prevented in the future. ICAO made it a requirement for all States to have a designated SIA by November 2016. Ireland has had a dedicated SIA, the Air Accident Investigation Unit (AAIU) for many years. It is a specialised and independent unit within the Department of Transport, Tourism and Sport.

The AAIU investigates civil aviation accidents and serious incidents that take place in Ireland, regardless of whether the Operator was flying under an AOC issued by the IAA or a National Authority based abroad, or which national Authority the aircraft was registered with. Occurrences involving an Irish AOC holder or an Irish registered aircraft that take place outside of Ireland may be investigated by a foreign SIA or they may delegate the investigation fully or in part to the AAIU.

If an SIA based in another State is investigating an occurrence involving an Irish Registered aircraft or Irish AOC holder the AAIU always appoints an Accredited Representative to provide assistance. Formal notification processes ensure the AAIU and other stakeholders are informed of the investigation and its findings.

Annex 13 Definitions of an Accident and Serious Incident

The definition of an aviation accident and serious incident is set out in ICAO Annex 13. In brief it defines an accident as an occurrence associated with the operation of an aircraft in which:

- A person is fatally or seriously injured as a result of being in the aircraft or in direct contact with any part of the aircraft, including exposure to jet blast;
- The aircraft sustains damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft and would normally require major repair or replacement of the affected component;
- The aircraft is missing or is completely inaccessible.

Annex 13 defines a serious incident as an occurrence involving circumstances indicating that an accident nearly occurred. It states the difference between an accident and a serious incident lies only in the result.

Annex 13 states that, in the case of a manned aircraft, an accident or serious incident takes place between the time the first person boards an aircraft with the intention of flight and the time all such persons have disembarked.

During the investigation into the accident or serious incident it may transpire that the classification was not appropriate. Under these circumstances the investigating SIA will revise it and assign the appropriate classification. Only the SIA investigating the occurrence has the authority to make this change. Once the investigation is complete an investigation report is published and made publicly available.

Accident and Serious Incident Data Summarised in this Report

The statistics on accidents and serious incidents provided within this document have been compiled using the accident and serious incident data provided by the AAIU. All accidents and serious incidents the AAIU have been formally notified of, are included in this report, even if the investigation itself is ongoing and the formal investigation report has not been finalised. There may be minor differences between consecutive Annual Safety Performance Reviews. This is due to the reclassification of an occurrence during the course of the SIAs investigation.

Irish Aircraft Register

The Irish Aviation Authority is responsible for the registration of civil aircraft in Ireland and maintains the Irish civil aircraft register. This register meets the requirements of ICAO Annex 7 (Aircraft Nationality and Registration Marks) of the Chicago Convention. The 'Nationality and Registration of Aircraft Order' S.I.107 of 2015 provides detailed information on the aircraft that can be registered in Ireland, the format and location of registration markings on the aircraft and the conditions that must be met for continued registration. Ireland has two nationality marks for the Irish civil aircraft register 'EI' and 'EJ' – only 'EI' is currently used.

SECTION B

The Irish Fixed-Wing Commercial Air Transport Sector



A Norwegian Long Haul Boeing 787-8 Dreamliner being pushed out of Hanger 6 at Dublin airport after having its tail decals applied. Photographer: Paul Morris.

Introduction

The Irish fixed-wing Commercial Air Transport (CAT) industry consists of two types of commercial organisations.

The first type of organisation are operators who hold an Air Operators Certificate (AOC) issued by the IAA. An AOC grants an Operator permission to fly an aeroplane or a helicopter for the purposes of CAT. The Irish AOC holders who provide CAT services are Aer Lingus, ASL Ltd. (formerly Air Contractors), CityJet, Galway Aviation Services (trading as Aer Arann Islands), National Flight Centre, Norwegian Air International (since 12th February 2015), Ryanair and Stobart Air (formerly Aer Arann).

The second type of organisation are those who place aeroplanes on the Irish aircraft register, which they then lease to an operator that holds an AOC issued by the IAA or by a foreign State. As per Article 83bis of Chicago Convention, when an operator holds a foreign AOC, Ireland retains responsibility for oversight of the aircraft airworthiness under an agreement with the State of Operator. Within the Annual Safety Performance Review aircraft subject to an article 83bis agreement are referred to as the 'Irish lease fleet'.

Between the Irish lease fleet and the Irish AOC holders there were 726 aeroplanes on the Irish aircraft register that were engaged in CAT on the 31st December 2016. This is a slight decrease over the previous 12 month period, and is very close to the number on the Irish Aircraft Register at the end of 2014.

Number of Accidents and Serious Incidents

Over the last five years' aeroplanes operated by Irish AOC holders or on the Irish lease fleet were involved in 21 non-fatal accidents, 1 of which occurred during 2016. It took place when a re-fuelling operative fell from the front stairs of the aircraft.

During October 2015 a foreign AOC holder operating an Irish registered aircraft experienced a fatal accident, which tragically resulted in the loss of 224 lives. The accident remains under investigation by the Egyptian Ministry of Civil Aviation. However, the Egyptian investigation's statement of 17 March 2016 notes 'the Committee received on 14 March 2016 an official report from the Russian Federation Investigative Committee. After studying this report, which suggests suspected criminal activity, the Committee has referred the matter to the Attorney General of the Arab Republic of Egypt'. The IAA and AAIU provided assistance to the Egyptian Ministry of Civil Aviation at the time of the accident and will continue to cooperate with any requests made over the course of their investigation.

Over the last five years' this part of the Irish aviation industry was involved in 86 serious incidents, 14 of which occurred during 2016.

Table B.1: Accidents and serious incidents involving Irish registered aeroplanes engaging in CAT over 2,250 kg.

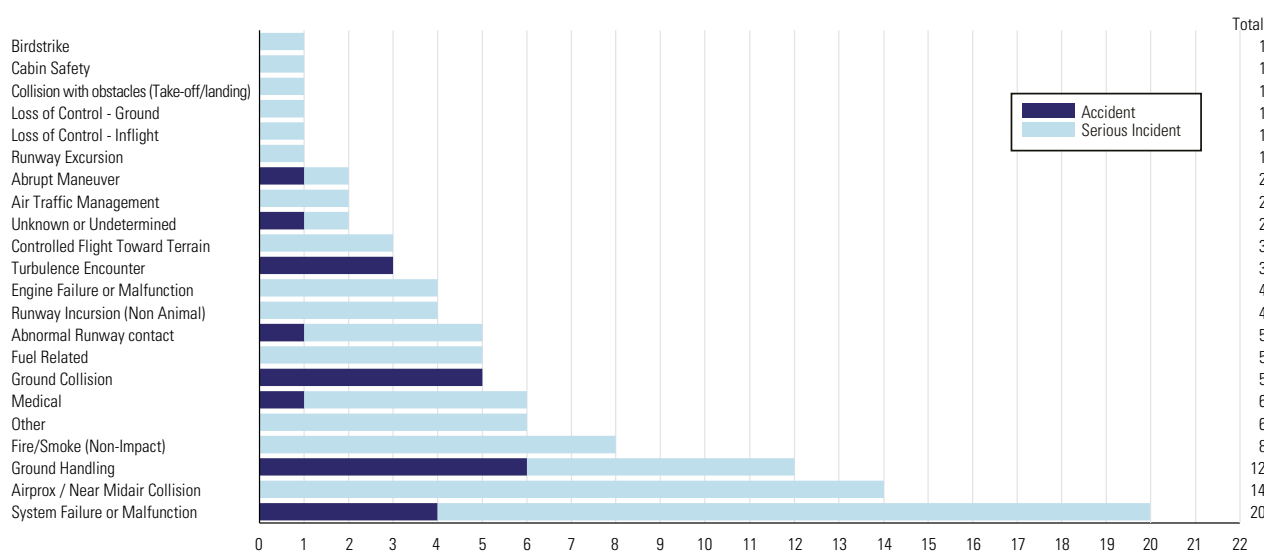
Year	No. on Irish aircraft register	Accidents			Serious incidents
		Non-fatal	Fatal	Total	
2012	748	6	0	6	24
2013	755	2	0	2	18
2014	728	8	0	8	10
2015	744	3	1	4	20
2016	726	2	0	2	14
Total	-	21	1	22	86

Categorisation of Accidents and Serious Incidents

To assist in identifying safety issues the investigating Authority assigns a CAST / ICAO - common taxonomy category to all Annex 13 accidents and serious incidents. In some cases the categories do not indicate the cause of the event, rather the end result in a chain of events. Figure B.2 summarises the categories assigned to the 22 accidents and 86 serious incidents that took place between 2012 and 2016.

At the time of publication the fatal accident experienced by an Operator utilising an aeroplane on the Irish aircraft register and flying under an AOC holder issued by a foreign State was categorised as 'Unknown or undetermined'. This categorisation may be revised at a later date by the Egyptian Ministry of Civil Aviation, who, as the investigating authority, are solely responsible for doing so.

Figure B.2: Categorisation assigned by the investigating Authority to the Annex 13 occurrences



The two most commonly assigned categories to accidents were 'Ground handling' (RAMP) and 'Ground collisions' (GCOL). The two categories most common assigned to serious incident were 'System failure and malfunction' (SCF-NP) and 'Airprox / near midair collision' (MAC).

Over the five year period 6 accidents were categorised as 'Ground handling' (RAMP). This category describes a wide variety of occurrences which may take place during or as a result of ground handling operations. Accidents classified as such include collisions that occur while servicing, boarding, loading or manoeuvring the aeroplane or occurrences that can cause serious or fatal injuries to people from propeller / fan blade strikes or jet blast. It was also the leading accident category during 2015, 2014 and 2013.

There were 5 accidents categorised as 'Ground collision' (GCOL). This category describes a collision while taxiing to or from a runway that is in use. The collision can involve two aeroplanes or involve one aeroplane and a person, animal, ground vehicle, obstacle, building or structures such as lighting poles etc. It excludes collisions that occur on the runway. It was also the second most common accident category during 2015 and 2014.

The category most commonly assigned to serious incidents was 'System failure or malfunction' (SCF-NP). It describes the failure or malfunction of components on-board the aeroplane that were not associated with the engine. During 2015 the IAA conducted an analysis of occurrences categorised as 'System failure or malfunction' within SRDs MOR database. The results of the analysis have been disseminated to all of the Irish stakeholders.

An 'Airprox / near midair collision' (MAC) occurs when there is a significant loss of separation between two or more airborne aeroplanes. Occurrences of this nature that escalate into an accident are very rare within Europe and an Irish AOC holder has never been involved in an accident caused by an Airprox.

Number and Rate of Mandatory Occurrence Reports (MORs): 2011 - 2016

This subsection provides information on the number and rate of MORs submitted by the Irish AOC holders. Information on MORs submitted by the lease fleet is not included.

Between 2012 and 2016 the AOC holders submitted 30,340 MORs. During this timeframe they conducted over 3.8 million flights, with less than 0.79% of flights being the subject of an MOR.

Of the 30,340 MORs 1,497 were assigned a risk-bearing ARMS score, indicating that 95% of MORs described incidents where all the safety barriers were effective.

Between 2012 and 2016 the number of MORs submitted annually fluctuated between 5,490 and 7,530 while the number of operations the AOC holders conducted annually increased steadily every year from 682,433 to 889,258.

To remove the effect the increasing number of flights had on the number of MORs submitted, an MOR rate based on the number of movements conducted was calculated. This allows a normalised comparison across years. The reporting rate over the 5 year period fluctuated between 64.82 and 86.52 MORs per 10,000 movements. The reporting rate across the 5 year period was 78.73 MORs per 10,000 movements.

Table B.3: Statistics on MORs submitted by the Irish AOC holders who operate aeroplanes
(MOR rates were calculated per 10,000 flights)

Year	Sectors flown	Total		ARMS: 1-10		ARMS: 20-102		ARMS: 500 – 2,500	
		Number	Rate	Number	Rate	Number	Rate	Number	Rate
2012	682,433	5,490	80.45	5,220	76.49	260	3.81	10	0.15
2013	695,001	6,013	86.52	5,654	81.35	356	5.12	3	0.04
2014	708,739	5,614	79.21	5,447	76.85	166	2.34	1	0.01
2015	878,240	5,693	64.82	5,407	61.57	283	3.22	3	0.03
2016	889,258	7,530	84.67	7,115	80.01	412	4.63	3	0.03
Total	3,853,671	30,340	78.73	28,843	74.85	1,477	3.83	20	0.05

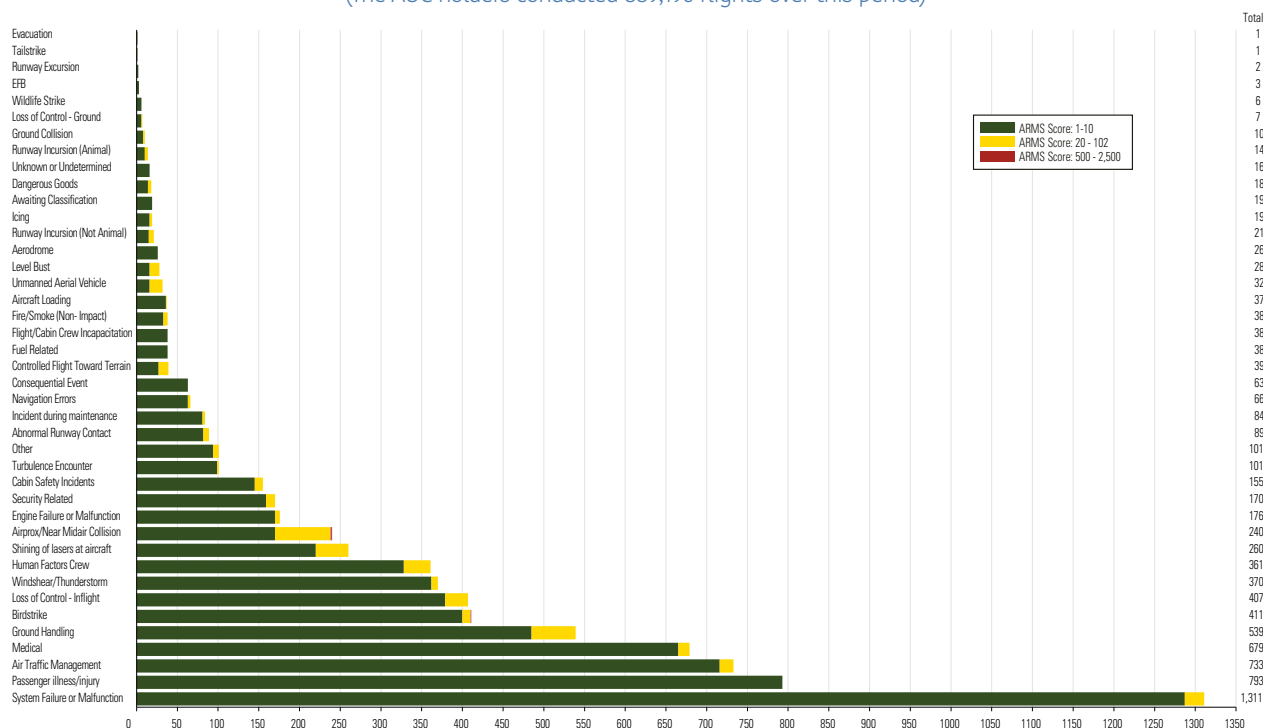
Occurrence Reporting Rates among EASA MS AOC holders

During 2011 and 2013 the IAA conducted a survey of MOR reporting rates of European operators who hold an AOC. The results of the survey indicated that Irish AOC holders have a strong reporting culture and indicates that Irish AOC holders have a mature Safety Management System (SMS) in place. The IAA hopes to rerun the survey, with the support of EASA and the Network of Analysts (NoA), during 2017.

Occurrence Categories and ARMS Score assigned to MORs: 2016

As well as assigning an ARMS score SRDs' Inspectors assign an occurrence category to all MORs submitted. The purpose of this is to assist in identifying emerging safety concerns. Figure B.4 summarises the categorisation and ARMS score assigned by SRDs' Inspectors to the MORs.

Figure B.4: Summary of the 7,530 occurrence reports submitted by Irish AOC holders during 2016
(The AOC holders conducted 889,196 flights over this period)



During 2016 the two most commonly reported occurrence categories were 'System failure or malfunction' (SCF-NP) and 'Passenger illness or injury' (CABIN: PAX. ILL).

Risk bearing occurrences are those which were assigned a score of 20 or higher using the ARMS methodology. The most commonly reported risk bearing occurrences during 2016 were 'Airprox / near MAC: TCAS' (MAC-TCAS) and 'Ground handling' (RAMP).

The most common type of incident reported was 'System failures or malfunctions' (SCF-NP), which describes the failure or malfunction of components on-board the aircraft that are not associated with the powerplant. Over 98% of these MORs were low risk and assigned an ARMS score of 10 or lower.

The second most commonly reported type of incident was 'Passenger illness or injury' (CABIN: PAX. ILL). This category describes situations where a passenger became unwell and all of these occurrences were minor in nature.

The most common type of risk-bearing occurrence reported by Irish AOC holders was 'Airprox / near MAC: TCAS' (MAC-TCAS). Most commercial aircraft are equipped with electronic traffic collision avoidance systems and these systems trigger alerts and guidance on avoiding actions for flight crews to help resolve traffic conflicts. Risk-bearing MACs are occurrences where a high level of flight crew intervention was required to resolve the conflict. For the technology to be effective all aircraft involved in the conflict must be suitably equipped, which is not always the case, e.g. conflicts between commercial and general aviation aircraft.

The second most common type of risk-bearing occurrence reported by Irish AOC holders was ‘Ground handling’ (RAMP). It describes a wide variety of occurrences that may take place during or as a result of ground handling operations. Accidents classified as such include collisions that occur while servicing, boarding, loading or manoeuvring the aeroplane or occurrences that cause serious or fatal injuries to people from propeller / fan blade strikes or jet blast.

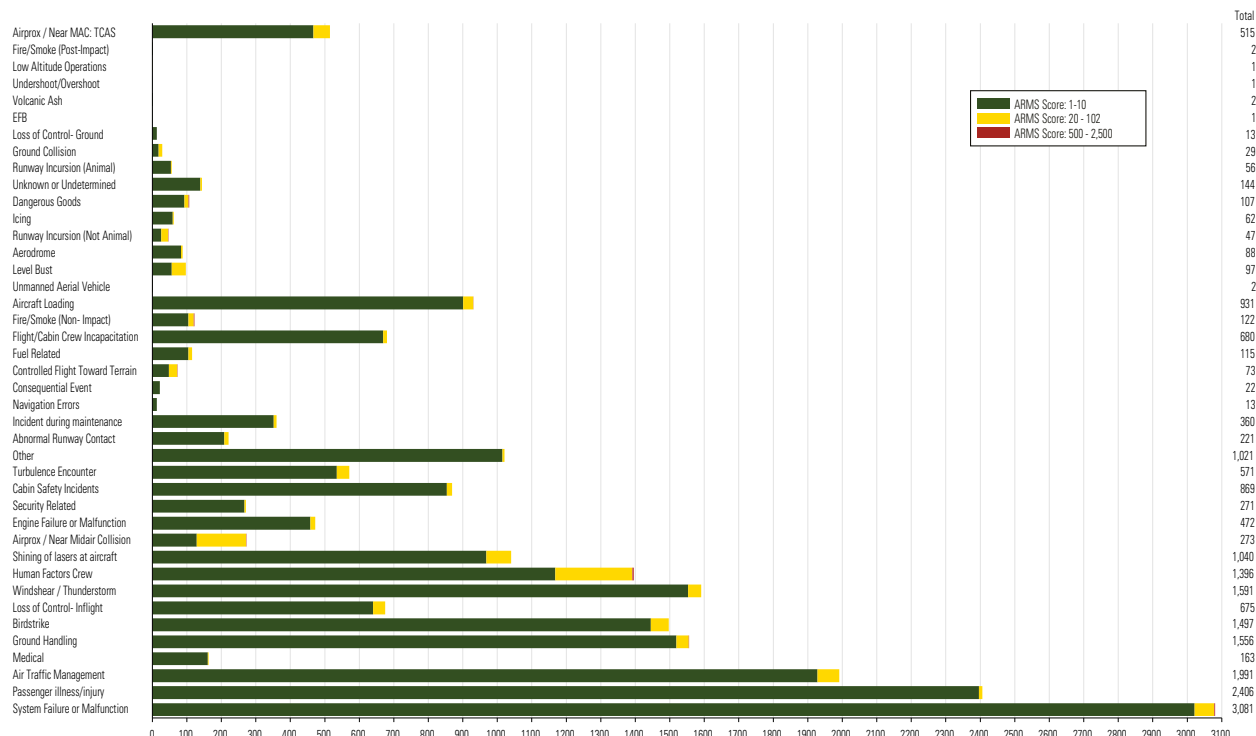
For comparison with 2016: Occurrence Categories and ARMS Score Assigned to MORs between 2012 - 2015

Between 1st Jan. 2012 and the 31st Dec. 2015 inclusive the Irish AOC holders submitted 22,810 MORs and conducted over 2.96 million flights. Figure B.5 summarises the categories and risk (ARMS score) assigned to these MORs. The order of the categories along the vertical axis reflects that used in Figure B.4. This highlights changes in the assigned categorisations, and hence changing safety issues, over time.

During 2016 occurrences were assigned to 4 categories that were not used between 2012 and 2014. They are ‘Evacuation’ (EVAC), ‘Runway excursion’ (RE), ‘Tailstrike’ (TAILSTRIKE) and ‘Wildlife strike’ (WILD (Rwy Taxi)).

Between 2012 and 2014 occurrences were assigned to 4 categories that were not used during 2016. They are ‘Fire / smoke (post-impact)’ (F-POST), ‘Low altitude operations’ (LALT (Gns Coll)), Undershoot / overshoot (USOS (UndrOvrsh)) and ‘Volcanic ash’ (VOLCANIC ASH). To standardise the terminology used ‘Airprox / near MAC: TCAS’ (MAC - TCAS) was relabelled ‘Airprox / near MAC’ (MAC).

Figure B.5: Summary of MOR reports during 2012, 2013, 2014 and 2015 for the Irish AOC holders
(Irish AOC holders conducted over 2.96 million flights during this period)



When MORs received during this timeframe were pooled the most commonly reported occurrences were 'System failure or malfunction' (SCF-NP) and 'Passenger illness or injury' (CABIN – PAX ILL). Further information on these categories was provided earlier in this chapter. The most commonly reported risk bearing occurrences were 'Human factors crew' (HF CREW) and 'Airprox / near midair collision' (MAC).

'Human factors crew' (HF-CREW) describes occurrences initiated through crew error, for example procedural or handling errors. It was identified as a safety concern within the EU and further afield. All Irish Operators have integrated human factors principles into their crew training programmes. The IAA has conducted an extensive analysis of all risk bearing human factors occurrences that involved the 5 largest Irish AOC holders. The findings of the analysis were communicated to the Irish AOC holders through IAA SRDs' Flight Operations Department.

The second most common type of risk-bearing occurrence was 'Airprox / near Mid Air Collision' (MAC). As already mentioned most commercial aircraft are equipped with electronic collision avoidance systems and these systems trigger alerts and guidance on avoiding actions to flight crews to help resolve traffic conflicts.



A Ryanair aircraft taxiing for takeoff. Photographer Izabela Wojtasik

SECTION C

The Irish Commercial Helicopter Sector



Rescue 115 moments from lifting off the helipad at Letterkenny Hospital, it had been tasked to transport a patient to University Hospital Galway. Photograph by Paul McMenamin.

Introduction

Another significant sector of the Irish aviation industry is the helicopter industry, which consists of a number of organisations providing different types of services.

Babcock Mission Critical Services (Ireland) (formerly Bond Air Services Ireland), CHC Ireland DAC (formerly CHC Ireland) and Executive Helicopters provide Commercial Air Transport (CAT) services under an Air Operators Certificate (AOC) issued by the IAA. Babcock Mission Critical Services conducts CAT operations within the offshore sector. CHC Ireland DAC conducts Search and Rescue (SAR) operations under an IAA issued National SAR Approval and Helicopter Emergency Medical Services (HEMS) operations, which requires the issue of an AOC specific Approval and an IAA issued Authorisation to conduct High Risk Specialised Operations (SPO). Executive Helicopters conducts CAT and commercial SPO under an IAA issued authorisation.

During 2015 Irish Helicopters Limited and Starlite Aviation Ireland, who provided CAT services, surrendered their AOCs. Accidents, serious incidents and MORs involving or submitted by these former AOC holders are included in this analysis up to the date they ceased trading.

The IAA also monitors helicopter operations carried out in Irish territory by Operators conducting CAT and declared activities (commercial SPO and NCC) in accordance with Regulation (EU) 965/2012 requirements. The CAT certificate and/or authorisation may be issued from another EASA Member State or an aerial work permission issued by the IAA to an Operator from a third Country (Non EASA Member State) conducting aerial work.

Another type of organisation consists of those who place helicopters on the Irish aircraft register, which they then lease to an Operator that holds an AOC issued in Ireland or by a foreign State. For foreign AOCs, Ireland retains airworthiness oversight responsibility utilising an agreement with the State of Operator as per Article 83bis of Chicago Convention.

Accidents and Serious Incidents

On 31st December 2016 there were 13 helicopters above 1,700 kg on the Irish aircraft register. Over the 5 year period operators flying under an AOC issued by the IAA were involved in 1 non-fatal accident during a training / flight check exercise and 2 serious incidents. The non-fatal accident took place during 2015 and was categorised as ‘Abnormal runway contact’ (ARC), both serious incidents were categorised as ‘Other’ (OTHR) by the investigating SIA.

Table C.1: No. of accidents, fatal accidents and serious incidents involving Irish AOC holders operating helicopters over 1,700 kg.

Year	Total registered in Ireland	Accidents			Serious incidents
		Non-fatal	Fatal	Total	
2012	13	-	-	-	-
2013	17	-	-	-	-
2014	15	-	-	-	1
2015	12	1	-	1	1
2016	13	-	-	-	-
Total	-	1	-	1	2

Number and Rate of MORs

This section provides information on the number and rate of MORs submitted by the Irish AOC holders flying helicopters. Information on MORs submitted by the lease fleet is not included.

A helicopter flight is defined as a departure and a landing, irrespective of where they took place. Hence a helicopter departing an airfield and landing on an off shore oil rig is considered to be one flight and a subsequent flight to another oil rig or the return flight to the airfield is an additional flight. During 2016 the three AOC holders conducted 6,752 flights.

Over the five year period the helicopter AOC holders submitted 323 MORs and conducted 44,178 flights. Of the 323 MORs, the SRD Inspectors identified one MOR as being risk bearing and assigned an ARMS score of greater than 500. The helicopter AOC holders submitted a much smaller number of MORs than the fixed-wing AOC holders because the number of helicopter flights conducted is much smaller and the operating environments differ significantly.

To account for annual fluctuations in the number of flights conducted an MOR rate per 1,000 flights was calculated. Over the period considered the occurrence reporting rate has fluctuated between 4.15 and 10.53 MORs per 1,000 flights.

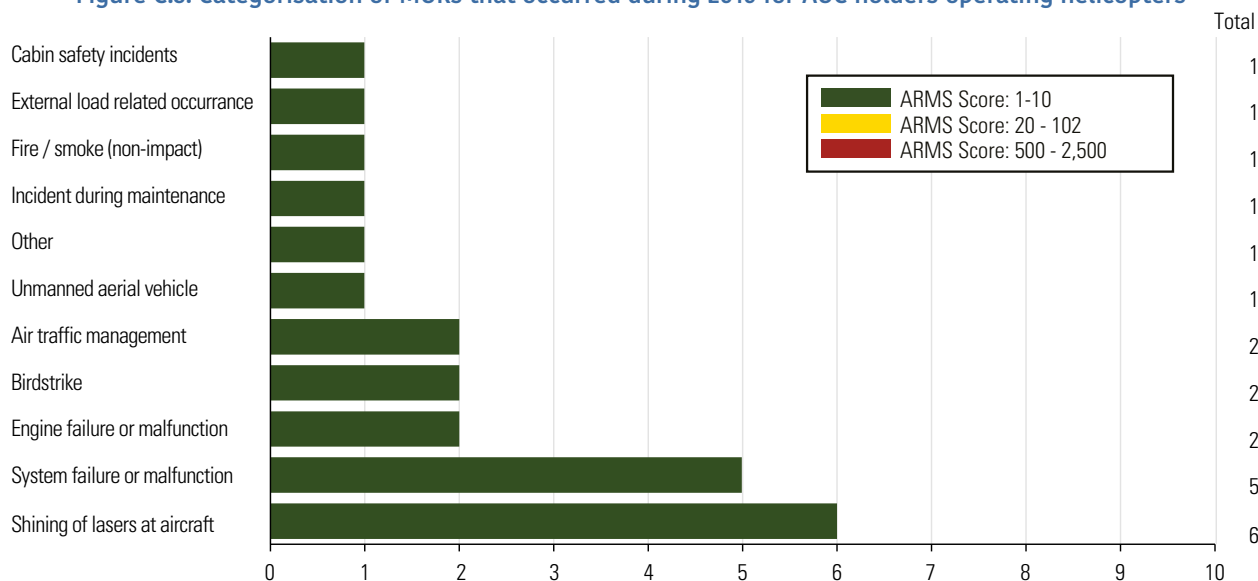
Table C.2: Statistics for MORs submitted by the Irish AOC holders operating helicopters

Year	Sectors flown	Total		ARMS: 1 - 10		ARMS: 20 - 102		ARMS: 500 - 2,500	
		Number	Rate	Number	Rate	Number	Rate	Number	Rate
2012	9,177	46	5.01	46	5.01	-	-	-	-
2013	9,514	100	10.51	99	10.41	-	-	1	0.11
2014	9,974	105	10.53	105	10.53	-	-	-	-
2015	8,761	44	5.02	44	5.02	-	-	-	-
2016	6,752	28	4.15	28	4.15	-	-	-	-
Total	44,178	323	7.31	322	7.31	-	-	1	0.02

Occurrence Categories and ARMS Score: 2016 MORs

When an AOC holder submits an MOR to the IAA an SRD Inspector categorises the type of occurrence that took place and uses the ARMS methodology to assess the safety risk associated with it. The purpose of this is to identify and monitor emerging safety concerns.

During 2016 the helicopter AOC holders reported 28 MORs through the IAA SOTS system. Figure C.3 summarises the categorisation and ARMS score assigned by SRD to the MORs.

Figure C.3: Categorisation of MORs that occurred during 2016 for AOC holders operating helicopters

The two occurrence categories most commonly applied to the MORs were ‘Shining lasers at aircraft’ (LASER) and ‘System failure or malfunction’ (SCF-NP).

Lasers are optical devices that produce a very highly concentrated beam of light in a single colour. The more serious effects reported by pilots’ include flash blindness, glare and being distracted. ‘Shining lasers at aircraft’ (LASER) is now a criminal act in Ireland and is one of the Key Safety Performance Indicators included in the State Safety Plan.

‘System failure or malfunction’ (SCF-NP) captures the failure or malfunction of components on-board the helicopter that are not associated with the engine. None of these occurrences received an ARMS score of greater than 10, indicating there were no circumstances under which the system failure could jeopardise the safety of the aircraft or those on-board.

For comparison with 2016: Occurrence Categories and ARMS Score Assigned to MORs between 2012 - 2015

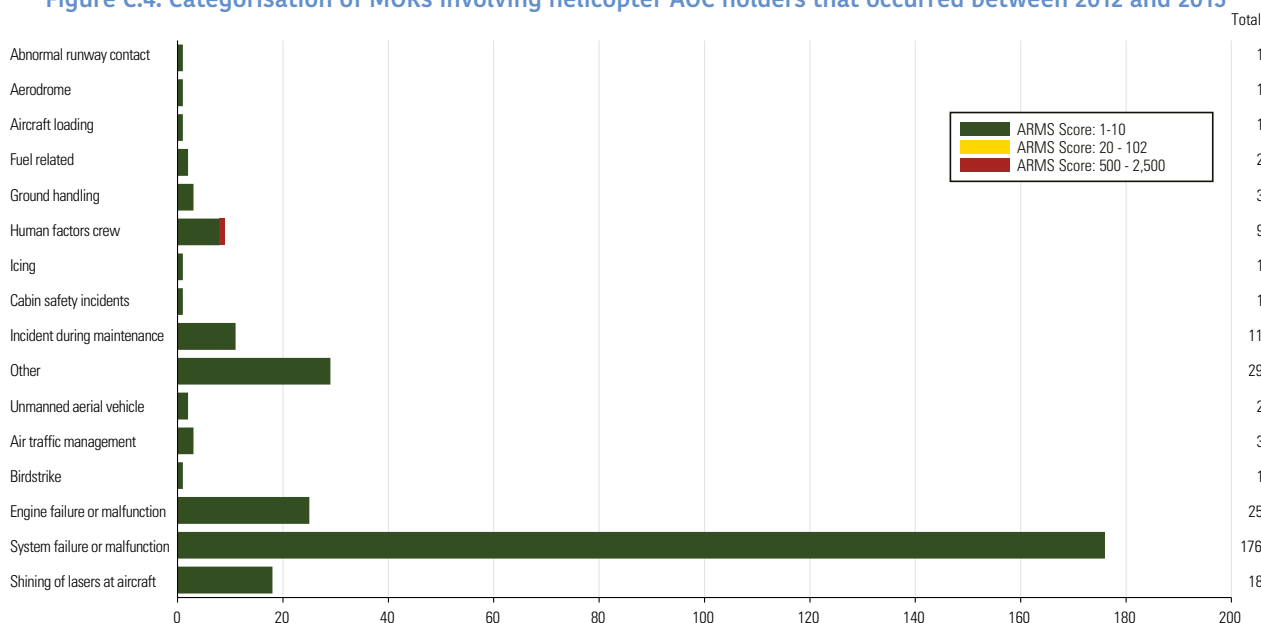
Between the 1st Jan. 2012 and the 31st Dec. 2015 inclusive the Irish AOC holders operating helicopters conducted 37,426 flights. During the same timeframe they submitted 295 MORs through the IAA SOTS system.

The categories assigned to the MORs are summarised in Figure C.4. To illustrate how the types of occurrences are changing over time the order of the categories along the vertical axis reflects that of Figure C.3.

During 2016 occurrences were assigned to two categories that were not used between 2012 and 2014. They are 'External load related occurrence' (EXTL) and 'Fire / smoke (Non-Impact)' (F-NI).

Between 2012 and 2014 occurrences were assigned to seven categories that were not used during 2016. They are 'Abnormal runway contact' (ARC), 'Aerodrome' (ADRM), 'Aircraft loading' (RAMP - LOADING), 'Fuel related' (Fuel), 'Ground handling' (RAMP), 'Human factors crew' (HF CREW) and 'Icing' (ICE).

Figure C.4: Categorisation of MORs involving helicopter AOC holders that occurred between 2012 and 2015



The two occurrence categories most commonly applied to MORs during this period were 'System failure or malfunction' (SCF-NP) and 'Other' (OTHR). There was 1 risk-bearing occurrences over the period considered. It was classified as 'Human factors crew' (HF-CREW).

The most common classification assigned to MORs which took place between 2012 and 2015 inclusive was 'System failure or malfunction' (SCF-NP), which captures the failure or malfunction of components on-board the helicopter that are not associated with the engine. None of these occurrences received an ARMS score of greater than 10, indicating they were low risk occurrences and there were no circumstances under which the system failure could jeopardise the safety of the aircraft or those on board.

The second most common classification assigned to the MORs was 'Other' (OTHR). As previously explained this classification captures occurrences that do not fit under an alternative category. None of the MORs categorised as such described situations which posed a safety risk to the helicopter or those on-board.



Executive Helicopters provide charter and aerial services. Photo supplied by Executive Helicopters

SECTION D

The Irish Corporate Aviation Sector



Gain Jet received an AOC from the IAA in August 2016, bringing the total number of Irish AOC holders to 14.
Photo provided by Gain Jet Ireland.

Introduction

Corporate aviation services describe one mode of unscheduled commercial flights, typically aimed at the business community. In Ireland it is conducted under an AOC issued by the IAA and there are currently three operators who provide this type of service: Airlink Airways, WestAir Aviation and, since 31st August 2016, Gain Jet Ireland. All three Operators have a number of different types of aircraft within their fleet.

Accidents and Serious Incidents

Over the five year period the number of aircraft on the Irish aircraft register engaged in this type of activity has fluctuated between 6 and 10.

The AOC holders providing corporate aviation services were not involved in any accidents or serious incidents between 1st Jan. 2012 and the 31st Dec. 2016.

Table D.1: No. of aeroplanes on the Irish aircraft register that were used to provide corporate aviation services
(They were not involved in any accidents or serious incidents over the period considered)

Year	2012	2013	2014	2015	2016
Aircraft register	6	8	8	6	10

Number of MORs

Between 1st Jan. 2012 and the 31st Dec. 2016 inclusive the Irish AOC holders providing corporate transport services submitted 79 MORs to SRD. The number of MORs reflects the relatively small number of aircraft operating within this sector of the Irish aviation industry.

The safety risk associated with the 79 MORs was assessed using the ARMS matrix as being of low risk and all of the 79 MORs were assigned an ARMS score of 10 or less.

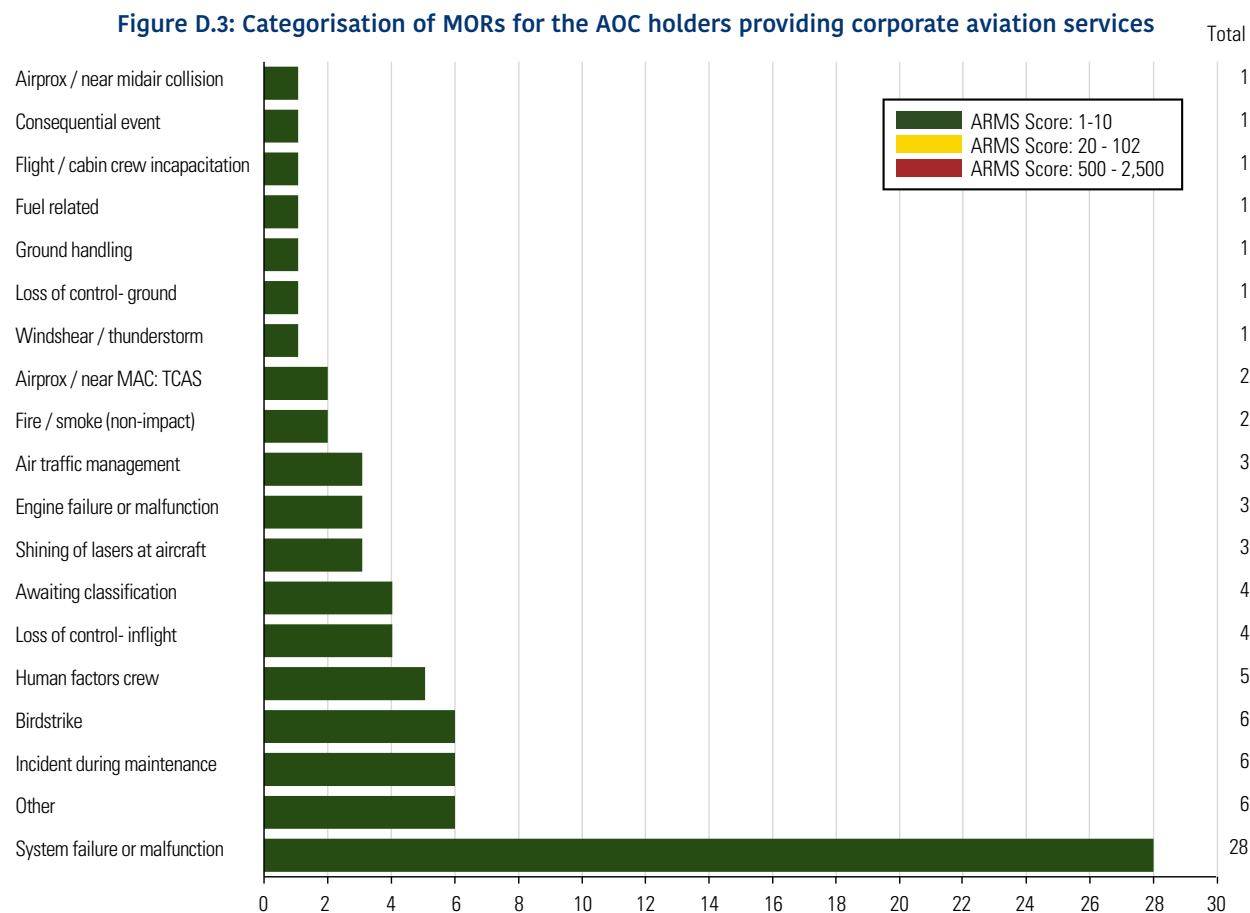
Table D.2: No. of MORs submitted by AOC holders who provide corporate aviation services
(All MORs were assessed as being of low-risk and assigned a score of between 1 and 10 on the ARMS matrix)

Year	2012	2013	2014	2015	2016	Total
No. MORs submitted	3	19	16	20	21	79

These AOC holders also provide the IAA with the number of movements and flight hours they conducted annually. However an MOR rate was not published as, for most of the period under review, there were two AOC holders providing this type of service and reversing the formula to calculate the MOR rate is a simple task which would reveal commercially sensitive information regarding the number of flights conducted to each of the AOC holders.

Occurrence Categories and ARMS Score: 2012 - 2016 MORs

Due to the relatively small number of MORs submitted an overview of the categories applied by SRD over the full period considered is presented.



The most commonly applied category to the MORs was 'System failure or malfunction' (SCF-NP). This category captures the failure or malfunction of components on-board the aircraft that are not associated with the engine. None of these occurrences received an ARMS score of greater than 10, indicating they were low risk occurrences and there were no circumstances under which the system failure could jeopardise the safety of the aircraft, or those on board.



A Cessna CJ3 Jet and a drone on the taxiway at Weston airport.
Image supplied by Aerial Photography Ireland.

SECTION E

Irish Aerodromes and Air Navigation Services



Aerial view of runway 17/35 at Cork airport while on takeoff from runway 25, picture taken from the Aer Lingus Iolar aircraft. Photographer Paul Daly

Introduction

There are two types of aerodrome in Ireland, those that are licenced for public use and those that are licenced for private use. Aerodromes licenced for private use accept aircraft engaging in Aerial Work (AW) and other aviation activities, such as General Aviation (GA) or flight training, but not aircraft engaged in Commercial Air Transport (CAT). Aerodromes licenced for public use accept aircraft engaged in CAT operations, as well as aircraft engaging in AW, and other aviation activities such as GA flight training.

Safety requirements for aerodromes are not based around the type of licence held; rather they are in proportion to the type of aircraft that use it, and other considerations such as whether night or low visibility operations are permitted there. The principal difference between the two types of aerodrome is that those with a licence for public use must be available to all aircraft on equal terms and conditions and must be open during promulgated hours, whereas using a private aerodrome is subject to the prior permission of the licensee.

There are 24 licenced aerodromes in Ireland, 11 for private use and 13 for public use. This section provides information on the aerodromes that were licenced for public use and offered ATC services between 1st January 2012 and 31st December 2016. These were Cork, Donegal, Dublin, Galway, Ireland West, Kerry, Shannon, Sligo, Waterford and Weston aerodromes. At the time of publication Galway aerodrome is not licenced for public use, however its data is included for the time it was licenced for public use.

Accidents and Serious Incidents

This section discusses flight hours, departures, accidents and serious incidents involving aircraft engaged in CAT at an aerodrome licenced for public use in Ireland. The aircraft involved may be on the Irish aircraft register or another States aircraft register, held an AOC issued by the IAA or by another National Aviation Authority. Some of the events included here are also included in the previous section on CAT. Accidents and serious incidents involving aircraft engaged in GA are not included unless there was a second aircraft involved in the same occurrence that was providing CAT services.

Flight hours for every aircraft that enters Irish airspace are calculated from the flight plan as the time difference between when the aircrafts enters and exits the controlled airspace of the flight trajectory. It includes en-route traffic which passes through Irish airspace but does not land (overflight traffic) as well as aircraft that land or depart from an Irish airport (terminal traffic). The number of flights describes the number of aircraft that land and depart at an aerodrome. The number of flight hours and flights both rose during 2016.

There were 5 accidents and 13 serious incidents over the five year period considered. None of the accidents resulted in fatalities.

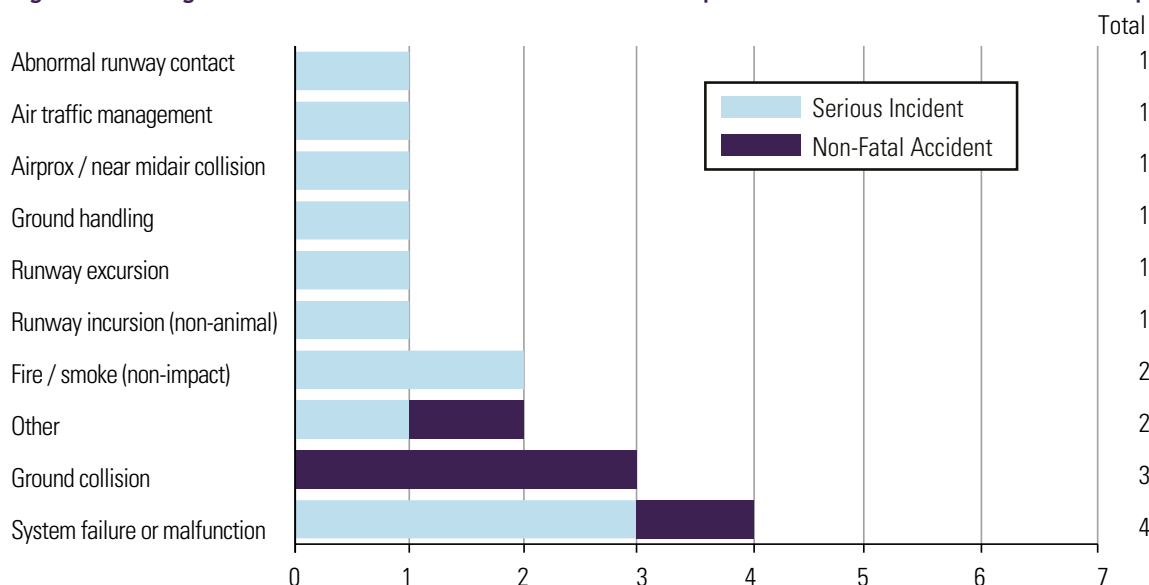
Table E.1: No. of accidents, fatal accidents and serious incidents involving CAT at Irish aerodromes

Year	No. flights at Irish airports	No. flight hours in Irish airspace	Accidents			Serious incidents
			Non-fatal	Fatal	Total	
2012	207,192	263,974	-	-	-	1
2013	229,983	267,860	1	-	1	2
2014	239,766	276,582	2	-	2	2
2015	253,335	288,780	2	-	2	5
2016	274,058	309,697	-	-	-	3
Total	1,204,334	1,406,893	5	-	5	13

Categorisation of accidents and serious incidents

Based on the findings of their investigation the AAIU assigns one of the CAST / ICAO common taxonomy categories to the accident or serious incident. The categories often relate to the event outcome and do not necessarily identify an aspect in the causal chain. Figure E.2 summarises the categories assigned to the 5 accidents and 13 serious incidents that took place between 2012 and 2016.

Figure E.2: Categorisations of Annex 13 occurrences that took place at Irish aerodromes licenced for public use



The most common classification applied to the non-fatal accidents was ‘Ground collision’ (GCOL); it was applied to 3 of the 5 accidents. The category most commonly applied to serious incidents was ‘System failure or malfunction’ (SCF-NP).

‘Ground collision’ (GCOL) describes a collision involving an aircraft while taxiing to or from a runway that is in use. It excludes collisions that occur on the runway. The collision can involve two aeroplanes or one aeroplane and a person, animal, ground vehicle, obstacle, building or structures such as lighting poles etc. It was also the most commonly assigned accident category during 2015. The IAAs SRD is currently undertaking a review of all accidents, serious incidents and occurrences classified as ‘Ground collision’ and the results of the analysis will be disseminated to all Stakeholders in due course.

The category most commonly assigned to serious incidents was ‘System failure or malfunction’ (SCF-NP). It describes the failure or malfunction of components on-board the aeroplane that were not associated with the engine.

Number and Rate of ATS MORs: 2014 - 2016

Prior to 1st Jan 2014 the ESARR2 Severity Classification Scheme was used to assess the risk associated with MORs. A summary of the resulting risk assessments are presented in previous Annual Safety Performance Reviews, which are publically available on the IAAs website. Since then the associated risk is being assessed using the ARMS methodology.

Between 1st Jan 2014 and 31st Dec 2016 the ATS providers at the principal aerodromes submitted 2,933 MORs to IAAs SRD. All MORs submitted to SRD by the ATS providers are categorised by an SRD Inspector and the associated risk assessed using the ARMS methodology. The IAAs SRD considers an ARMS score of 20 or more to be risk-bearing.

The number of MORs submitted over the three-year period fluctuated between 805 and 1,299 per year and more than 94% of MORs were not associated with any safety risk. However of the 2,933 MORs assessed 171 were identified as being risk-bearing and 5 of these were assigned a score of 500 or greater, indicating they were high-risk events.

As the vast majority of MORs relate to occurrences that took place while the aircraft was air borne flight hours, rather than the number of arrivals / departures, were used to standardise the number of MORs received. Over the three-year period the Irish ATS providers reported between 27.88 and 41.94 MORs per 10,000 flight hours. MOR rates are good measures of how mature an organisations Safety Management System (SMS) is.

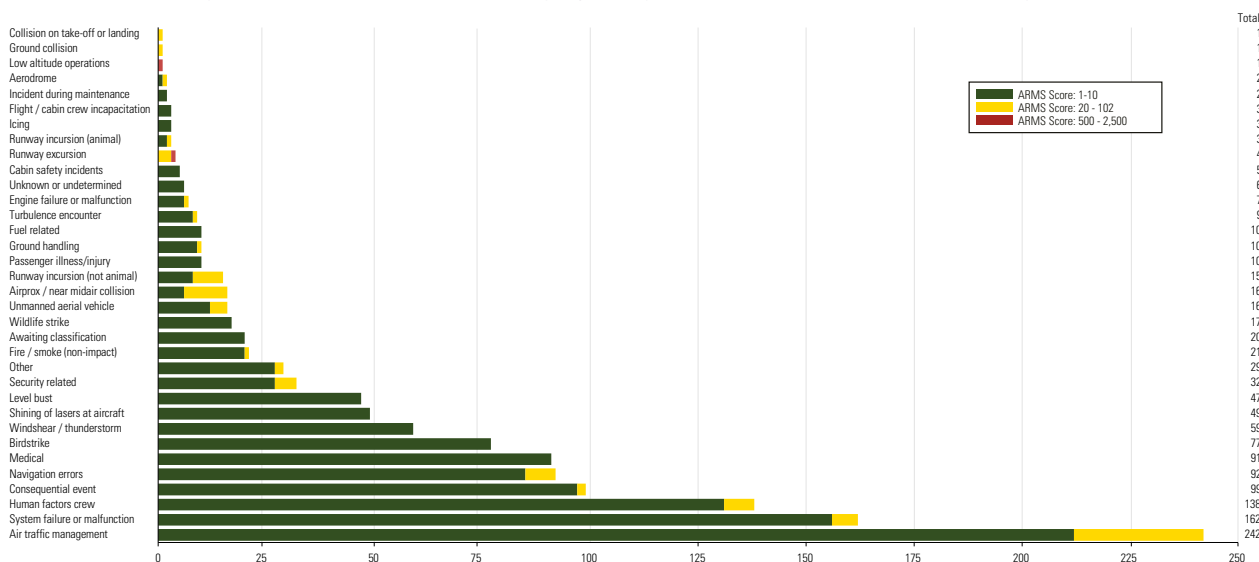
Table E.3: No. and rate of MORs according to ARMS score during 2014, 2015 and 2016

Year	Flight hours	Total		ARMS: 1-10		ARMS: 20-102		ARMS: 500 – 2,500	
		Number	Rate	Number	Rate	Number	Rate	Number	Rate
2014	276,582	829	29.97	804	29.07	24	0.87	1	0.04
2015	288,780	805	27.88	752	26.04	51	1.77	2	0.07
2016	309,697	1,299	41.94	1,206	38.94	91	2.94	2	0.06

2016 ATS MORs: Categorisation and ARMS score assigned

As well as assessing the safety risk using ARMS, the SRD Inspectors assigned a category to the MOR that captures the type of event that took place. Figure E.4 summarises these key pieces of information for MORs that occurred during 2016.

Figure E.4: ARMS score and category assigned to MORs that occurred during 2016



The category most commonly assigned to ATC MORs by SRD Inspectors was 'Air traffic management' (ATM). This is also the category with the largest number of risk-bearing MORs. The second most frequently assigned category was 'System failure or malfunction' (SCF-NP). The category with the second largest number of risk-bearing MORs was 'Airprox / near midair collision' (MAC).

‘Air traffic management’ (ATM) captures occurrences involving the failure or degradation of ATM services, communication, navigation services and surveillance services; for example a NAVAID outage would be categorised as ATM. All ATC systems at Irish aerodromes are installed and maintained to international standards and procedures and were developed in accordance with safety management principles. This helps ensure high standards of safety performance, which, as a minimum, meet the provisions of safety regulatory requirements. Due to the safety critical nature of ATM resilience is built into the system, this takes the form of multiple layers of redundancy and robust contingency plans in the event of a full system failure.

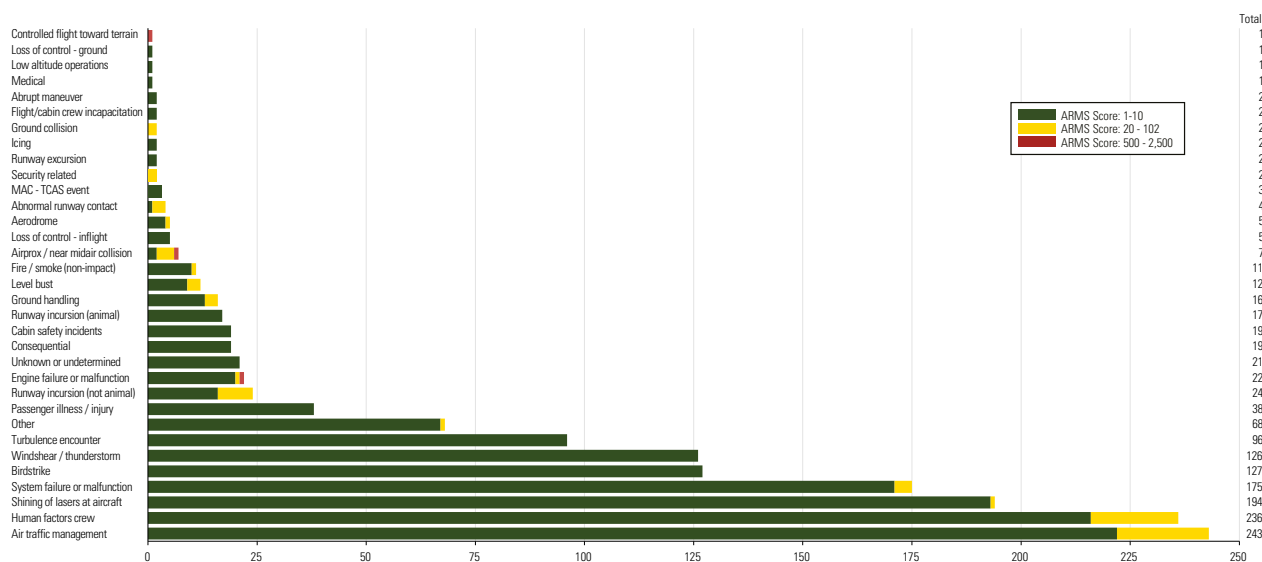
As previously explained, ‘System failures or malfunctions’ (SCF-NP) describes the failure or malfunction of components on-board the aircraft that are not associated with the powerplant. Over 96% of these MORs were low risk and assigned an ARMS score of 10 or lower.

‘Airprox / near midair collision’ (MAC) occurs when there is a loss of separation between two or more airborne aeroplanes. Most commercial aircraft are equipped with electronic collision avoidance systems and these systems trigger alerts and guidance on avoiding actions to flight crews to help resolve traffic conflicts. The ground based electronic safety net, Short Term Conflict Alert (STCA) triggers alerts to ATC in scenarios where minimum separation distances between any pair of radar tracks is, or is predicted to be imminently, breached in a radar environment. Occurrences of this nature that escalate into an accident are very rare within Europe.

2014 and 2015 ATS MORs: Categorisation and ARMS score assigned (for comparison with 2016 data)

During these two years SRD received 1,634 MORs from ATC. Figure E.5 summarises the category and ARMS score assigned to MORs that occurred during these years.

Figure E.5: ARMS score and category assigned to MORs that occurred during 2014 and 2015



The two categories most commonly assigned by SRD Inspectors to ATC MORs were ‘Air traffic management’ (ATM) and ‘Human factors crew’ (HF-CREW). These categories also contain the largest number of risk-bearing occurrences.

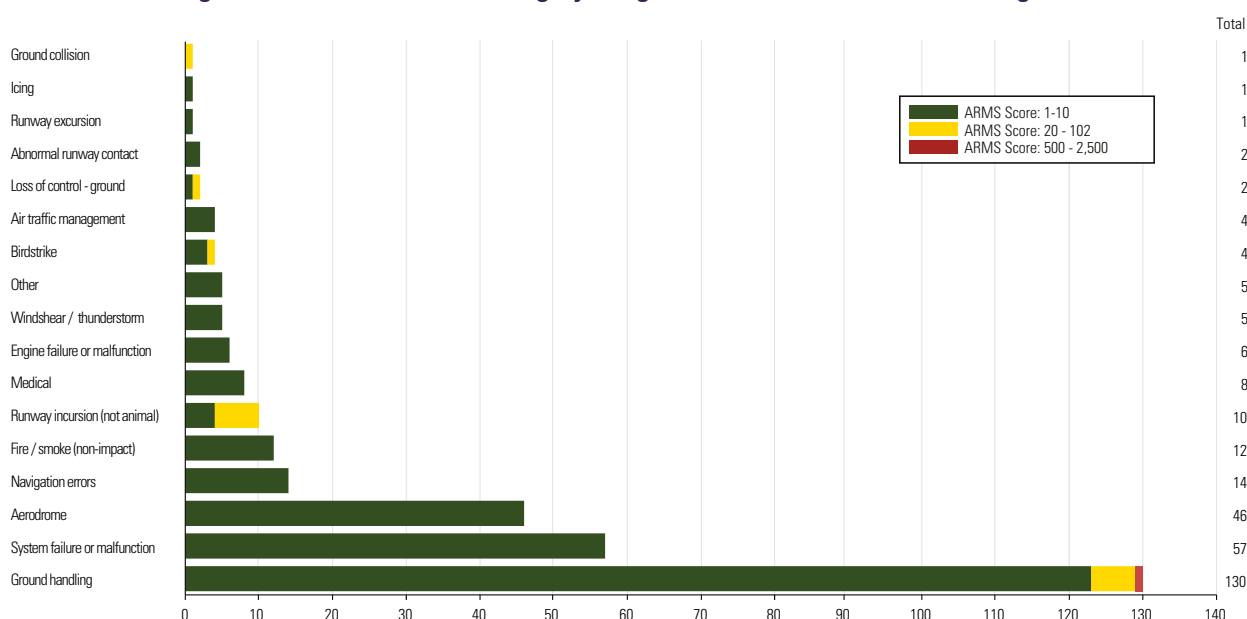
Information on the types of occurrence classified as ‘Air traffic management’ (ATM) was provided earlier in this chapter.

‘Human factors crew’ (HF-CREW) describes occurrences that were initiated through crew error, for example procedural or handling errors. It has been identified as one of the main safety concerns within the EU and further afield.

2016 Aerodrome MORs: Categorisation and ARMS score assigned

Between 1st Jan 2016 and 31st Dec 2016 the Aerodrome managers at the principal aerodromes submitted 308 MORs to IAAs SRD. All of these MORs have been assigned a category that captures the type of event that took place and the safety risk associated with these MORs has been assessed using ARMS. Figure E.6 summarises this data for MORs that occurred during 2016.

Figure E.6: ARMS score and category assigned to MORs that occurred during 2016



During 2016 the two most commonly reported occurrence categories were ‘Ground handling’ (RAMP) and ‘System failure or malfunction’ (SCF-NP). The categories to which the largest number of risk-bearing MORs was assigned were ‘Ground handling’ (RAMP) and ‘Runway incursion (Not animal)’ (RI-VAP).

‘Ground handling’ (RAMP) describes a wide variety of occurrences that may take place during, or as a result of, ground handling operations. Occurrences categorised as such include issues related to snow, frost and or ice removal from the aircraft, pushback / powerback / towing errors, aircraft external preflight configurations errors. The IAAs SRD is currently undertaking a review of all accidents, serious incidents and occurrences classified as ‘Ground handling’. The results of the analysis will be disseminated to all Stakeholders in due course.

Information on the types of occurrence classified as ‘System failures or malfunctions’ (SCF-NP) was provided earlier in this chapter.

ICAO define a ‘Runway incursion (Not animal)’ (RI-VAP) as being the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft. They are one of the IAAs Key Safety Performance Indicators (KSPIs) and the number and rate of RI-VAPs is closely monitored by the IAAs SRD.

SECTION F

General Aviation



A Land Africa parked at Birr Airfield, Co. Offaly during an General Aviation fly-in.
Photographer: Paul Kolbe.

Scope of Analysis and Sources of Data

General Aviation (GA) covers all civil aviation other than CAT (Commercial Air Transport) or AW (Aerial Work). This section discusses accidents and serious incidents involving aircraft engaged in GA according to the type of aircraft being flown. Voluntary Occurrence Reports (VORs) submitted by the GA community are discussed in Section F. The type of aircraft involved in GA accidents and serious incidents was determined using the Irish and foreign civil aircraft registers.

General Aviation: Aeroplanes

This section provides fatal accident, non-fatal accident and serious incident statistics for fixed-wing aeroplanes involved in GA activity according to whether the aircraft had an Maximum Take-Off Mass (MTOM) less than or greater than 2,250 kg.

The data is further broken down according to whether the aircraft was registered on the Irish civil aircraft register or an Aviation Authority based in another State. The number of Irish registered aircraft in each category is also provided. There is no information available on the number of aeroplanes permanently based in Ireland and listed on a foreign Aviation Authorities aircraft register.

Aeroplanes with an MTOM below 2,250 kg

Between 1st Jan 2012 and 31st Dec 2016 the number of aeroplanes registered with the IAA that have an MTOM below 2,250 kg fluctuated between 211 and 225.

Over the last five years 22 accidents have occurred, 6 of which involved aeroplanes on a foreign aircraft register and 16 involving aircraft on the Irish aircraft register. Tragically 3 accidents resulted in fatalities. These occurred during 2012, 2015 and 2016.

During the same period 5 serious incidents occurred. Given the number of accidents this is a surprisingly low number, a rough rule of thumb used in CAT is there are three serious incidents for every accident.

Table F.1: No. of accidents, fatal accidents and serious incidents involving GA aeroplanes with an MTOM below 2,250 kg

Year	Registered with IAA	Irish reg. accidents		Foreign reg. accidents		Total accidents	Serious incidents		
		Non-fatal	Fatal	Non-fatal	Fatal		Irish reg.	Foreign reg	Total
2012	216	2	1	1	-	4	-	1	1
2013	214	3	-	-	-	3	1	1	2
2014	211	3	-	3	-	6	-	-	-
2015	225	3	1	1	-	5	1	-	1
2016	222	3	-	-	1	4	-	1	1
Total	-	14	2	5	1	22	2	3	5

During the course of its' investigation the AAIU assigns one of the CAST / ICAO common taxonomy categories to the accident or serious incident. The purpose of this is to assist in identifying safety issues. In some cases the category describes the end result in a chain of events rather than the cause.

Figure F.2: Categorisations applied to accidents and serious incidents involving GA aeroplanes with an MTOM below 2,250 kg



‘Runway excursion’ (RE) was applied 5 times to accidents involving GA aeroplanes with an MTOM below 2,250 kg. This was the largest number of times a category was applied to accidents. ‘System failure or malfunction’ (SCF-NP) and ‘Engine failure or malfunction’ (SCF-PP) were each applied 3 times to accidents. These were the second most commonly assigned categories. The most commonly assigned category to serious incidents was ‘Airprox / near midair collision’ (MAC), it was applied twice.

Aeroplanes with an MTOM above 2,250 kg

On the 31st Dec. 2016 there were 8 aeroplanes on the Irish aircraft register with an MTOM greater than 2,250 kg that are being used for GA activity.

Table F.3: No. of accidents and fatal accidents involving GA aeroplanes with an MTOM above 2,250 kg
(There were no serious incidents over the period covered)

Year	Registered with IAA	Irish reg. accidents		Foreign reg. accidents		Total accidents
		Non-fatal	Fatal	Non-fatal	Fatal	
2012	11	1	-	-	-	1
2013	11	-	-	-	-	-
2014	8	-	-	1	-	1
2015	8	-	-	-	1	1
2016	8	-	-	-	-	-
Total	-	1	-	1	1	3

They were involved in 3 accidents over the last 5 years, one of which resulted in fatalities. There were no serious incidents over the period considered. The AAIU categorised the non-fatal accidents as ‘Runway excursion’ (RE) and ‘Other’ (OTHR). The fatal accident was categorised as ‘Controlled flight into terrain’ (CFIT).

General Aviation: Helicopters

This section provides fatal accident, non-fatal accident and serious incident statistics for helicopters involved in GA activity according to whether the aircraft had an MTOM less than or greater than 2,250 kg.

The data is further broken down according to whether the aircraft was registered with the IAA or an Aviation Authority based abroad. The number of Irish registered aircraft in each category is also provided. There is no information available on the number of helicopters permanently based in Ireland that are listed on a foreign Aviation Authorities aircraft register.

Helicopters with an MTOM below 2,250 kg

The number of helicopters with an MTOM below 2,250 kg that are on the IAA aircraft register has fallen slightly from 27 in 2012 to 20 in 2016.

There were 4 non-fatal accidents and 2 serious incidents over the same time frame in this category. All 6 helicopters that were involved in an accident or a serious incident were on a foreign Aviation Authority's aircraft register.

Table F.4: No. of accidents and serious incidents involving GA helicopters with an MTOM below 2,250 kg
(There were no fatal accidents over the period covered)

Year	Registered with IAA	Non-fatal accidents			Serious incidents		
		Irish reg.	Foreign reg.	Total	Irish reg.	Foreign reg.	Total
2012	27	-	-	-	-	-	-
2013	26	-	-	-	-	-	-
2014	22	-	1	1	-	-	-
2015	22	-	2	2	-	1	1
2016	20	-	1	1	-	1	1
Total	-	-	4	4	-	2	2

The 4 non-fatal accidents were categorised by the AAIU as 'Collision with obstacles during take-off and landing' (CTOL, 2 accidents), 'Loss of control in flight' (LOC-I, 1 accident), and 'Loss of control on the ground' (LOC-G, 1 accident).

The serious incidents were categorised as 'Airprox / near midair collision' (MAC, 1 accident) and 'Collision with obstacles during take-off and landing' (CTOL, 1 accident).

Helicopters with an MTOM above 2,250 kg

There were 4 helicopters on the Irish aircraft register that are above 2,250 kg and used for GA on the 31st Dec. 2015. This is a fall from 12 in 2012.

Table F.5: No. of GA helicopters with an MTOM above 2,250 kg on the Irish aircraft register
(There were no accidents or serious incidents over the period considered)

Year	2012	2013	2014	2015	2016
Registered with IAA	12	5	4	4	4

There were no accidents or serious incidents involving helicopter with an MTOM greater than 2,250 kg over the time frame considered.

General Aviation: Microlights

Since 1st Jan 2012 the number of microlights on the Irish civil aircraft register has increased from 133 to 164 on the 31st Dec 2016.

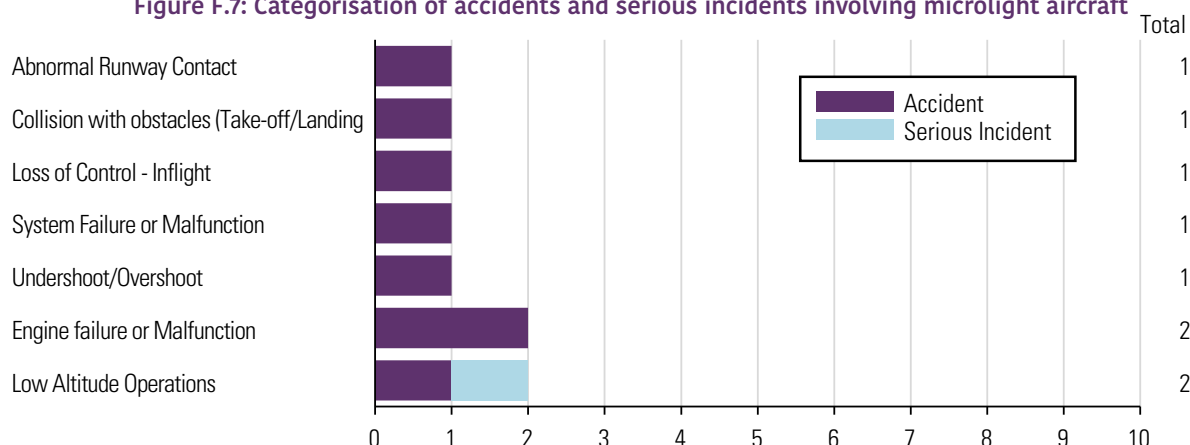
Between 1st Jan 2012 and the 31st Dec 2016 they have been involved in 8 non-fatal accidents, 2 of which occurred during 2016. There were no fatal accidents over the same timeframe. Of the 8 accidents 5 involved microlights that were not on the Irish civil aircraft register and 3 involved microlights that were.

Over the same period they have been involved in 1 serious incident, which occurred during 2012. The microlight involved in the serious incident was on a foreign States aircraft register.

Table F.6: No. of accidents and serious incidents involving microlight aircraft
(There were no fatal accidents over the period covered)

Year	Registered with IAA	Non-fatal accidents			Serious incidents		
		Irish reg.	Foreign reg.	Total	Irish reg.	Foreign reg.	Total
2012	133	2	2	4	-	1	1
2013	135	-	1	1	-	-	-
2014	148	-	1	1	-	-	-
2015	141	-	-	-	-	-	-
2016	164	1	1	2	-	-	-
Total	-	3	5	8	-	1	1

During the course of its investigation the Irish AAIU assigned one of the CAST / ICAO common taxonomy categories to the accident or serious incident. As Figure F.7 illustrates the categories assigned to accidents or serious incidents involving microlights has no conclusive pattern.

Figure F.7: Categorisation of accidents and serious incidents involving microlight aircraft

General Aviation: Paragliders, Powered Paragliders and Powered Parachutes

A paraglider is a wide canopy resembling a parachute that is attached to a person's body by a harness in order to allow them to glide through the air after jumping from or being hauled to a height. Powered paragliding, also known as paramotoring, is a form of aviation where the pilot wears a motor on her / his back to provide enough thrust to take off using an adapted paraglider wing. Powered parachuting utilises a self-powered flying parachute equipped with a motor. Paragliders and powered parachutes are not included on the Irish civil aircraft register, however powered paragliders are included since 2016.

There was 3 non-fatal accidents and 1 fatal accident involving paragliders, powered paragliders and powered parachutes between 2012 and 2016 in Ireland. There were no serious incidents. One of the accidents involved 2 paragliders, bringing the total number of paragliders involved in accidents to 5.

Table F.8: No. of accidents involving paragliders, powered paragliders and powered parachutes
(There were no serious incidents over the period covered)

Year	2012	2013	2014	2015	2016	Total
Non-fatal accidents	2*	-	1	-	-	3
Fatal accidents	-	-	-	-	1	1
Powered paragliders registered with IAA	Owners not required to register powered paragliders until 2016				7	-

* 1 accident involved 2 paragliders

The AAU categorised 3 accidents, one of which resulted in a fatality, as 'Loss of control in flight' (LOC-I). A non-fatal accident in 2012, which resulted in both pilots sustaining injuries, was categorised as 'Airprox / near midair collision' (MAC).

General Aviation: Sailplanes and Powered Sailplanes

A sailplane is a type of glider aircraft with rigid wings and an undercarriage. Powered sailplanes have motors that can be used for take-off or to allow the pilot to fly for an extended period. Some gliders may be launched by a tug aircraft or vehicle. The EASA basic regulation does not apply to Annex II (g) gliders with a maximum empty mass of no more than 80 kg when single seater or 100 kg when two-seater, including those which are foot launched.

On the 31st Dec. 2016 there were 23 sailplanes / powered sailplanes on the Irish aircraft register. The number of sailplanes and powered sailplanes on the Irish aircraft register has remained almost static over the 5 year period considered.

Table F.9: No. of serious incidents involving sailplanes and powered sailplanes
(There were no accidents over the period covered)

Year	2012	2013	2014	2015	2016	Total
Registered with IAA	27	26	26	25	23	-
Serious incidents	1	-	-	-	-	1

This category of aircraft was involved in 1 serious incident and no accidents over the 5 years considered. The serious incident was categorised as a 'Runway excursion' (RE).

General Aviation: Gyroplane

A gyroplane is a type of rotorcraft which uses an unpowered rotor in autorotation to develop lift, and an engine-powered propeller, similar to that of a fixed-wing aircraft, to provide thrust. Single and two-seater gyroplanes with a maximum take-off mass not exceeding 560 kg are regulated through Ireland's national legislation. Larger gyroplanes are regulated by EASA.

Gyrocopters were involved in 1 non-fatal accident, categorised as 'Loss of control in flight' (LOC-I), during 2014 and 1 serious incident, categorised as 'System failure or malfunction' (SCF-NP), during 2012.

Table F.10: No. non-fatal accidents and serious incidents involving gyroplanes
(There were no fatal accidents over the period covered)

Year	2012	2013	2014	2015	2016	Total
Registered with IAA	13	15	17	13	18	-
Non-Fatal Accidents	-	-	1	-	-	1
Serious Incidents	1	-	-	-	-	1

General Aviation: Hot Air Balloon Aircraft

A hot air balloon consists of an envelope, which is capable of containing heated air, suspended above a gondola or wicker basket, which carries people and a source of heat such as an open flame. The heated air inside the envelope makes it buoyant and allows the aircraft to become airborne.

There have been 10 hot air balloons on the Irish aircraft register for the last 5 years. There were no reports of any accidents involving balloons between 2012 and 2016 in Ireland.

Table F.11: Total no. of accidents involving sailplanes and powered sailplanes
(There were no accidents or serious incidents over the period covered)

Year	2012	2013	2014	2015	2016	Total
Registered with IAA	10	10	10	10	10	-

General Aviation: Parachuting

Parachuting is distinguished from the para-gliding / motoring activities discussed earlier in this section by the fact that the parachute flight commences from an airborne aircraft and they return to earth using only gravity. The rate of descent is slowed during the last part of the jump using a parachute or other means, such as a wing suit.

The figures in this subsection relate solely to accidents and serious incidents to parachutists after they exited the aircraft and were clear of the aircraft. Not all of the injuries sustained by parachutists as a result of jump resulted in the incident being classified by the AAIU as an accident or a serious incident. Accidents or serious incidents involving aircraft engaged in parachuting activity are included in the subsections on fixed-wing aircraft engaging in GA activity.

Over the 5 years considered there were 2 accidents. The first occurred in 2012 when the main and tandem parachute went into a condition of partial inflation. The second occurred during 2015 when the main parachute became entangled around the right-hand side horizontal stabiliser of the aircraft. There were no serious incidents.

Small Unmanned Aircraft

A Small Unmanned Aircraft (SUA) also called a drone, an RPAS or UAV, is an unmanned aircraft and their use is becoming increasingly prevalent in Ireland. Currently operators are not required to obtain a licence to fly a drone within the restrictions of the legislation; however the IAA recommends that everybody who intends to do so undertakes a course of safety training.

Under SI 563 of 2015 'Small Unmanned Aircraft (Drones) and Rockets Order, 2015' all drones and model aircraft over 1 kg, including the weight of the battery and all attached equipment, must be registered with the IAA by their owner. Owners of drones that weigh less than 1 kg may also register their aircraft with the IAA; however there is no regulatory requirement to do so. Owners can register the aircraft via the IAA website at www.iaa.ie/drones. This facility was made available during December 2015. On the 31st December 2016 there were 6,313 drones on the Irish drone register.

Operating Drones

The same rules apply to operating drones outdoors as to model aircraft, and these are laid down in SI 563 of 2015 ‘Small Unmanned Aircraft (Drones) and Rockets Order, 2015’. The regulations apply everywhere in Irish airspace and their purpose is to ensure the safe interaction of manned and unmanned aircraft and the safety of uninvolved persons on the ground.

Operators do not need permission from the IAA to use drones for commercial purposes, however if an operator wishes to fly a drone outside the limits prescribed in the regulations, permission must be sought from the IAA in the form of a Specific Operators Permission (SOP). The SOP will normally be dependent upon the operator attending a drone safety training course and producing a procedures manual that is acceptable to the IAA.

It is important to note there may be other rules that are not within the remit of the IAA, such as privacy or trespass laws, which should be taken into consideration by the person operating the drone.

Operators’ responsibilities

Regardless of whether or not they hold an SOP, it is the responsibility of the operator to ensure the area they intend to fly it in is suitable for such an activity. This means the drone Operator should carry out an on-site risk assessment in advance of the flight. The risk assessment should include identifying the classification of airspace the drone will be operated in and if there are any additional requirements applicable. The IAA’s Asset tool can be of some assistance by identifying controlled and restricted airspace areas.

For more detailed information please see the IAA’s website, which has a section dedicated to Drones within its ‘General Aviation’ area – <https://www.ie/general-aviation/drones>.

Reports and complaints applying to drones

If a drone has been operated in an unsafe manner, involved in a safety incident or operated in such a way contrary to SI 563 of 2015, it should be reported into the IAA via the Voluntary Occurrence Reporting (VOR) system. The safety implications of all reported incidents may be investigated by an SRD Inspector. Further information on how to use the VOR system is provided in Section G. If the concern relates to breaches of privacy the incident should report to the Data Commissioners. They have issued guidelines on their website, which may be accessed via the following address: <https://www.dataprotection.ie/docs/Guidance-on-the-use-of-Drone-Aircraft/1510.htm>.

General Aviation Safety Council of Ireland

GASCI is a volunteer body, made up of representatives from the GA community in Ireland. It was founded to promote safety awareness among those involved in the Irish GA community and to give the GA community and the IAA a forum through which they can readily communicate with each other. It meets on a regular basis and new members are always welcome. The current membership of GASCI includes:

- National Microlight Association of Ireland;
- Irish Microlight Association;
- Irish Paramotor Association;
- The Irish Gliding and Soaring Association;
- Irish Aviation Authority;
- Aircraft Owners and Pilots Association Ireland;
- Air Accident Investigation Unit;
- Irish Sport Rotorcraft Club;

- Model Aeronautics Council of Ireland;
- Irish Hang Gliding and Paragliding Association;
- Irish Ballooning Association;
- The Parachute Association of Ireland Ltd;
- Irish Light Aviation Society;
- RPAS/Drone Operators;
- Irish Instructors and Examiners Panel.

A representative of any club or association who would like to become involved can make contact with GASCI through their facebook page at: <https://www.facebook.com/gasci.ireland>.

GASCI works to a specific plan of action which is updated regularly. The main risks being addressed in the current action plan are:

- Airspace infringements into controlled airspace;
- Mid-air collision in Class G airspace (including other GA aircraft & drones) ;
- Loss of control in flight;
- Guidance for post-accident survivability;
- Specific guidance for paramotor and paraglider pilots.

It organises safety evenings with specific themes based on the current action plan. These safety evenings are both informative and entertaining and all GA enthusiasts are welcome to attend. GASCI are planning five safety evenings during 2017. They are planned for across the country to try to ensure that everyone in the GA community who wishes to attend may do so. At time of publication meetings are planned for the months of April and November. Closer to these months please refer to the GASCI website or facebook page for the exact dates, start time and a list of locations.

As part of GASCI's role is to provide safety information derived from lessons learnt the AAIU can, and has, issued Safety Recommendations to GASCI when the actions relate to the promotion of safety in GA. Outside of this GASCI may highlight important safety information from the AAIUs investigation into GA accidents or serious incidents or from relevant emerging threats. It pursues this aim by developing its own safety information based on the risks identified in the Irish context. Some safety information GASCI developed was provided to EASA to support EU wide safety awareness campaigns.

GASCI also distributes safety information provided by other States and EASA as well as highlighting NOTAMs which affect GA operations and other useful information for GA pilots. A copy of the safety information GASCI has made available to the GA community is available on GASCI website <http://gasci.weebly.com/> and on GASCI's facebook page.

In addition to safety promotion activities, GASCI provides a forum for the GA communities input at State level on issues such as airspace policy and airspace design and provides inputs on the latest GA activities to assist in updating published aeronautical charts.

SECTION G

Voluntary Occurrence Reporting



A construction team upgrades the surface and lighting system of Runway 10/28 at Dublin airport. This runway handles 95% of all flights at the airport. Copyright Leo Hillier and Lagan Clare JV.

EU Regulations

Since 15th November 2015 occurrence reporting in civil aviation in Europe has been subject to (EU) 376/2014. It includes provisions for reporting to the competent authority in each EU Member State using two types of reports, Mandatory Occurrence Reports (MOR) and Voluntary Occurrence Reports (VOR). Summaries of the data submitted through the MOR system were provided earlier in this report. This section summarises safety reports received by SRD through the VOR system. It includes reports:

- From organisations or individuals that are not required to report under the mandatory provisions (e.g. Annex II aircraft operators);
- Which address safety issues not listed in Commission Implementing Regulation 2015/2018;
- From individuals who feel their own organisations are not fully addressing their safety concerns.

Reporters can submit a report in the following ways:

- The European Commission has developed an on-line portal to facilitate the submission of either mandatory (MOR) or voluntary (VOR) reports from individuals or organisations. This facility is available at <http://www.aviationreporting.eu>. The IAA has received 8 voluntary reports through this portal;
- Prior to the introduction of the EU regulatory framework IAA had established a voluntary reporting system. It is available at <https://www.iaa.ie/general-aviation/occurrence-reporting/confidential-reporting> and the IAA will maintain this system until would be reporters become familiar with the new EU wide system.

The IAA appreciates the efforts of all those who voluntarily submit reports that may help improve aviation safety and is especially thankful to those reporters who have kindly provided permission to the IAA to contact them. Reporters should not be concerned if the IAA does not contact them, it may be that the report provided is comprehensive enough for IAA to investigate without further information or that the report concerns a known issue IAA is investigating. Even if the issue has already been identified, the IAA welcomes the report as it will provide information on the recurrence rate and may contain additional details.

Analysis of VOR reports

Regardless of how they were submitted, the IAA reviews all VORs to identify safety hazards or concerns that may be emerging or were previously unidentified. All reports are fully investigated, if necessary in conjunction with the Operator (in such as way that the identity of the reporter is protected), and all necessary actions to avoid future similar occurrences are taken.

The number of VOR reports submitted annually is provided in Table G.1. It can be seen that there is a generally increasing trend in the volume of reports the IAA receives annually.

Table G.1: Number of VOR received

Year	2011	2012	2013	2014	2015	2016
VORs received	30	63	38	71	68	115

The vast majority of VORs the IAA receives concern Commercial Air Transport (CAT). These reports address passenger experience (cabin related issues) and passenger perceptions of hazardous aircraft operations (heavy landings, proximate traffic) as well as a growing number of voluntary reports from aviation professionals (pilots, cabin crew, ground handlers) concerning human factors related issues.

The IAA would like to see the GA community making more use of the VOR system and so the IAA, in conjunction with GASCI, will continue to promote voluntary reporting in areas not covered under the EU regulatory framework, such as pilots of uncertified light sports aircraft, drone operators etc.

As part of an update to the IAAs voluntary reporting website in Nov. 2015, a drop-down menu listing types of reporter was introduced. A breakdown of who is reporting is illustrated in Table G.2. It illustrates the majority of reporters were passengers followed by individuals who work in the industry in a professional capacity.

Table G.2: No. of VOR received from according to who submitted them

Reporter Type	Aircraft Passenger	CAT Professional	Other	General Public	General / Sports Aviation	RPAS / Drone Operator
Frequency	54	43	8	6	3	1



Acknowledgements

The author wishes to acknowledge the contribution made by the AAIU, Irish aviation industry, Irish aviation community and IAA personnel in the preparation of this report and thanks them for their support.

Disclaimer

The data presented in this document is strictly for information purposes only. It is obtained from a number of different sources and, whilst every care has been taken to ensure the accuracy of the data and to avoid errors in the content, the IAA makes no warranty as to the accuracy, completeness or currency of the content.

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Most of the images which appear within this document were provided by photography enthusiasts who work within the Irish aviation industry or enjoy flying recreationally around Ireland. We would like to take this opportunity to thank everyone who granted us permission to use their work. The IAA would like to continue using photographs showing different aspects of Irish aviation and its support systems within future Annual Safety Performance Reviews. If you took a photograph you are willing to let us use, please send it to us at Kathleen.Cussen@IAA.ie with some information for the photo caption.

Scope and Content of the Report

The Annual Safety Performance Review provides statistics on safety in the Irish aviation industry. Information relating to the safety activity the IAA has undertaken or intends to undertake is presented in the IAA's State Safety Plan. The IAA intends to publish its 2017 – 2020 State Safety Plan during Q2 2017. Previous editions of the State Safety Plan are available on the IAA's website.



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Registered Office: The Times Building, 11 – 12 D'Olier Street, Dublin 2
Registered Number: 211082. Place of Registration: Ireland
A Limited liability company