Total Aviation System Baseline Risk Picture

N. Aghdassi (Avanssa), A.L.C. Roelen (NLR), A.D. Balk (NLR)

A2COS safety certification

A baseline risk picture is created by highlighting relevant statistical snapshots from annual safety reports produced by EASA and Eurocontrol. Additionally, in order to create a baseline risk picture for the total aviation system, the key operational issues identified in the European Aviation Safety Plan (EASp) are quantified using the NLR Air Safety Database, which uses the ECCAIRS to store, collect and analyse safety data and information, and an improved Causal model for Air Transport Safety (CATS).

Coordinator	L.J.P. Speijker (NLR)
Work Package Manager	N. Aghdassi (Avanssa)

Grant Agreement No.	314299
Document Identification	D2.2
Status	Approved
Version	1.3
Date of Issue	21-08-2013
Classification	Restricted

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Document Change Log

Version	Author(s)	Date	Affected Sections	Description of Change
1.0	N. Aghdassi et al.	13-07-2013	All	Version for approval by PMT
1.1	N. Aghdassi et al.	06-08-2013	All	Incorporated PMT comments
1.2	A.L.C. Roelen, L.J.P. Speijker	19-08-2013	4.4, 4.5	Incorporated SESAR JU comments
1.3	L.J.P. Speijker	21-08-2013	All	Incorporated EASA comments

Review and Approval of the Document

Organisation Responsible for Review	Name of person reviewing the document	Date
NLR	L.J.P. Speijker, J.G. Verstraeten	28-06-2013
CAAi	S. Long, T. Longhurst	09-07-2013
Deep Blue	L. Save	09-07-2013
JRC	W. Post	09-07-2013
Institute of Aviation	A. Iwaniuk	09-07-2013
APSYS	V. Bonvino, J.P. Heckmann	24-07-2013
Thales Air Systems	B. Pauly	02-08-2013
ISDEFE	I. Etxebarria, M.M. Sanchez	02-08-2013
CertiFlyer	G. Temme, M. Heiligers	02-08-2013
Organisation Responsible for Approval	Name of person approving the document	Date
Avanssa	N. Aghdassi	13-07-2013
NLR	L.J.P. Speijker	21-08-2013

Document Distribution

Organisation	Names
European Commission	M. Kyriakopoulos, S. Grand-Perret
NLR	L.J.P. Speijker, A.D.J. Rutten, A.L.C. Roelen, A.D. Balk, G.W.H. van Es, J.G. Verstraeten, P.J. van der Geest, U.G. Dees, M.A. Piers
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Eurocontrol	E. Perrin
CAA Netherlands	R. van de Boom, R. van de Leijgraaf
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ESASI	K. Conradi

Acronyms

Acronym	Definition
ACARE	Advisory Council for Aviation Research
ADREP	Aviation Data Reporting Program (ICAO)
ANSP	Air Navigation Service Provider
ARC	Abnormal Runway Contact
ASCOS	Aviation Safety and Certification of new Operations and Systems
AST	Annual Safety Template
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Service
CATS	Causal model for Air Transport Safety
CFIT	Controlled Flight Into Terrain
CGAA	Collision on the ground between aircraft
CGAVPO	Collision on the ground between aircraft and vehicle/ person/obstruction
CICTT	CAST-ICAO Common Taxonomy Team
EASA	European Aviation Safety Agency
EASAC	European Aviation Safety Advisory Committee
EASp	European Aviation Safety Plan
EC	European Commission
ECAC	European Civil Aviation Conference
ECCAIRS	European Co-ordination Centre for Aviation Incident Reporting Systems

ECR	European Central Repository
ESARR	Eurocontrol Safety Regulatory Requirements
ESIMS	ESARR Implementation Monitoring and Support
EU	European Union
HEMS	Helicopter Emergency Medical Services
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
LALT	Low Altitude
LOC-I	Loss of Control In-flight
MID-AIR	Mid-Air Collisions
MS	Member States
MTOM	Maximum Take-Off Mass
MTOW	Maximum Take-Off Weight
RAMP	Ground Handling events
SCF-PP	System or component failure or malfunction related to the engine
SISG	ICAO's Safety Indicator Study Group
SMS	Safety Management System
SRC	Safety Regulation Council (Eurocontrol)
SSP	State Safety Plan
TCAS	Traffic Alert and Collision Avoidance System

Executive Summary

A baseline risk picture is created by highlighting relevant statistical snapshots from annual safety reports produced by the European Aviation Safety Agency (EASA) and Eurocontrol, with reference to the influence of some key accidents in recent years and the evolution of aviation safety in Europe to the present day. Additionally, in order to create the baseline risk picture for the total aviation system, the key operational issues identified in the European Aviation Safety Plan (EASp) are quantified using air safety data from the NLR Air Safety Database, which uses the European Co-ordination Centre for Aviation Incident Reporting System (ECCAIRS) for all safety data and information, and an improved Causal model for Air Transport Safety (CATS).

The results show that although there has been a significant overall improvement in safety in the last 2 decades, the stagnation in the rate of fatal accidents may pose a concern in case of a pick-up in traffic following the economic downturn of 2008. Although helicopter operations have also seen improvements in safety over the years, one activity which stands out continues to be Emergency Medical Services which accounts for most fatal accidents.

The probabilities calculated for the key operational issues identified in the European Aviation Safety Plan (EASp), using the NLR Air Safety Database and an improved Causal model for Air Transport Safety (CATS), support the focus of the EASp on runway excursion and ground collision events for their frequency. However, despite being less frequent, controlled flight into terrain, mid-air collision and in-flight loss of control events remain the most deadly when they occur:

Table 1 Frequencies of EASp key operational issues calculated using the CATS model

Key operational safety issue	**Frequency**
Runway excursion	$1.24 \cdot 10^{-6}$
Mid-air collision	$3.67 \cdot 10^{-8}$
CFIT	$3.72\ 10^{-8}$
Loss of control in flight	$4.13 \cdot 10^{-7}$
Ground collision	$1.17 \cdot 10^{-6}$

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1 Introduction

1.1 Background

ASCOS is an innovative EU funded research project, dealing with Aviation Safety and Certification of new Operations and Systems. ASCOS contributes to the Area/Topic Operational Safety in the Activity Ensuring Customer Satisfaction and Safety of the EU 7th Framework Programme Aeronautics and Air Transport.

The work contributes directly to the high level Flight Path 2050 and ACARE Vision 2020 safety goals. By 2020, the target is 1) reducing accident rate by 80%, and 2) reducing human error and its consequences. Figure 1 gives the worldwide fatal accident rate for commercial operations with western-built jet aircraft over the period 1980 until 2010. As can be observed, there has been little to no improvement of aviation safety worldwide from about 2004 onwards. Europe, the United States and other 'western' regions show a similar trend.

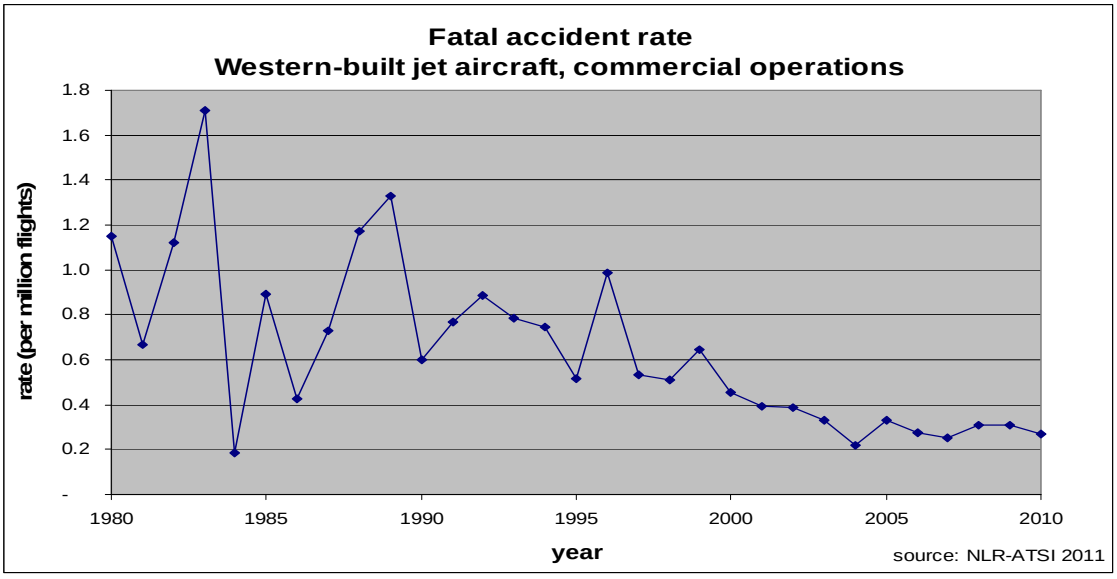


Figure 1 Worldwide fatal accident rates over the period 1980 until 2010 (Source: NLR-ATSI)

ASCOS aims to break this 'stagnation' of safety improvement through introduction of novel and innovative certification adaptations, which will ease the certification and approval process of safety enhancement systems and operations. It is clear that significant impact on the accident rate can only be realised if the priorities are focused on areas that exhibit a high risk. A specific activity during establishment of ASCOS has been the identification of such priority areas through analysis of the European Aviation Safety Programme Manual, European Aviation Safety Plan, Annual Safety Reviews from EASA and Eurocontrol, and consultation with the ASCOS User Group.

The top 5 commercial air transport accident categories that include a high number of fatal accidents are 1) loss of control in flight; 2) Aircraft system or component failure or malfunction; 3) abnormal runway contacts,

usually involving long, fast or hard landings; 4) ground handling aircraft damage by vehicles or ground equipment or incorrect loading; and 5) controlled flight into terrain. The EASA Annual Safety Review 2010 also provides information on safety occurrences in the European Central Repository (ECR). The top ECR safety occurrence categories include: Air Traffic Management / Communication Navigation Surveillance (ATM/CNS); aircraft system/ component failure or malfunctions; ground handling; Airprox/TCAS alert/loss of separation/ near midair collisions/midair collision; and bird strikes.

General aircraft operation is the most frequent event in the ECR occurrences. Analyzing this event further, gives three major events affecting the aircraft operation: flight crew interaction with air navigation services; aircraft collisions with obstacles, including bird strikes; and aircraft handling. The ATM domain has a small contribution to aviation incidents and accidents. However, according to EASA, efforts are still required to further improve ATM Safety. This may be due to the fact that – although ATM safety occurrences seldom lead to fatal accidents – they are still listed in the top ECR occurrence categories.

The creation of a Baseline Risk Picture for the Total Aviation System is a part of the activities of the ASCOS Work Package Continuous Safety Monitoring, which also includes a framework of safety performance indicators for the total aviation system (a task which is a precursor to this one), development of an improved process for safety performance monitoring and, finally, the development and implementation of tools in support of continuous safety monitoring.

1.2 Objectives

The objective of the work done in this report is to create a baseline risk picture of the various parts of the total aviation system by quantifying the frequency of occurrence of the key operational issues identified in the European Aviation Safety Plan (EASp) (and their accident scenarios).

1.3 Research approach and methodology

Initially, the data scope and data analysis methodology will be defined, because the baseline must be established using a representative, reliable and reproducible set of safety data. The NLR-ATSI Air Safety database will be used as data source for quantification of the accident scenarios. Air safety data are all data that characterise activities of the air transport system. The NLR-ATSI Air Safety Database contains detailed information on accidents, serious incidents and incidents of fixed wing aircraft and helicopters (covering commercial operations and General Aviation) from 1960 onwards. Currently the Air Safety Database contains information on more than 200,000 accidents, serious incidents and incidents that occurred worldwide. Furthermore, the Air Safety Database contains a large collection of worldwide non-accident related data, flight exposure data, weather data, fleet data, and more. The Air Safety Database is updated frequently using reliable sources including data from official reporting systems, insurance claims, accident investigation boards, aircraft manufacturers, and civil aviation authorities. The Air Safety Database uses the most recent version of ECCAIRS to collect, store and analyse all this safety information.

An improved quantified Causal model for Air Transport Safety (CATS) will be used in order to quantify the frequencies of occurrence of the accident scenarios and the key operational issues identified in the EASp (runway excursion, ground collision, controlled flight into terrain, mid-air collision and in-flight loss of control).

A review will also be carried out of EASA and Eurocontrol's Annual Safety Report in order to gather additional data to support and supplement where needed the CATS model. In general, the amount of data will be limited to what is required for the purpose of the analysis. Finally, statistical analysis will be performed on the selected air safety data from the NLR-ATSI Air Safety database in order to obtain the required results, e.g. in the form of a ratio or probability for events representing all possible accident scenarios in the total aviation system.

1.4 Structure of the document

The document is structured in 5 main Sections which follow the normal sequencing of tasks:

- Section 1 introduces the work and sets the objectives.
- Section 2 defines the data scope and explains the data analysis methodology.
- Section 3 which will present the results of the review carried out of EASA and Eurocontrol's Annual Safety Report.
- Section 4 presents the baseline risk level for the main operational issues of the European Aviation Safety Plan.
- Section 5 reviews the results and presents the conclusions.

2 Data scope and data analysis methodology

2.1 Safety performance indicators (SPI)

Traditionally, accident rates were used to measure the performance of aviation safety, but when safety increased accidents became rare events and a larger statistical base was required. With the introduction of safety management systems (SMS) and regulators increasingly moving away from a very active role in the supervision of aviation activities, safety performance indicators have become a means of monitoring the performance of safety management systems, be it within an organisation, at State level or even at a global level.

However, selecting the right safety performance indicators can be a challenge and will pose issues, such as; Which indicators are truly representative? How can the reliability and quality of the data and data analysis be preserved? Is the data source reproducible?

This is why within ASCOS's Continuous Safety Monitoring work package, particular emphasis is being given to the creation of the framework for developing safety performance indicators for the main operational issues of the European Aviation Safety Plan and then quantifying them using the Causal model for Air Transport Safety to help create the baseline risk picture.

2.2 Scoping of data sources

The occurrence and exposure data sources which are considered for this study go back to 1995 and refer to scheduled and unscheduled commercial air transport operations within Europe (27 EU Member States plus Iceland, Liechtenstein, Norway and Switzerland), involving powered turbine engine aircraft with maximum take-off weight above 5,700 kg.

This scope will be applied to the data used to quantify the key operational issues of the European Aviation Safety Plan using the Causal model for Air Transport Safety as well as any complementary data retrieved from review of other sources of aviation safety information.

2.3 European Aviation Safety Plan (EASp)

In order to further improve the already good safety record that exists in the civil aviation industry, ICAO developed and is promoting the principles of safety management throughout the aviation industry. The concept of safety management isn't new but when ICAO issued the first edition of their Safety Management Manual, it set into motion a new, more structured and integrated approach to safety management, right across the aviation industry.

The new philosophy of safety management suggests that there needs to be a cascading effect that sets the foundations for a safety management system that is integrated throughout; at an organizational level, at national level with the regulator and, finally, at a global level.

These principles revolve around the implementation of a Safety Management System (SMS) in industry organisations which are based on the State Safety Programme (SSP) of their national regulatory authority. Therefore, as a starting point, every ICAO Contracting State must have an SSP.

The sharing of roles between the European Union and the Member States, as described in the Basic Regulation made it impossible for Member States to take full responsibility for an SSP by themselves. Although some EU States went ahead and created their own SSP, most Member States did not have the capabilities to create such a programme. This is why there was a need to create the European Aviation Safety Programme (EASp) and also to complement what is already done by the Member States which encompasses the powers transferred to the Union.

In view of this need and in order to streamline the strategic approach, a European Aviation Safety Advisory Committee (EASAC) was established in October 2009 with representation from industry, some Member States, Eurocontrol, the European Commission and the Agency. Its fruitful guidance and the collaboration mechanisms established have culminated in the development of two important elements of the EASp: a manual and a safety plan.

The European Aviation Safety Plan (EASp) details the EU's strategy and priorities areas that need to be tackled in order to improve aviation safety in Europe. Its framework consists of systemic issues, operational issues, emerging issues and human factors and performance.

The plan identifies the following 5 key operational safety issues for commercial air transport:

- Runway Excursions
- Mid-Air Collisions
- Controlled Flight Into Terrain (CFIT)
- Loss of Control In Flight (LOC-I)
- Ground Collisions

These 5 safety issues are the basis upon which the ASCOS framework for safety performance indicators is created, and are therefore also central to the baseline risk picture for the total aviation system.

2.4 Causal model for Air Transport Safety (CATS)

The Causal model for Air Transport Safety (CATS) was initially developed as a result of an initiative by the Netherlands Ministry of Transport in order to gain a thorough understanding of the causal factors underlying the risks of air transport and their relation to the different possible consequences so that efforts to improve safety can be made as effective as possible.

The causal model uses a backbone structure of generic accident scenarios which have been defined based on the ICAO definition of an accident, in order to systematically develop accident scenarios: abrupt manoeuvre, cabin environment, uncontrolled collision with ground, controlled flight into terrain, forced landing, mid-air collision, collision on ground, structural overload and fire/explosion. The accident scenarios are grouped by accident type and different flight phases. The Event Sequence Diagram (ESD) methodology is used for representing the accident scenarios.

An ESD consists of an initiating event, pivotal events and end states. A representation of a generic ESD is given in Figure 2. ESDs provide a qualitative description of series of events leading to accidents. Because pivotal events can also cause avoidance of an accident, an ESD also models scenarios which lead to incidents and reportable occurrences. An initiating event represents the start of the main accident scenario. The initiating event of course also may have causes, and they are represented in a fault tree. Each pivotal event represents a possibility for the safety occurrence to develop into an accident, or a possibility that the accident is avoided. If all pivotal events contribute towards an unwanted outcome, than the end state is an accident or serious incident. If a pivotal event causes avoidance of an accident the end state is a safe continuation of the flight. A single ESD therefore can represent more than one accident scenario, and also represents accident avoidance scenarios. In case of the generic ESD of Figure 2, there are two accident scenarios and two accident avoidance scenarios.

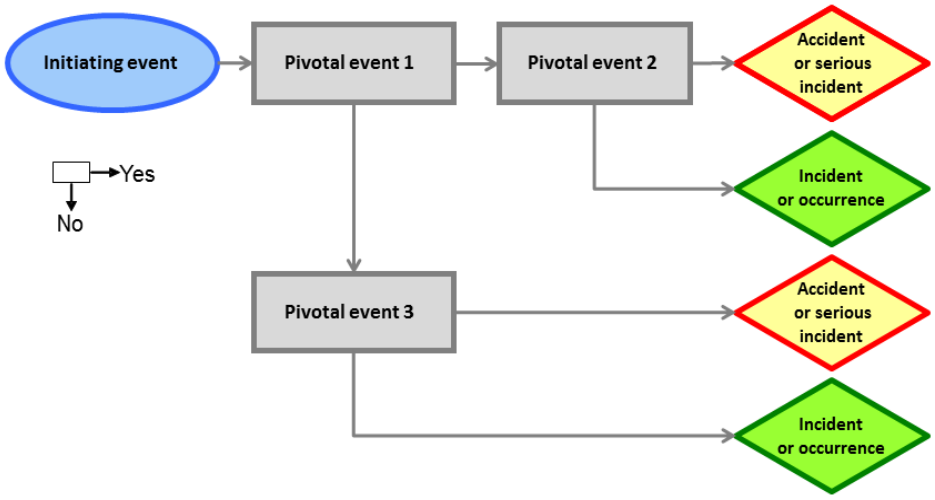


Figure 2 Generic representation of an ESD

In total 35 generic accident scenarios were developed based on a combination of retrospective and prospective analyses. These scenarios were subsequently quantified and allow the user to obtain a probability of occurrence for any given combination of an event.

Note that an improved version of the Causal model for Air Transport Safety, representing all possible accident scenarios in the current total aviation system is being developed as part of the ASCOS Project. Within the remainder of this study, this improved version is used to establish a total aviation system baseline risk picture.

3 Review of aviation safety information

The two main sources for aviation safety information for the European region are the annual safety review produced by the European Aviation Safety Agency (EASA) and Eurocontrol's Safety Regulation Council (SRC). Analysis of these documents over time contributes to the understanding of how safety has evolved over the years to what it is today within the different stakeholders which make up the European aviation system.

3.1 European Aviation Safety Agency (EASA) Annual Safety Reviews

EASA published the first of its annual safety reviews in 2005 in response to Article 11 (4) of Regulation (EC) No 1592/2002 of the European Parliament and of the Council of 15 July 2002 which requires the agency to inform the public of the general safety level in the field of civil aviation.

3.1.1 Fatal accidents and passenger fatalities

The 2005 report gave an account of the improvements seen in passenger fatalities per 100 million miles flown since 1945 and showed that it took some 20 years (1948 to 1968) to achieve the first ten-fold improvement from 5 to 0.5. In 1997, some 30 years later, another ten-fold improvement was observed in the passenger fatalities rate when this figure dropped below 0.05 (see figure 3).

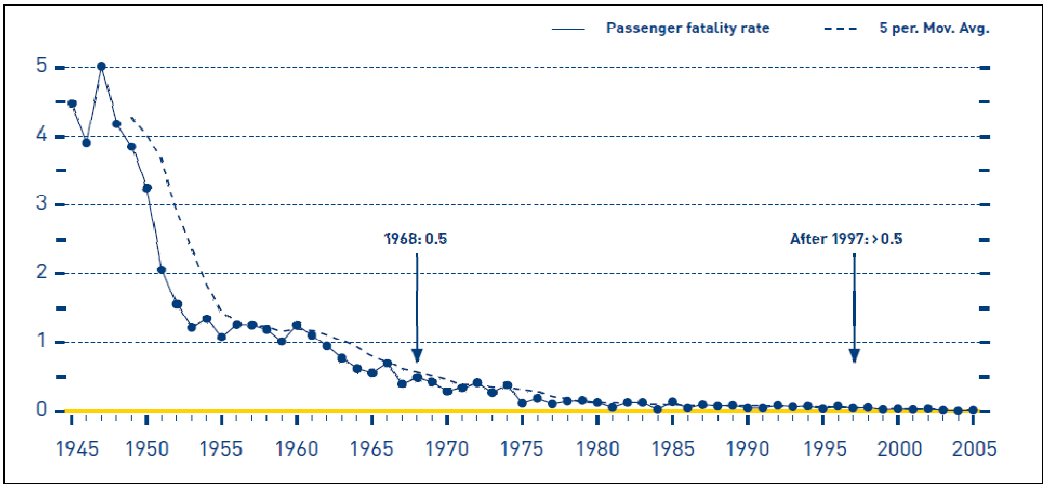


Figure 3 Rate of passenger fatalities per 100 million passenger miles, scheduled operations, excluding acts of unlawful interference (Source: EASA)

In recent years, the rate of passenger fatalities stagnated between 1986 and 1993 but then resumed a continuous decrease until 2003, where it reached its lowest value of 0.03. However, on average, the rate of accidents involving passenger fatalities in scheduled operations has dropped by about half from 1986 to 2005.

The increase seen in the rate of passenger fatalities in 2005 was due to an increase also in the number of accidents (see figure 4).

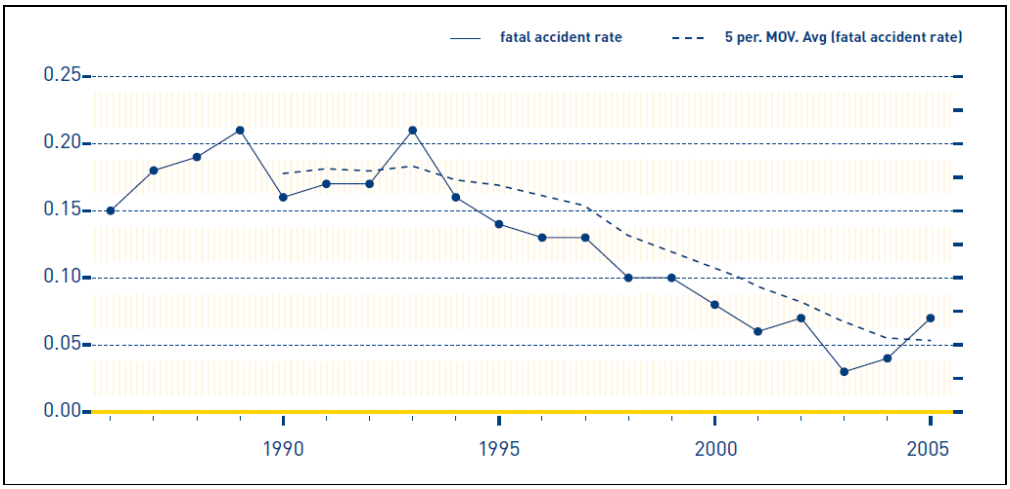


Figure 4 Rate accidents involving passenger fatalities per 100 000 flights, scheduled operations, excluding acts of unlawful interference (Source: EASA)

The number of accidents provided in the 2005 report was based on data obtained from the ICAO Accident/Incident Data reporting (ADREP) system. The data concerned fatal accidents to fixed wing aircraft with a maximum certificated take-off mass exceeding 2250 kg. A fatal accident is an accident that resulted in at least one fatality, flight crew and/or passenger or on the ground, within 30 days of the accident. Note that in the graphs the number of fatal accidents to aircraft registered in States of the European Union plus Iceland, Norway and Switzerland (EU25+3) is at the bottom of the bars. From 2006 onwards, the EASA annual safety reviews also included data from the new EU Member States Bulgaria and Romania and an additional non-EU EASA member – Lichtenstein.

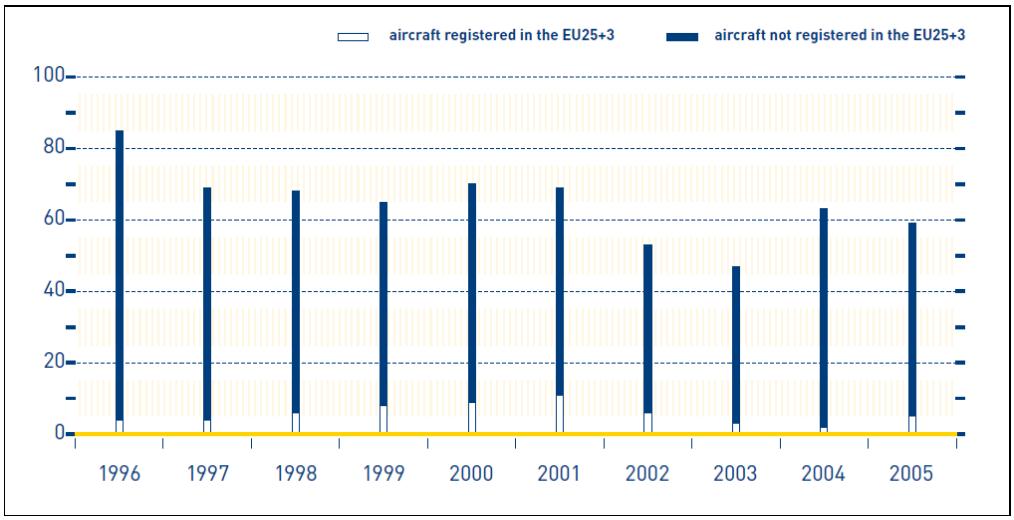


Figure 5 Fatal accidents, public transport operations, fixed wing aircraft over 2250 kg max certificated take-off mass (Source: EASA)

Analysis of fatal accidents of public transport operations, involving fixed wing aircraft over 2250 kg max certificated take-off mass, showed that from 1996 to 2005, there was an overall decreasing trend. 2003 saw the fewest total number of fatal accidents within this period (47), in comparison with what was recorded for 2004 and 2005 (63 and 59, respectively) (see figure 5).

Considering only scheduled public transport operations, the number of fatal accidents in 2005 was 22, up from 12 in the year 2004 and 10 in the year 2003. This result was just below the average for the decade, 22.4 and lower than any of the results of the years 1996 to 2001 (see figure 6).

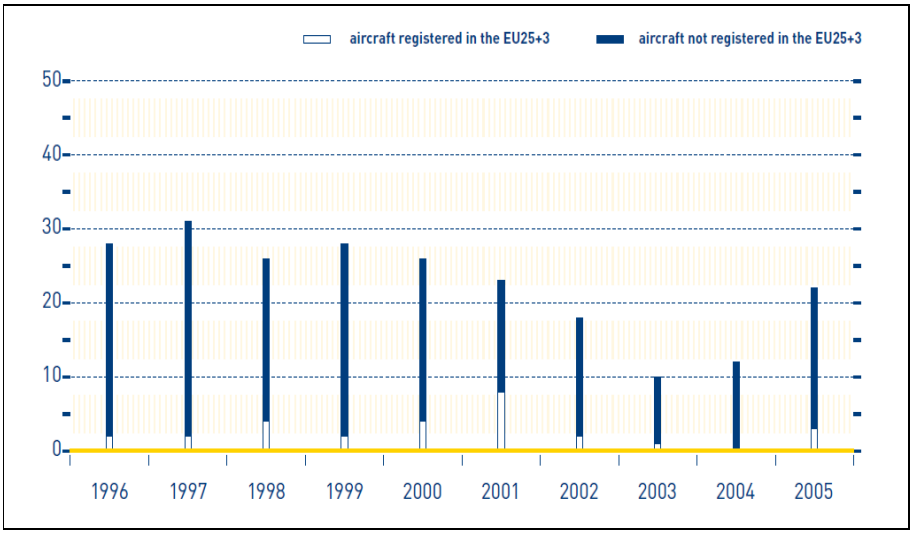


Figure 6 Fatal accidents, scheduled public transport operations, fixed wing aircraft over 2250 kg max certificated take-off mass (Source: EASA)

The number of fatal accidents involving fixed wing aircraft, performing public transport operations in Europe, in 2005 was 5, up from 2 in 2004 and below the average for the decade 1996–2005 of 5.8. The number of passenger fatalities in public transport operations in 2005 was 117, up from 4 in 2004 and 0 in 2003. The number of passenger fatalities was above the average (79.6) for the decade from 1996 to 2005.

One of the fatal accidents in 2005 resulted in 115 fatalities and occurred in Greece on 14th of August 2005. It involved a Helios Airways Boeing 737-300, which collided with terrain, north of Marathon, whilst flying from Larnaca (Cyprus) to Prague (Czech Republic) via Athens. A lack of oxygen incapacitated the crew, leading to the aircraft's eventual crash after running out of fuel.

Image 1 Tail section of Helios Airways Boeing 737-300 that crashed near the village of Grammatiko on 14th of August 2005 (Source: EMAK – Greece)

The other passenger fatalities involved a passenger falling off an air stair (scheduled operation) and a small aircraft crashing into the sea (non-scheduled operation, 1 crew and 1 passenger fatally injured).

The number of onboard fatalities in Europe increased from 127 in 2005 to 147 in 2006, which was above the average of the decade (105.3). The number of passenger fatalities in public transport operations in 2006 was 134, up from 4 in 2004 and 117 in 2005. The number of passenger fatalities was also above the average (91.4) for the decade 1997 to 2006 (see figure 7).

Both in 2005 and 2006, the high number of fatalities was the result of a single accident with more than 100 fatalities. On 9th of July 2006, a French registered Airbus 310 of Sibir Airlines overran the runway when landing in Irkutsk, Russia, resulting in 126 fatalities. Even though the aircraft involved in this accident was registered in an EASA Member State, it was operated by a company from a non-EASA Member State.

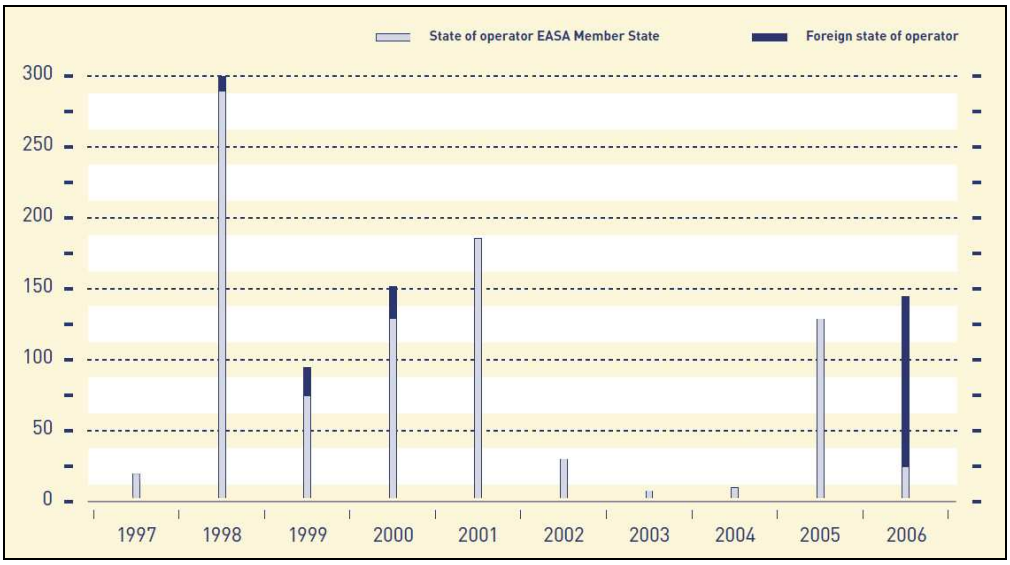


Figure 7 On-board fatalities, public transport operations total, fixed wing aircraft over 2,250 kg MTOM, registered in EASA Member State (Source: EASA)

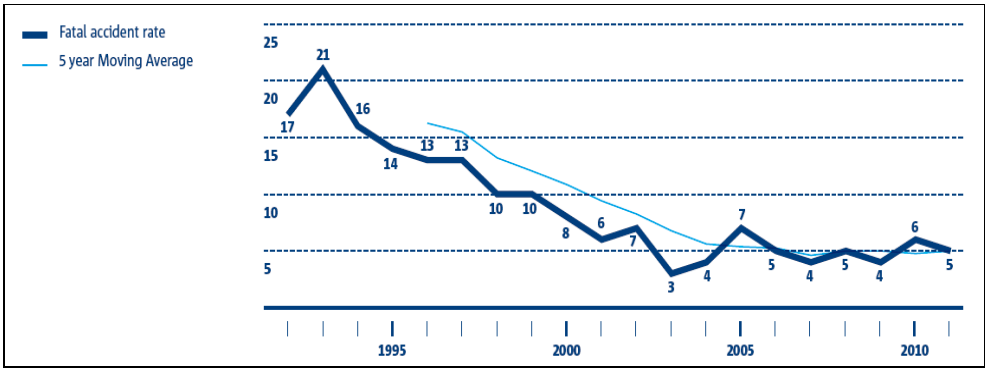


Figure 8 Global rate of accidents involving passenger fatalities per 10 million flights, scheduled commercial air transport operations, excluding acts of unlawful interference (Source: EASA)

In more recent years the rate of fatal accidents has not improved significantly, averaging between 4 and 5 fatal accidents per 10 million flights. Also, the 5 year moving average rate has remained almost constant since 2004 (see figure 8).

Figure 9 Distribution of fatal accidents over the phases of flight, world, public transport operations, 1997 – 2006, fixed wing aircraft over 2,250 kg MTOM (Source: EASA)

40% of all accidents that occurred between 1997 and 2006 happened during the approach and landing phase even though most of the time aboard is spent in the en-route or cruise phase of flight (see figure 9).

The average rate of fatal accidents per 10 million flights from 2000 until 2007, per world region, is shown in figure 10. The region of South America includes Central America and the Caribbean. The regions of North America, East Asia and EASA MS have the lowest rates of fatal accidents in the world.

Figure 10 Rate of fatal accidents per 10 million flights per world region (2000–2007), scheduled passenger and cargo operations) (Source: EASA)

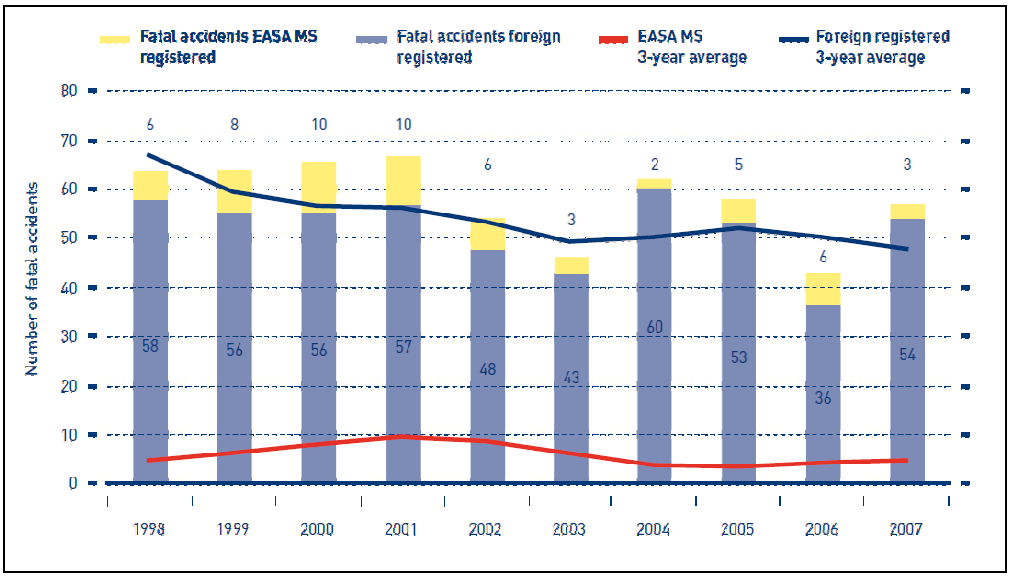


Figure 11 Fatal accidents—EASA MS and foreign registered (Source: EASA)

The number of fatal accidents involving foreign registered aircraft increased from 36 in the year 2006 to 54 accidents in 2007. The number of accidents in 2007 was higher than the decade (1998-2007) average (52) but was not one of the highest in the decade. The trend for the decade indicated that the number of accidents worldwide continued to decline (see figure 11).

The number of fatal accidents involving aircraft registered in EASA MS decreased from six in 2006 to three in 2007. The number of accidents in 2007 was one of the lowest in the decade, well below the average of six fatal accidents per year. The number of accidents involving aircraft registered in the EASA MS represented 5 % of the total number of accidents worldwide that occurred in 2007 (see figure 12).

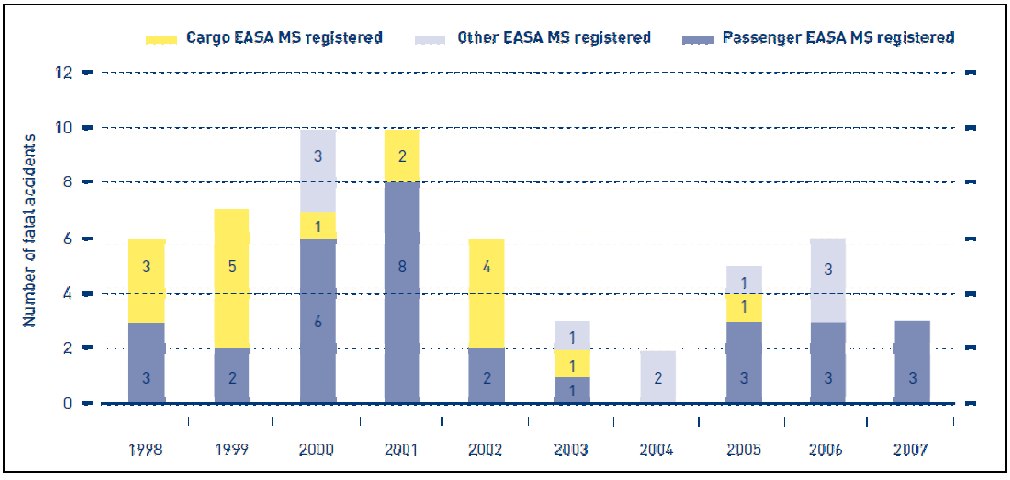


Figure 12 Fatal accidents by type of operation—EASA MS (Source: EASA)

The small number of accidents involving EASA Member State (MS) registered aircraft makes the type of operation during which they occurred an almost random characteristic. However, despite the steadily decreasing number of accidents, there was a constant occurrence of accidents involving passenger air transport operations up to 2007 (see figure 12).

In 2008, the number of fatalities onboard (160 fatalities) was above the average of the decade 1997 – 2006 (105 fatalities). A total of 154 people were fatally injured when a McDonnell Douglas MD-82 aircraft crashed during take-off in Madrid. Another accident concerned an Airbus A320 in Honduras that overran the runway during landing. Although this aircraft was operated by an airline from outside Europe, it was registered in one of the EASA MS.

Image 2 TACA Airlines Airbus A320 runway overrun at Tegucigalpa, Honduras, in 2008 (Source: www.latrola.net)

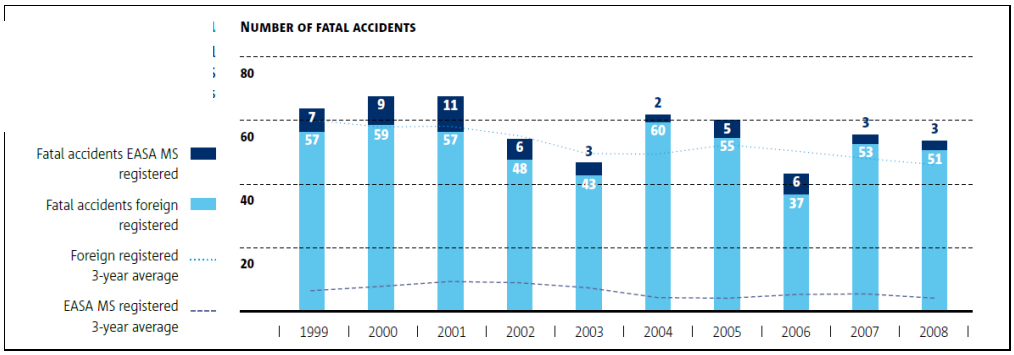


Figure 13 Fatal accidents in commercial air transport — EASA MS and foreign registered aeroplanes (Source: EASA)

The total number of fatal accidents for EASA MS and for foreign (non-EASA MS) registered aeroplanes within the decade 1999 to 2008 is shown in figure 13. The number of fatal accidents for foreign registered aeroplanes had decreased from 53 in the year 2007 to 51 accidents in 2008. The number of accidents in 2008 was within the decade's average (53 accidents). The trend for the decade indicated that the number of accidents worldwide was declining in 2008.

The number of fatal accidents involving aircraft registered in EASA MS remained unchanged in 2008 compared with the past two consecutive years (3 accidents) and represented one of the lowest in the decade, well below the average of 6 fatal accidents per year. The number of accidents involving aircraft registered in the EASA MS represented 6% of the total number of accidents worldwide that occurred in 2008.

Figure 14 provides the fatal accident rate per 10 million scheduled passenger flights averaged over three-year periods for scheduled commercial air transport flights only (2009 traffic was based on estimates). Although the number of fatal accidents for aircraft operated by EASA MS airlines remained the same (one accident), the decrease in the number of flights during the years of 2008 and 2009 led to an increase in the rate of such accidents.

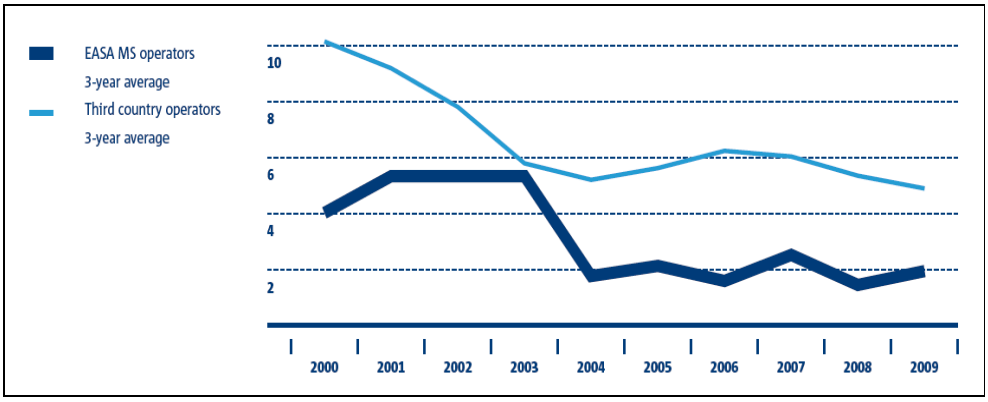


Figure 14 Rate of fatal accidents in scheduled passenger operations – EASA MS and third country operated aeroplanes (fatal accidents per 10 million flights) (Source: EASA)

By dividing accidents by type of operation one can observe that worldwide (excluding EASA MS) passenger air transport operations appear to have a declining proportion of the total number of fatal accidents. Other commercial air transport operations, such as air taxi or ferry flights (category: Other) have an increasing proportion of the total. Almost a quarter of all accidents involved aircraft conducting operations under this category. It is worth noting that the proportion of accidents in this category was significantly higher than the proportion of aircraft conducting such operations (see figure 15).

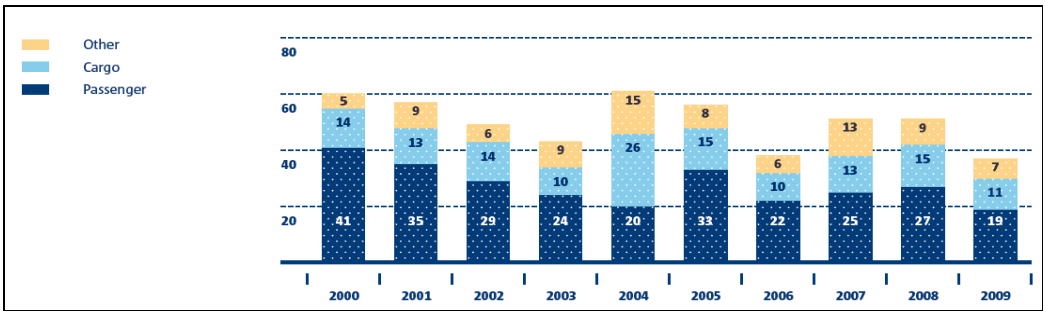


Figure 15 Fatal accidents by type of commercial air transport operation – third country operated aeroplanes (Source: EASA)

Figure 16 shows that the number of fatal accidents in business aviation for aircraft registered in EASA MS was low. Nevertheless, it would appear that worldwide the numbers of fatal accidents were increasing in the years up to 2007.

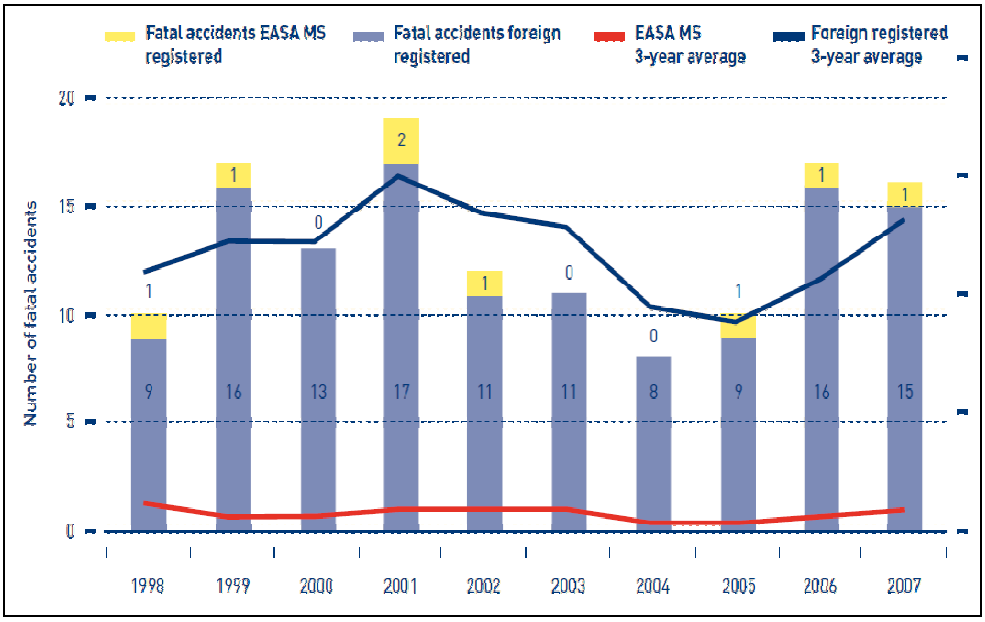


Figure 16 Business aviation fatal accidents, EASA MS and foreign registered (Source: EASA)

In more recent years, there was one accident in business aviation each year for EASA MS registered aeroplanes. Worldwide, the number of fatal accidents in this category has been decreasing overall in the last decade (see figure 17).

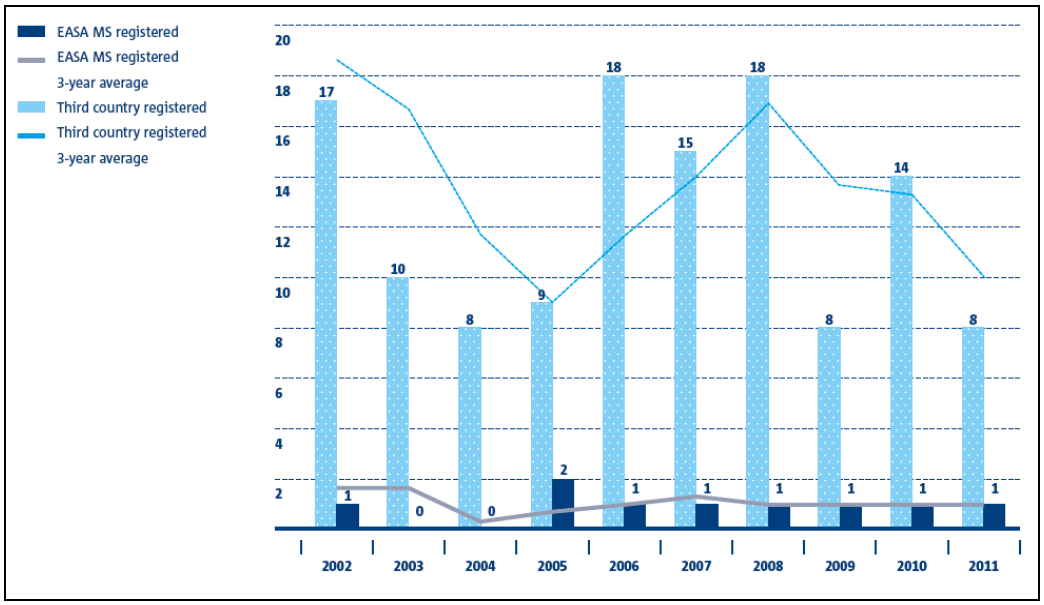


Figure 17 Fatal accidents in business aviation – EASA MS and third country registered aeroplanes (Source: EASA)

Between 1998 and 2007 there were 26 fatal accidents involving an EASA MS registered helicopter compared with 120 fatal accidents involving foreign registered aircraft. As a proportion, EASA MS accidents represented 8% of the total. The number of accidents varied over the decade. When looking at the three-year moving average, it appears that the number of fatal accidents had increased in the second half of the decade (see figure 18).

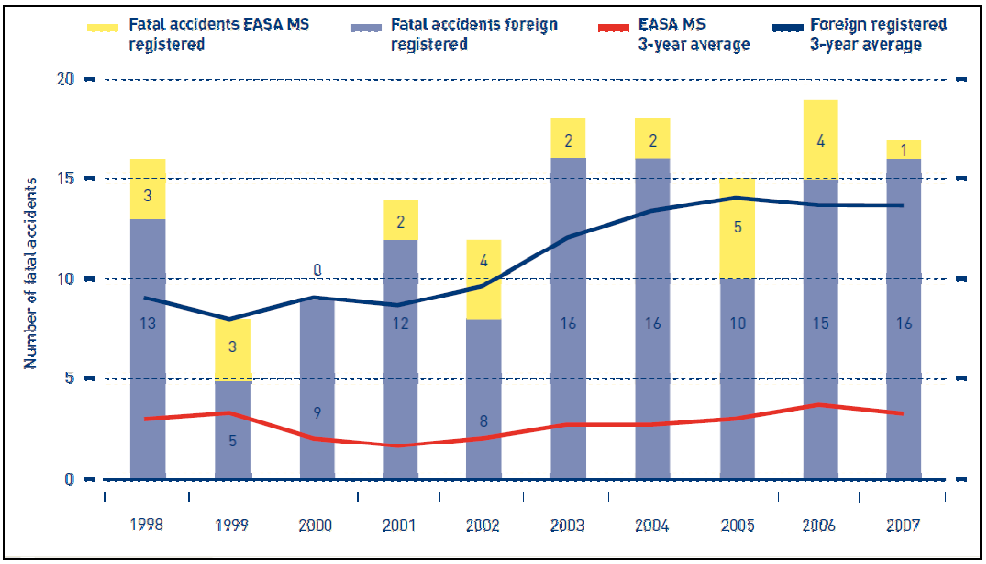


Figure 18 Rate of fatal accidents—EASA MS and foreign registered helicopters (Source: EASA)

There were no fatal accidents recorded in 2010 involving commercial air transport helicopters operated by EASA MS operators. In addition, the number of non-fatal accidents was below the decade average which is

positive considering that helicopters often operate close to terrain and take-off or land in areas other than aerodromes, such as helipads, private landing sites and natural landing sites. Also, a helicopter has different aerodynamic and handling characteristics from aeroplanes which are reflected in the different accident characteristics.

The number of fatal helicopter accidents for EASA MS and third country operators are shown in figure 19. Between 2001 and 2010, 25 fatal accidents involving an EASA MS operator occurred compared to 119 fatal accidents involving helicopters operated by third-country operators. Overall, fatal accidents involving EASA MS operators represented 17% of the total number of accidents worldwide. For third country operators, the number of fatal accidents in 2010 was low (5 accidents) compared to the average for the decade 2001 – 2010 (12 accidents).

When looking at the three-year moving averages, it appears that both the average number of fatal helicopter accidents worldwide and for EASA MS operators have decreased over recent years.

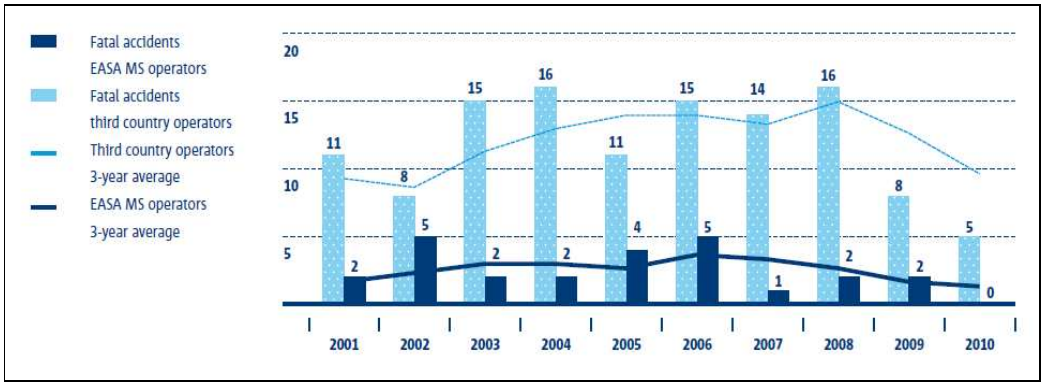


Figure 19 Fatal accidents in commercial air transport – EASA MS and third country operated helicopters (Source: EASA)

When reviewing the type of commercial air transport operation involved in fatal accidents, a difference can be observed between EASA MS and third country operators (see figure 20). Passenger transport is the main type of operation involved in fatal accidents of third country operators. Most fatal accidents of EASA MS aircraft (14) involved helicopter emergency medical services (HEMS). This represents 42 % of the total number of fatal accidents for helicopter EMS operations worldwide. The category 'Other' includes cargo and air taxi operations. 22 helicopters involved in fatal accidents worldwide were performing an offshore flight (flights to or from an offshore installation).

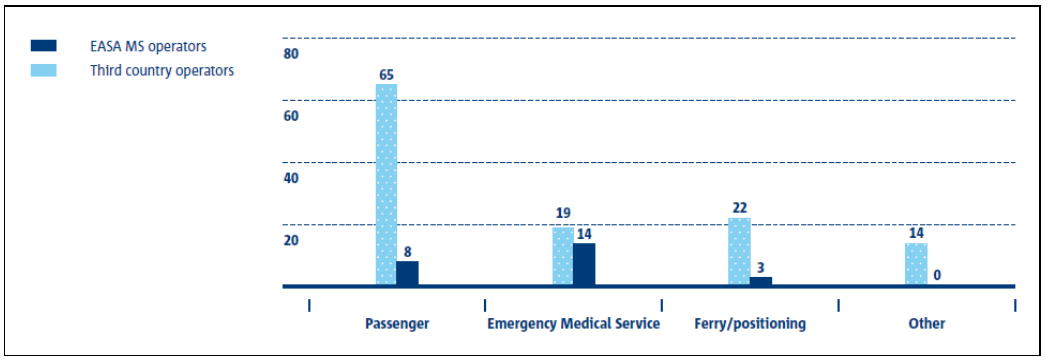


Figure 20 Fatal accidents by type of operation – EASA MS and third country operated helicopters (2001 – 2010) (Source: EASA)

3.1.2 Accident categories

When looking at fatal accidents from 1997 – 2006, the two most frequent accident categories assigned by ICAO's Safety Indicator Study Group (SISG) were 'loss of control in-flight' and 'controlled flight into terrain'. They also accounted for most of the fatalities worldwide (see figure 21).

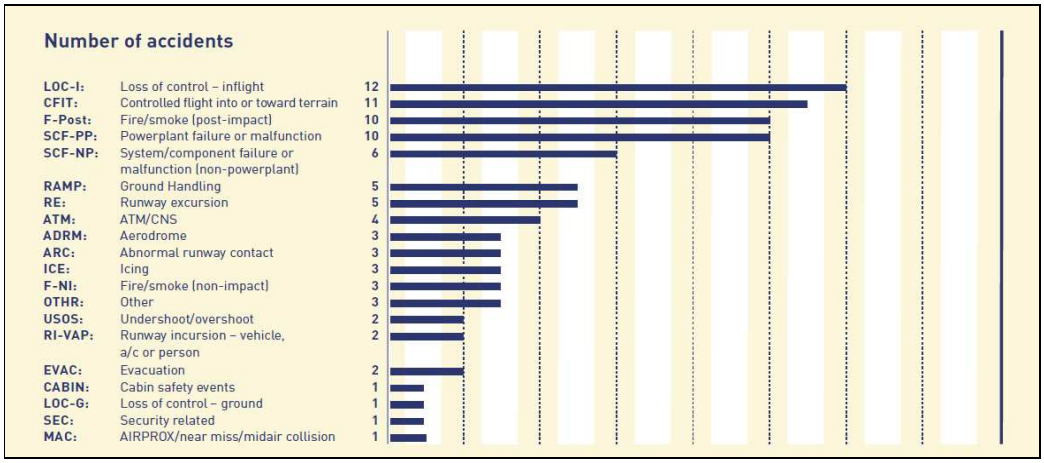


Figure 21 Accident categories – fatal accidents to aircraft registered in EASA Member State used in public transport operations or general aviation turbine powered, fixed wing aircraft, over 5,700 kg MTOM from 1997 – 2006 (Source: EASA)

For European registered aircraft the dominant categories regarding the number of fatalities were 'system and component failure or malfunction-non powerplant' and 'fire – non impact' (see figure 22). As there have only been a few accidents involving European registered aircraft, resulting in large number of fatalities, these cause a bias in the analysis. The large number of fatalities related to the category of non-impact fires is the result of two accidents: Swissair MD-11 (1998) and the Air France Concorde (2000). Both accidents also accounted for almost all of the fatalities in the SCF-NP category.

Image 3 The crash site of the Concorde accident in 2000, near Gonesse (Photograph: Joachim Beltrand/EPA)

The occurrence category 'aerodrome' came fourth, the number of fatalities mainly resulting from two major accidents: SAS MD80 (2001) in Italy and Air France Concorde (2000) in France. 'Controlled flight into terrain' and 'loss of control in-flight' were represented with 137 and 162 fatalities respectively (see figure 22).

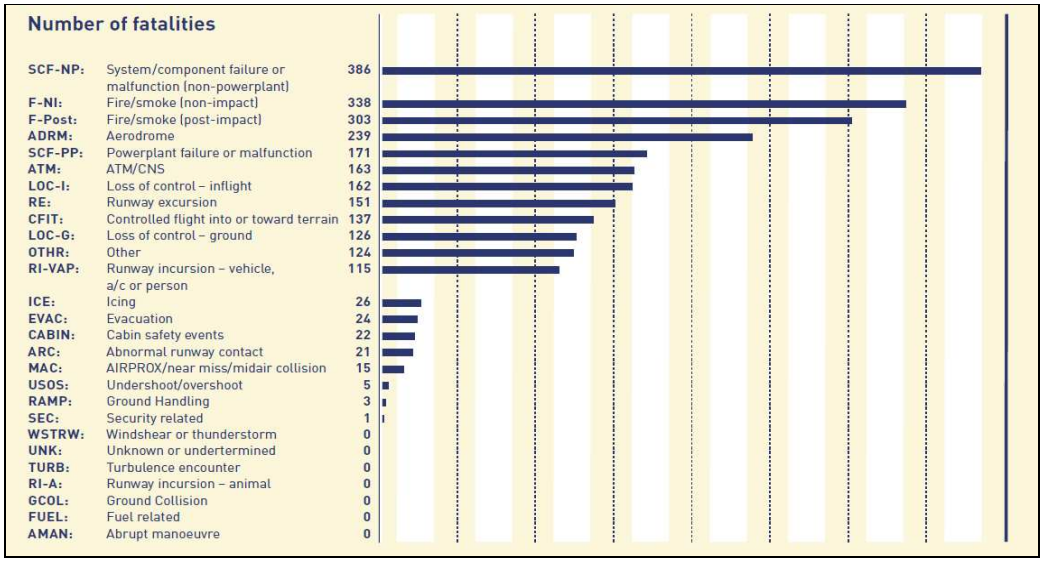


Figure 22 Fatalities per accident category, aircraft registered in EASA Member State used in public transport operations or general aviation, turbine powered, fixed wing aircraft, over 5,700 kg MTOM from 1997 – 2006 (Source: EASA)

Fatal and non-fatal accidents involving EASA MS operated aircraft which occurred during commercial air transport operations were assigned under related accident categories. These categories were based on the definitions developed by the CAST-ICAO Common Taxonomy Team (CICTT). Figure 23 shows the number of accidents per category for all accidents involving aeroplanes operated by EASA MS airlines in the decade 2000-2009.

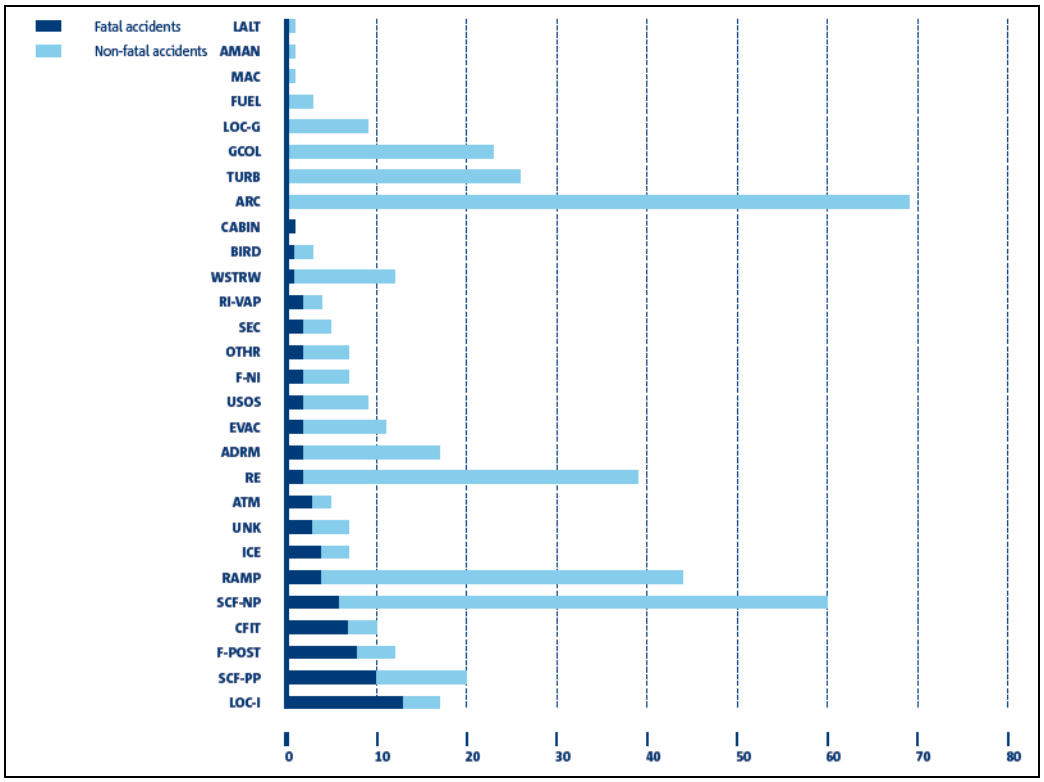


Figure 23 Accident categories for fatal and non-fatal accidents – number of accidents by EASA MS operated aeroplanes (2000 – 2009) (Source: EASA)

An accident may be assigned to more than one category depending on the factors contributing to its occurrence. Figure 23 shows that the categories which included a higher number of fatal accidents were, amongst others, LOC-I ('loss of control in-flight') and SCF-PP ('system or component failure or malfunction related to the engine').

Events assigned under LOC-I involve the momentary or total loss of control of the aircraft by the crew. This loss of control might be the result of reduced aircraft performance or because the aircraft was flown outside its capabilities for control. SCF-PP involves the malfunction of a single or of multiple engines which might have led to a complete or partial loss of engine power.

Figure 24 shows the percentile share of each accident category in the total number of accidents. In recent years the proportion of accidents which included the categorisation of ARC ('abnormal runway contact') has increased. Such accidents usually involve long, fast or hard landings. Often during such accidents the landing

gear or other parts of the aircraft are damaged. Also increasing is the percentile of accidents involving RAMP ('ground handling') events. These accidents involve damage to the aircraft by vehicles or ground equipment or the incorrect loading of an aeroplane. Accidents attributed as 'controlled flight into terrain' (CFIT) appear to have an overall decreasing trend. These accidents involve the collision or near collision of an aircraft with terrain most often under circumstances of limited or significantly reduced visibility.

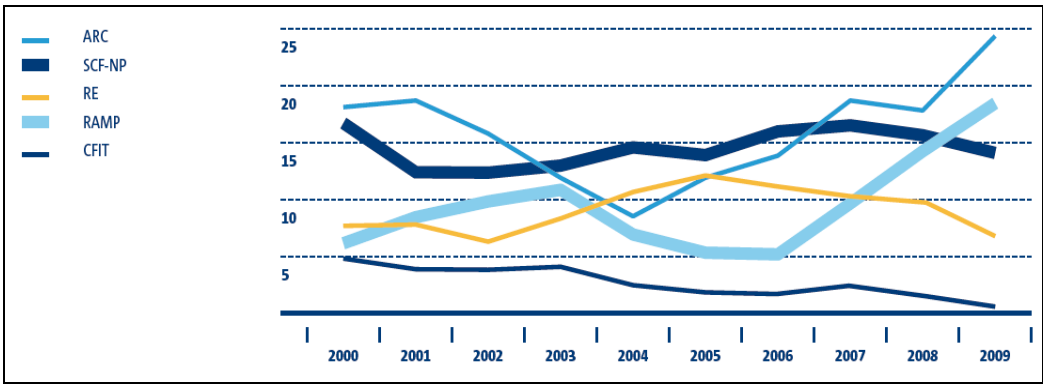


Figure 24 Annual proportion of top four accident categories and CFIT category – EASA MS operated aeroplanes (in percentile) (Source: EASA)

The number of severe runway excursions in EASA MS has seen an improvement in recent years. Both accidents and serious incidents involving runway excursions show an overall declining trend. The number of incidents reported shows an increasing trend, most likely due to improved reporting (see figure 25).

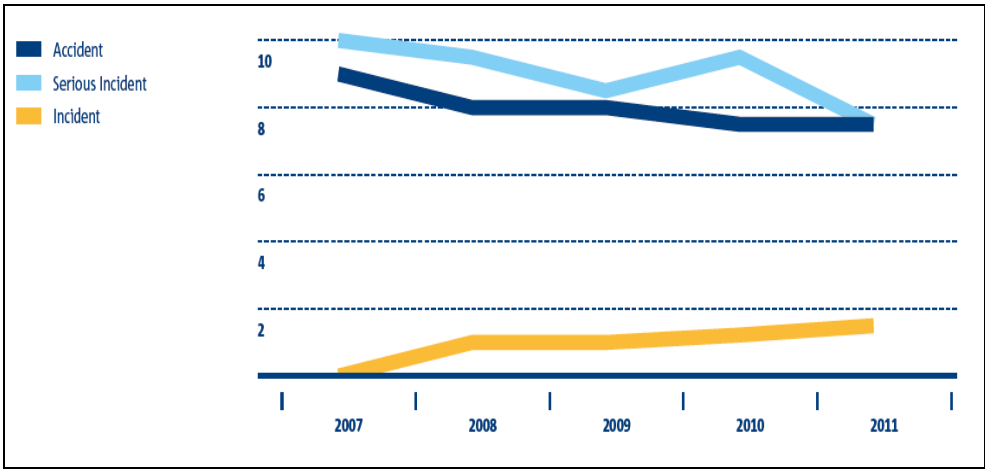


Figure 25 Occurrences involving a runway excursion at EASA MS aerodromes, by occurrence class (2007 – 2011) (Source: EASA)

Figure 26 shows that most of the runway excursions have occurred during the landing phase. It also shows that the severity of runway excursions during take-off is higher than in other phases of flight, as more than half were accidents. The lowest severity are runway excursion during the taxi phase and this is likely because of the low speed of the aircraft during that phase.

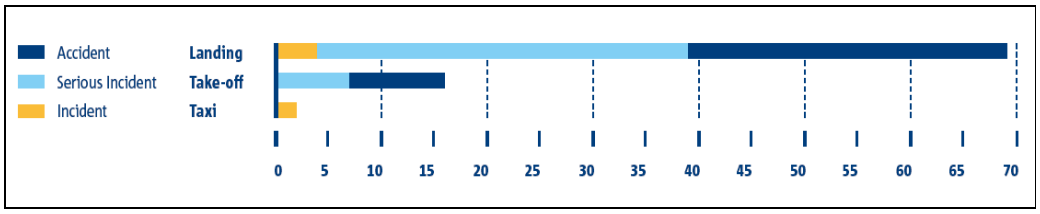


Figure 26 Occurrences involving a runway excursion at EASA MS aerodromes by occurrence class and phase of flight (2007 – 2011) (Source: EASA)

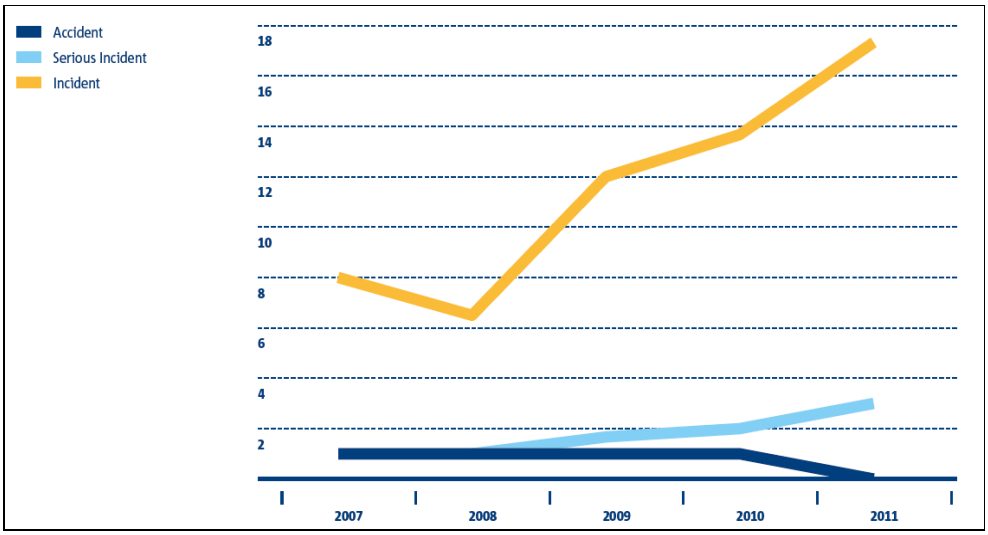


Figure 27 Occurrences involving bird strikes at EASA MS aerodromes by occurrence class (2007 – 2011) (Source: EASA)

The number of reported bird strikes has increased to more than double of what it was in 2007. This increase is substantial after 2009, following a high profile accident involving a bird strike in the United States in January of that year. In the same period the number of serious incidents and accidents has not followed the trend of incidents. The most likely reason for this disparity is increased awareness of the safety issue and improved reporting of such occurrences (see figure 27).

When assigning the CICTT categories to the helicopter accidents involving EASA MS operators (see figure 28), it is observed that the top category is 'controlled flight into terrain' (CFIT). In most cases adverse weather circumstances were prevalent, such as reduced visibility due to mist or fog. Also, several flights had taken place at night or in mountainous or hilly terrain.

'Loss of control in flight' (LOC-I) has the second highest number of fatal accidents assigned and also the second highest number of total accidents assigned.

'Low altitude' (LALT) accidents are collisions with terrain and objects that occurred while intentionally flying close to the surface, excluding take-off and landing phases.

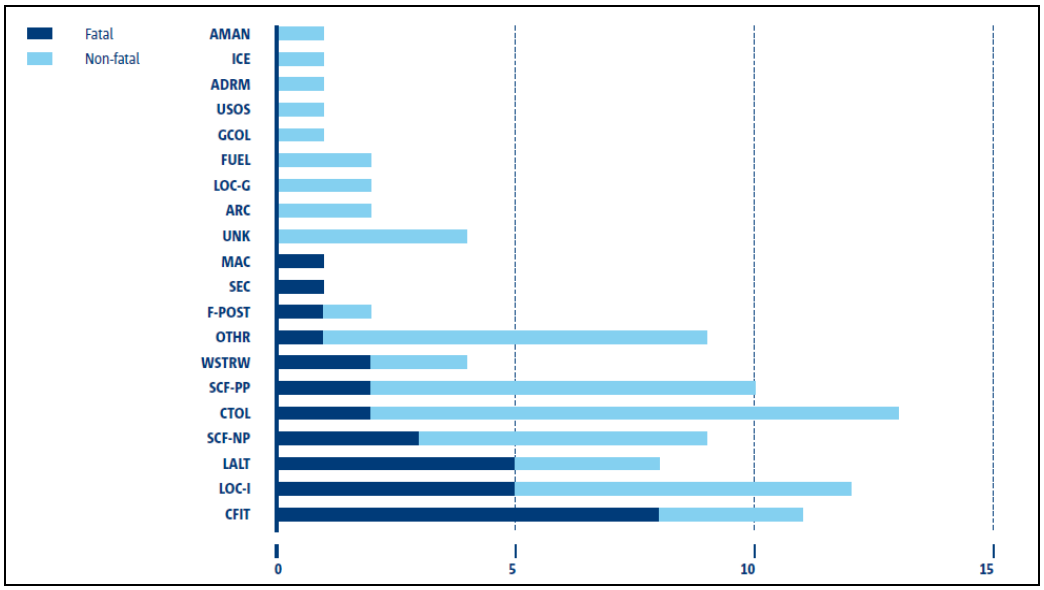


Figure 28 Accident categories for fatal and non-fatal accidents — Number of accidents by EASA MS operated helicopters (2001 – 2010) (Source: EASA)

The 'other' (OTHR) category is assigned when the accident is not covered under another category. In several accidents in this category the powerful rotor downwash resulted in serious injuries to persons on the ground or caused loose objects to damage the helicopter.

The two categories addressing system or component failures and malfunctions are SCF-NP and SCF-PP, for respectively non-engine and engine failures or malfunctions. The accidents in these categories mainly involve engine, main rotor system, tail rotor system or flight control failures or malfunctions.

The accidents in the category 'collisions with obstacles during take-off and landing' (CTOL) involve all accidents during take-off and landing phases where the main or tail rotor collided with objects on the ground.

3.1.3 Other

According to ICAO, in the decade leading up to 2005, 99% of the public air transport fleet, aircraft over 9,000 kg MTOM, was composed of turbine powered aircraft (see figure 29).

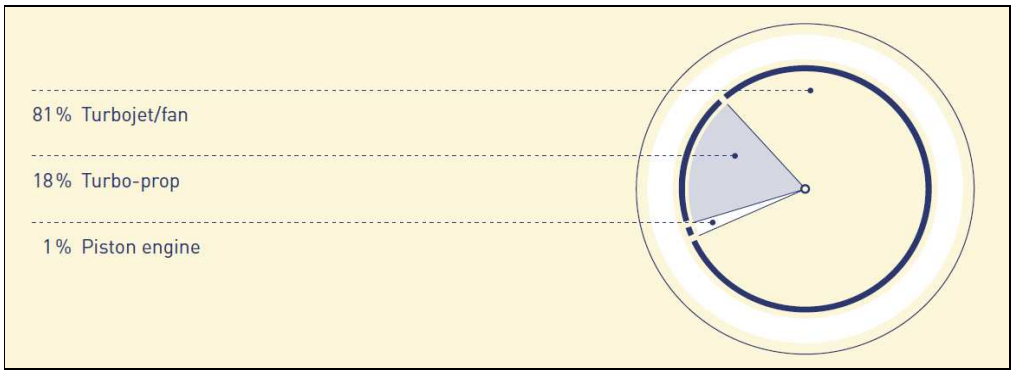


Figure 29 Public air transport fleet, distribution by type of propulsion, ICAO contracting states 1996 – 2005, aircraft mass greater than 9,000 kg MTOM (Source: EASA)

The traffic levels in the EASA MS have shown a steady yearly increase since 2003 that reached a maximum of 5.6% in 2008. This was followed by a significant decrease, of over 7% in 2009, that could be associated with the beginning of the global economic crisis. As from 2010 the traffic level has started to gradually increase. The level reached in 2011 was similar to that of 2006 (see figure 30).

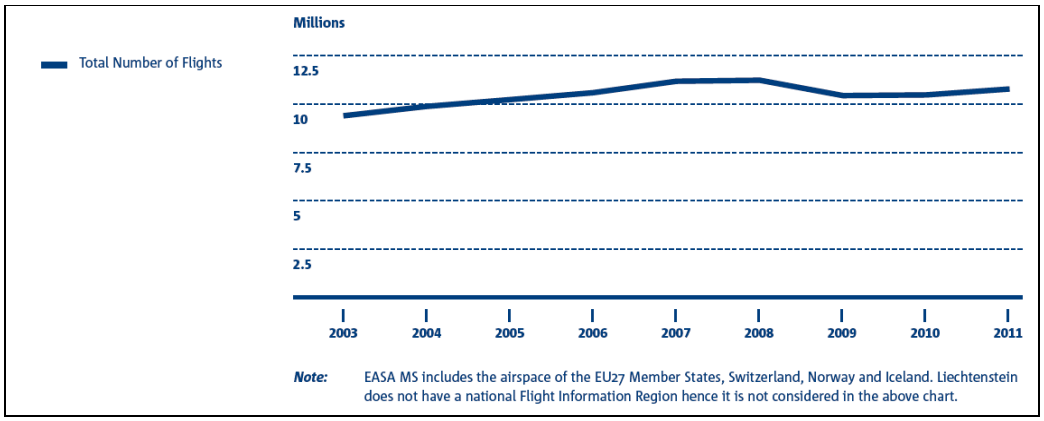


Figure 30 Evolution of traffic in EASA MS (2003 – 2011) (Source: EASA)

In 2011, aircraft with mass from 5 701 kg to 272 000 kg represent more than 60% of the EASA MS registered fleet (see figure 31). Of these, more than 90% of aircraft are aeroplanes with helicopters representing 5% of the total fleet (see figure 32).

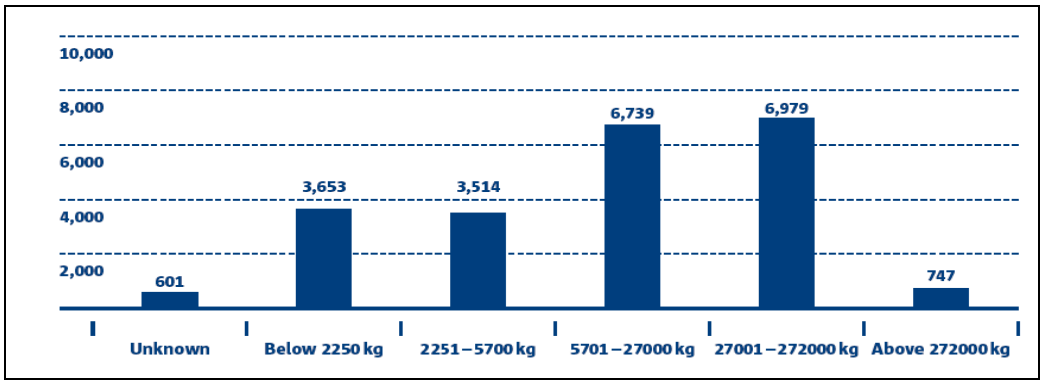


Figure 31 Aircraft registered in EASA MS by mass category (Source: EASA)

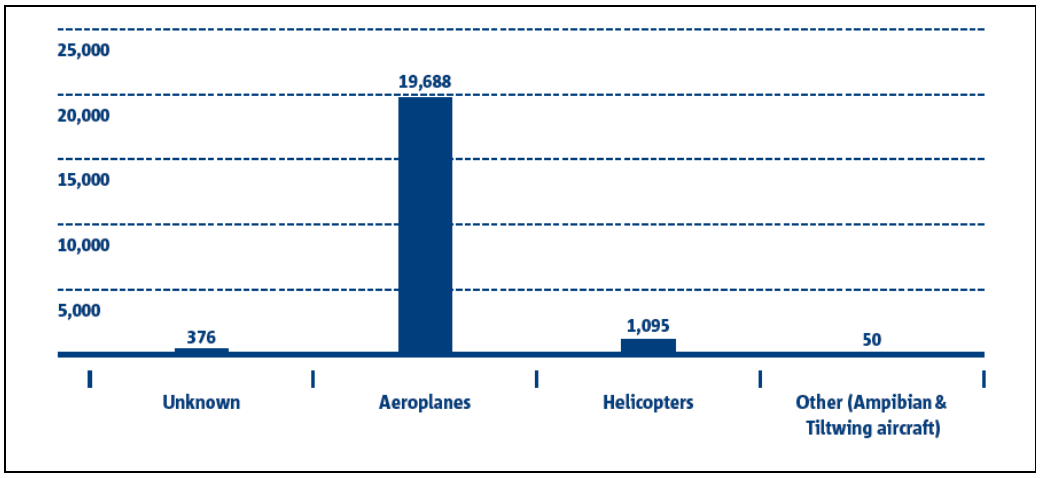


Figure 32 Aircraft registered in EASA MS by aircraft category (Source: EASA)

3.2 Eurocontrol's Safety Regulation Council (SRC) Annual Safety Reports

In 2003, Eurocontrol's Safety Regulation Council (SRC) published its first annual safety report as a complement to its reporting to the Provisional Council on specific issues such as Eurocontrol Safety Regulatory Requirements (ESARRs) and their implementation across national safety regulatory authorities and air traffic management (ATM) service providers. Each annual safety report presents measured safety performance indicators, the status of ESARRs implementation, SRC achievements and areas of focus for the following year.

The following 6 ESARRs were created:

- **ESARR 1 – Safety Oversight in ATM** – Implementation date: 05-Nov-2007
- **ESARR 2 – Reporting and Assessment of Safety Occurrences in ATM** – Implementation date: 01-Jan-2000 (Phase 1), 01-Jan-2001 (Phase 2) and 01-Jan-2002 (Phase 3)

- **ESARR 3 – Use of Safety Management Systems (SMS) by ATM Service Providers** – Implementation date: 13-Jul-2003
- **ESARR 4 – Risk Assessment and Mitigation in ATM** – Implementation date: 05-Apr-2004
- **ESARR 5 – ATM Services' Personnel** – Implementation date: 10-Nov-2003 (for ATCO & General) and 11-Apr-2005 (for ATS engineering and technical)
- **ESARR 6 – Software in ATM systems** – Implementation date: 06-Nov-2006

In 2002, the Eurocontrol Permanent Commission established the ESARR implementation monitoring and support (ESIMS) programme in order to ensure the uniform implementation of ESARRs across the European Civil Aviation Conference (ECAC).

By the end of July 2003, 14 States received ESIMS safety oversight audits. The main conclusions were that even though progress was being made in a significant number of States, the incorporation of ESARRs into national regulatory arrangements faced delays of up to two years after the target date for implementation. Overall, ESARRs implementation clearly suffered from a lack of resources, especially in safety oversight and at the time, very few States were in an adequate position to verify the implementation by national Air Navigation Service Providers (ANSPs) of the provisions of ESARRs.

In 2002 and 2003 safety statistics were collected from States, relying on a continuously improved Annual Summary Template (AST). These were the basis for Eurocontrol safety indicators, assessment of safety trends and identification of key risk areas. The delay in the implementation of ESARR 2 (Reporting and Assessment of Safety Occurrences in ATM) resulted in quality and consistency issues with the data. Other issues had to do with a lack of national resources and expertise as well as the need to implement a 'just culture' within the reporting organisations.

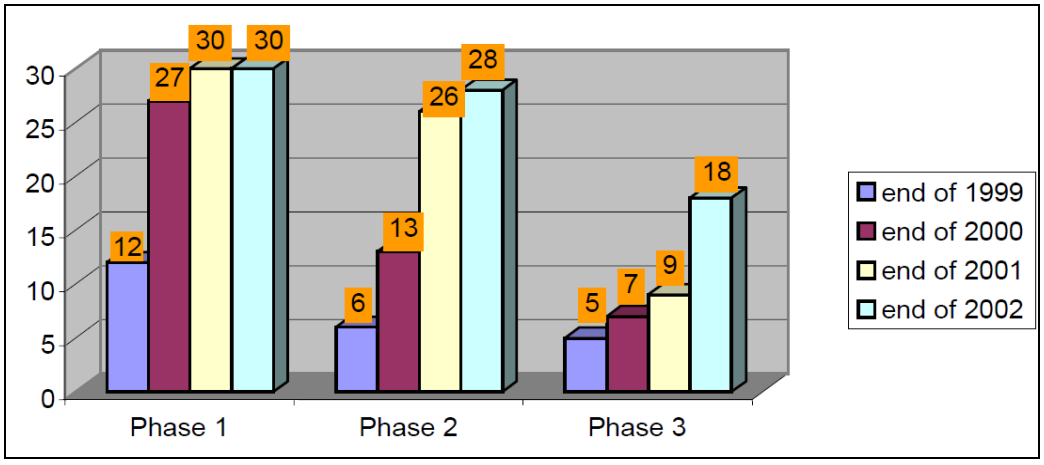


Figure 33 ESARR 2 adherence by ECAC States according to AST reports (1999 – 2002) (Source: Eurocontrol)

The delay in implementation of ESARR 2 throughout the 41 ECAC States is shown in figure 33. The deadline for implementation of phase 3 was the 1st of January 2002 and by the end of that year, only 18 States had achieved full ESARR 2 implementation.

The audits conducted within the ESIMS programme identified the main constraints and obstacles for ESARR implementation in the ECAC area by States or national safety regulatory authorities. These were found to be:

- Inconsistencies with Single European Sky (SES) Common Requirements (CRs);
- Legislative impediments preventing establishment of 'non-punitive' environment;
- Co-existence of non-harmonised safety regulatory approaches;
- Lack of fully developed harmonised severity and risk classification schemes;
- Resources and staffing level not at the optimal level;
- Non-availability of the required expertise.

The following issues were identified with ATM providers:

- Reporting and assessment of safety occurrences, and exchange of safety data impeded by the legal framework in some European countries;
- Justification of safety of externally provided services;
- Implementation of quantified ESARR 4 compliant risk assessment;
- Difficulties in obtaining and/or delivering the evidence meeting the applicable software assurance level requirements for newly implemented and changed ATM system software;
- Scope of SMS requirements for small organisations and units;
- Resources and staffing not at the optimal level;
- Military controllers licensing;
- Non-availability of the required expertise;
- Cultural change issues.

Notwithstanding the issues surrounding the implementation of the ESARRs, particularly with respect to safety reporting, the SRC tracks a number of safety indicators, categorized as follows:

- **Accidents:** including accidents with ATM contribution (overall figures and within the following categories):

- Mid-Air Accidents (MID-AIR);
- Controlled Flight Into Terrain (CFIT);
- Collision on the ground between aircraft (CGAA);
- Collision on the ground between aircraft and vehicle/ person/obstruction (CGAVPO).

- **Incidents:** overall figures and within the following sub categories, normalised to millions of flight hours:
  - Separation minima infringements;
  - Near CFIT;
  - Runway Incursions;
  - Unauthorised Penetration of Airspace;
  - Aircraft Deviation from Applicable ATM Regulation;
  - Aircraft Deviation from ATC Clearance (including their sub-classification per severity);
  - Ratio of ATM related reports and ATM-related reports investigated.
- **ATM Specific Occurrences:** As from 2002, the total number of ATM Specific Occurrences, including those related to the provision of ATM services and failures of ATM components.
- **Causes:** a number of high-level categories are being monitored; low level causes are being collected and used to perform in-depth analysis of identified key risk areas.

Between 1999 and 2004, the total number of accidents remained consistently within the range between 700 and 800 per year (this figure included all types of accident irrespective of flight rules, type of operation, type of flight, phase of flight, class of airspace or ATM contribution). The absolute numbers reported for 2004 were lower than in most-recent previous years. This was partially explained by the failure of a small number of States which had reported this category in 2003 to do so in 2004 (see figure 34).

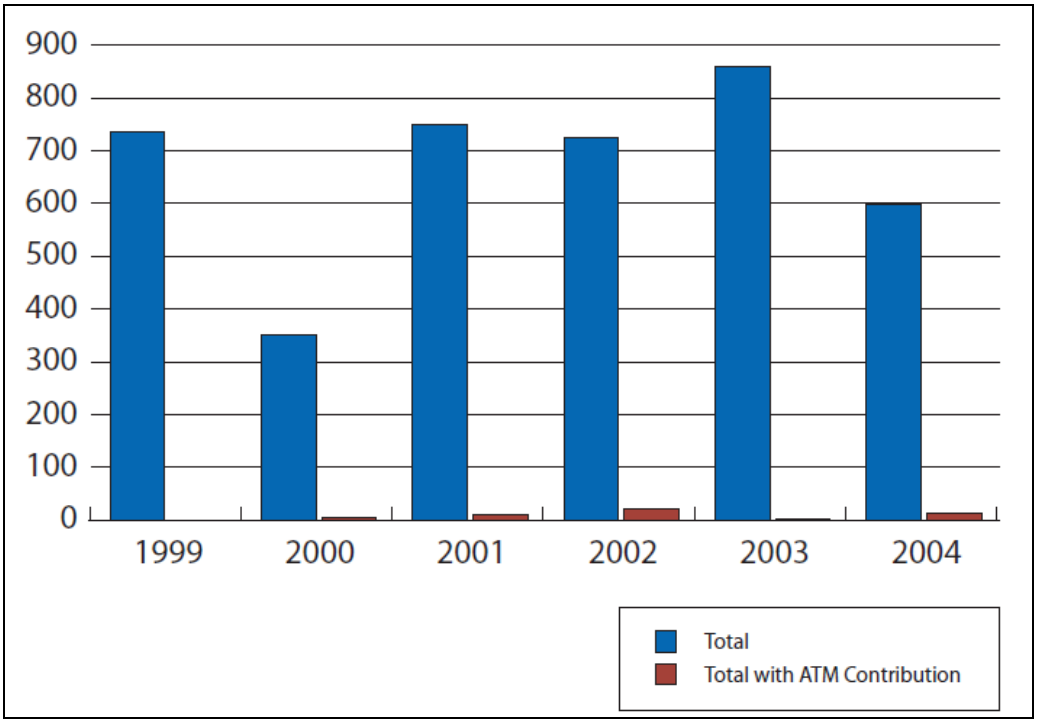


Figure 34 Total accidents with ATM Contribution (1999 – 2004) (Source: Eurocontrol)

The ATM direct contribution to total accidents in 2004 was zero although indirect contribution was reported to have been present in six accidents.

In 2005, the number of accidents with an ATM contribution continued to remain very low. Nevertheless, for the period from 2000 to 2005 the category of 'Collision on the ground between aircraft' showed a range of between six and 12 per year. Seven accidents were indicated for 2005 with one indicated as having a direct ATM contribution (see figure 35).

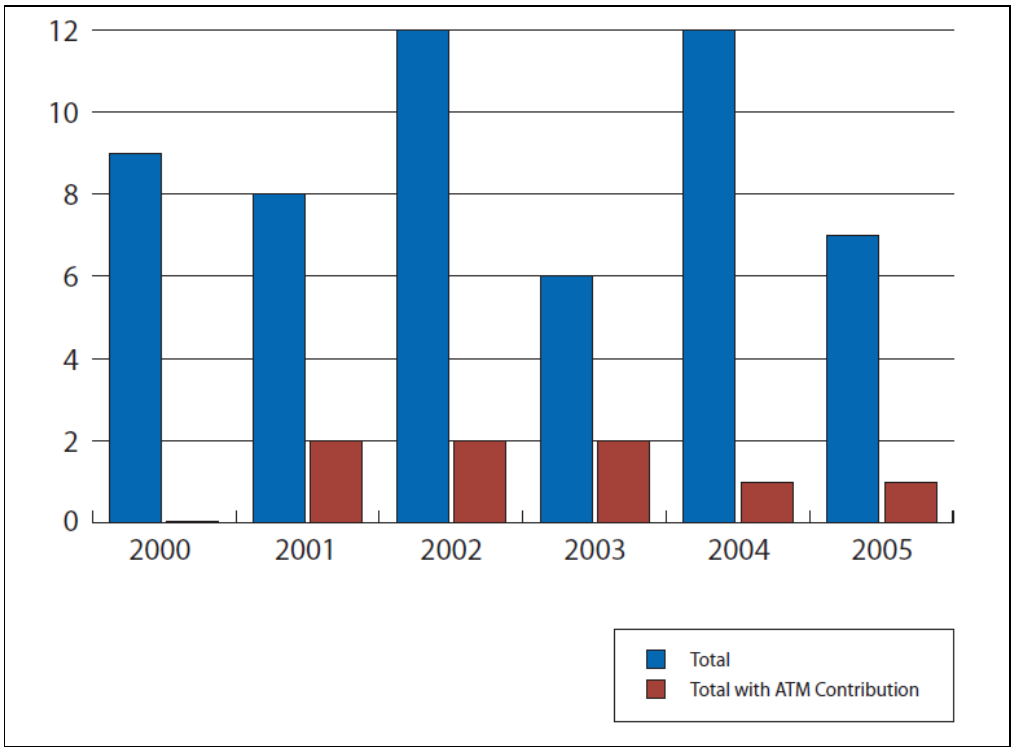
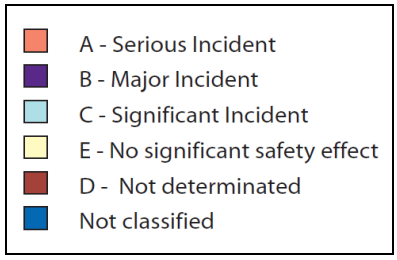


Figure 35 Total 'Collision on the ground between aircraft' accidents (2000 – 2005) (Source: Eurocontrol)

Seven 'collisions on the ground between aircraft and vehicle / obstacle / persons' were reported in 2005. Although the numbers decreased, comparison of the proportion of this category in the total number of accidents reported showed a level about the same as in 2004 but, in 2005, no accident in this category had any ATM Contribution.

The classification of ATM-related incidents is based on the severity of their effect on the safe operations of aircraft and occupants as shown in the following table:

Table 2 Severity classification of ATM-related incidents (Source: Eurocontrol)



The safety data for 2005 showed an increase in both total number of reports and number of incidents. Overall traffic volume increase in the ECAC area in 2005 was around 4% (comprising 4.5% in terms of flight duration and 3.9% in terms of number of flights) (see figure 36).

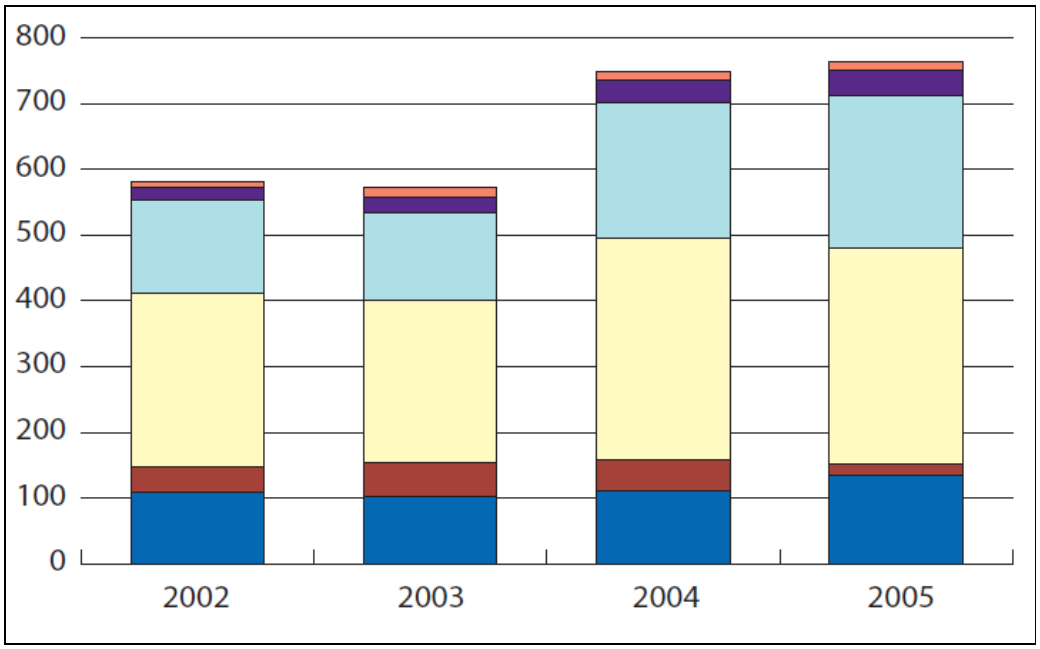


Figure 36 Total ATM related incidents – Occurrence per million flight hours and severity (2002 – 2005) (Source: Eurocontrol)

The total number of reported incidents showed an increase of 5% in 2005 compared to 2004.

For the category of 'controlled flight into terrain (CFIT)', 2006 showed an increase over 2005 (from 6 to 7) see figure 37). Five of seven CFIT accidents were fatal, although none had either a direct or indirect ATM contribution. CFIT was the second most significant category (after collisions on the ground).

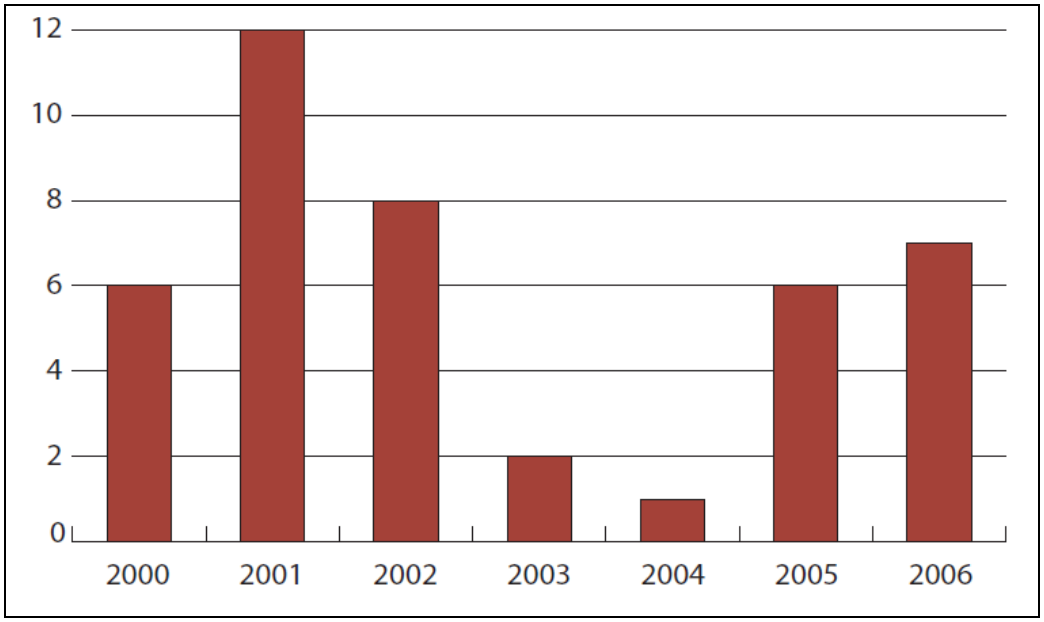


Figure 37 Percentage CFIT (2002 – 2006) (Source : Eurocontrol)

Total numbers of separation minima Infringement incidents in 2006 registered a small decrease of less than 2% (in absolute numbers) and 6% in normalised figures compared with 2005. This decrease was also reflected in the high risk bearing separation minima infringements (see figure 38).

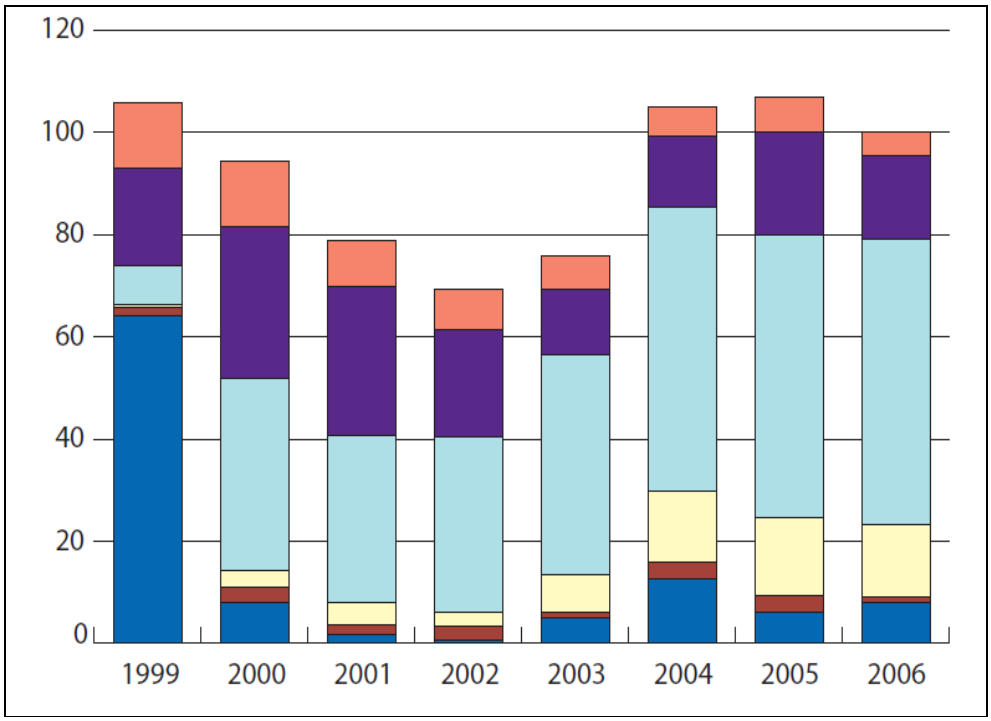


Figure 38 Separation minima infringements (occurrence per million flight hours and severity) (Source: Eurocontrol)

The total number of near CFIT incidents decreased (21 in 2006, 31 in 2005). However, the risk bearing incidents were almost at the same high level as in 2005 (3 severity A in 2006 vs. 4 in 2005, and 6 severity B in both 2006 and 2005) after a marked increase in 2005. Moreover, the proportion of high risk bearing near CFITs was very high (see figure 39).

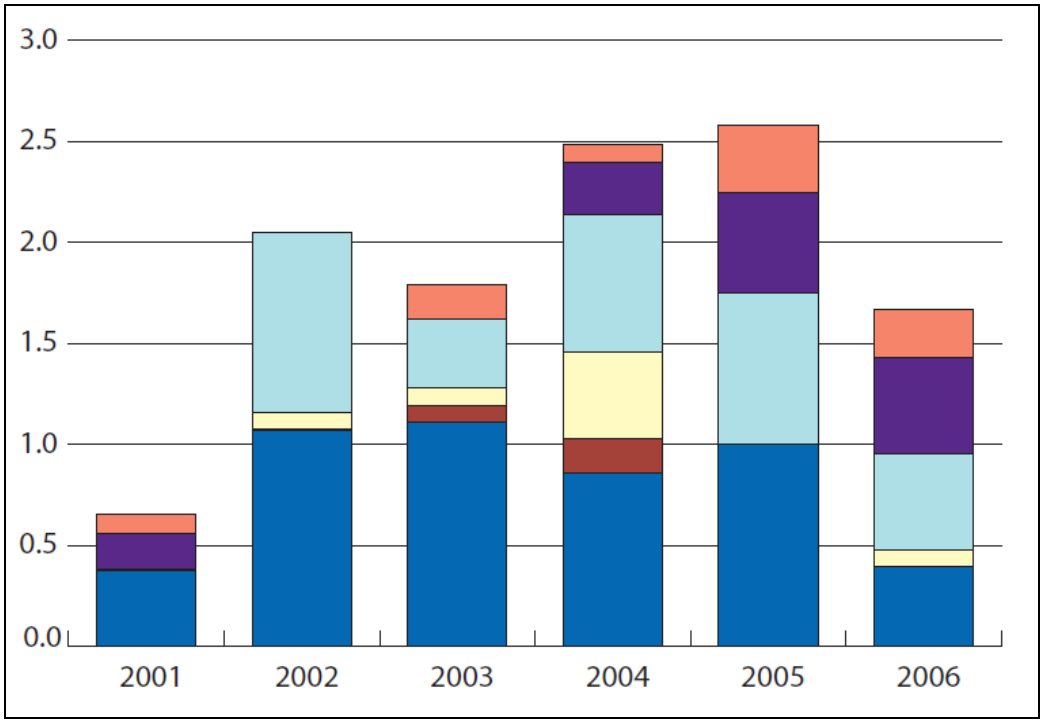


Figure 39 Near Controlled Flight Into Terrain (CFIT) (occurrence per million flight hours and severity) (Source: Eurocontrol)

In 2006, 667 runway incursions were reported in the ECAC region – almost 2 runway incursions per day. This total showed an increase of 6% in 2006 compared to 2005. Since 2003 the overall trend in the highest severity (A-serious) incursions was decreasing; only a marginal increase was observed in the 2006 reported preliminary data, but the numbers still remained at a low level. After an increase in the severity category B-major incursions in 2005, associated with the improved use of the severity classification scheme, the number levelled in 2006 (see figure 40).

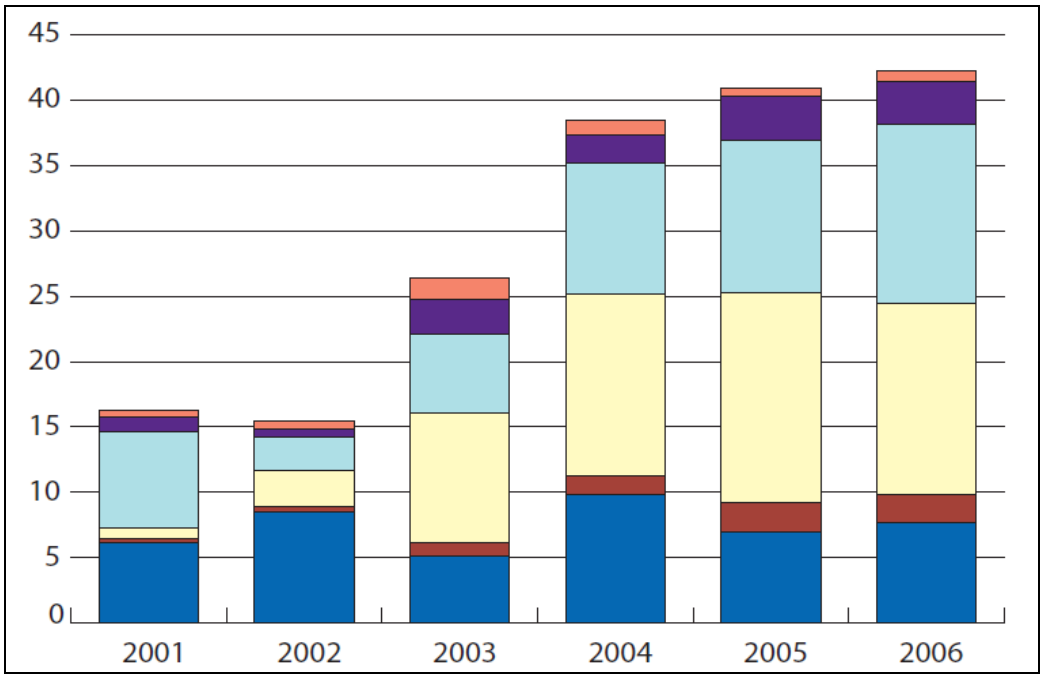


Figure 40 Runway incursions (occurrence per million aircraft movements and severity) (Source: Eurocontrol)

The overall number of unauthorised penetration of airspace events increased considerably (18%) in 2007 and another marked increase was reported in 2008 (13.5%). Over the reporting period, severity A classified incidents decreased in absolute numbers, from 5 to 2, in comparison with 2007. However, severity B occurrences in this category increased from 49 in 2007 to 52 in 2008, which was the highest since 2005 (see figure 41).

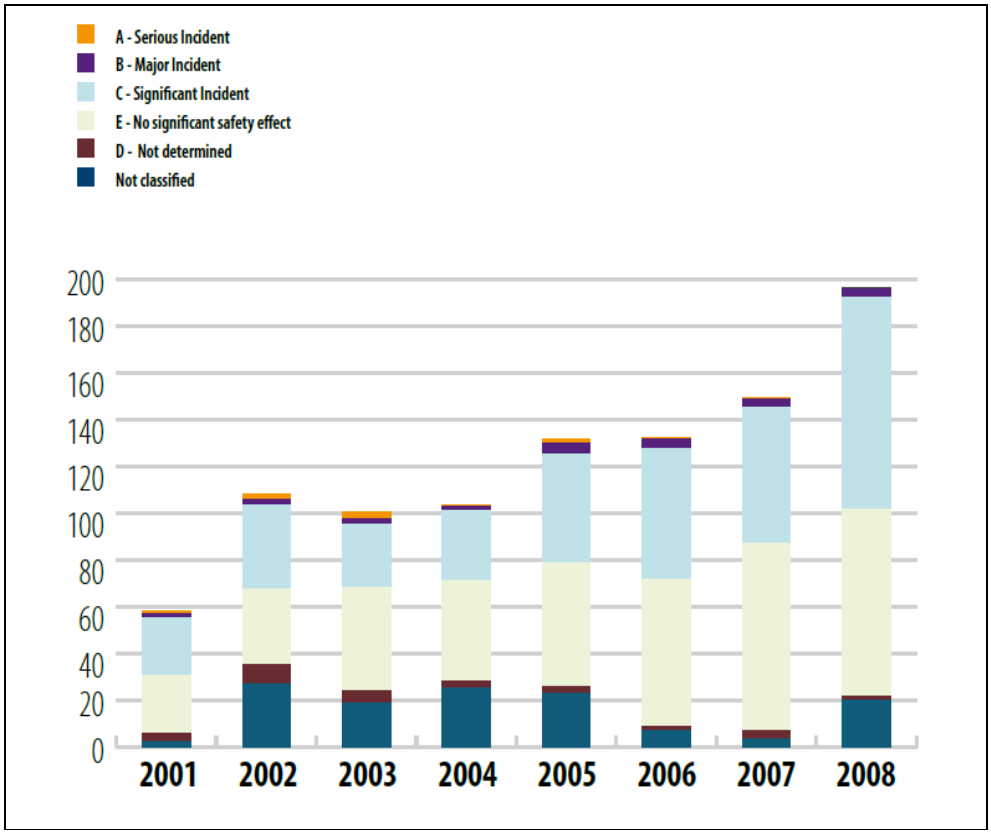


Figure 41 Unauthorised penetration of airspace (occurrence per million flight hours and severity) (Source: Eurocontrol)

The number of runway excursions reported in 2008 showed an increase over the previous year, back at the level of 2006. The number of serious incidents (severity A) remained the same while the major incidents (severity B) increased. There was, however, little ATM involvement in these runway excursions. Out of 52 runway excursions reported in 2008, only one was indicated as having a direct ATM contribution and one an indirect ATM contribution (see figure 42).

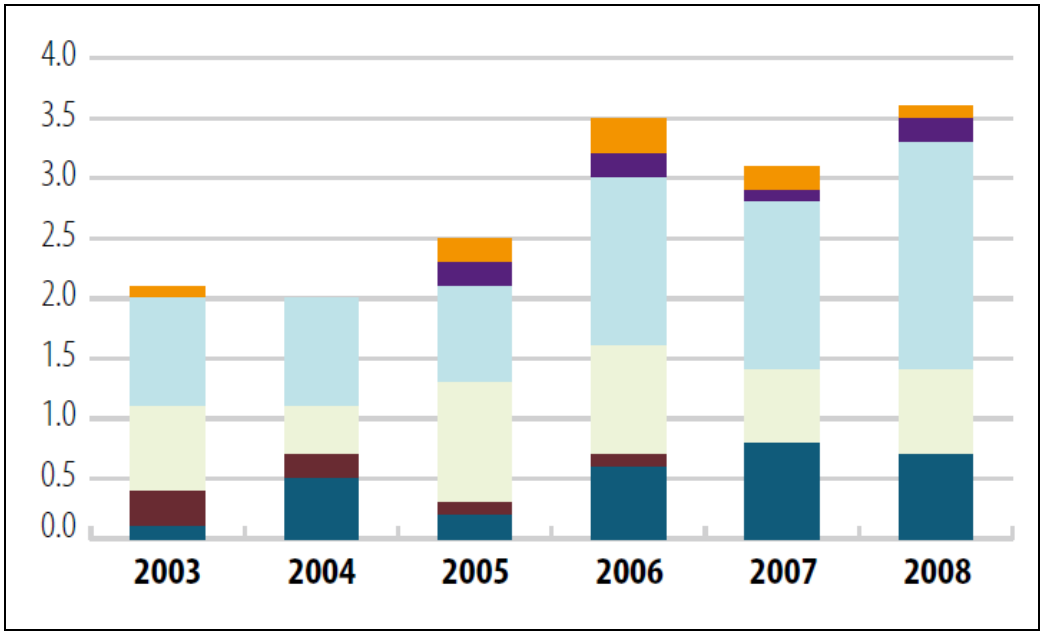


Figure 42 Runway excursions (occurrence per million flight hours and severity) (Source: Eurocontrol)

In 2011, there were 71 accidents in the ECAC States of which 11 resulted in fatalities. What is important is that despite a 4.8% increase in traffic levels compared with 2010, none of the reported accidents had either a direct or indirect ATM contribution (for accidents involving aircraft above 2250kg MTOM) (see figure 43).

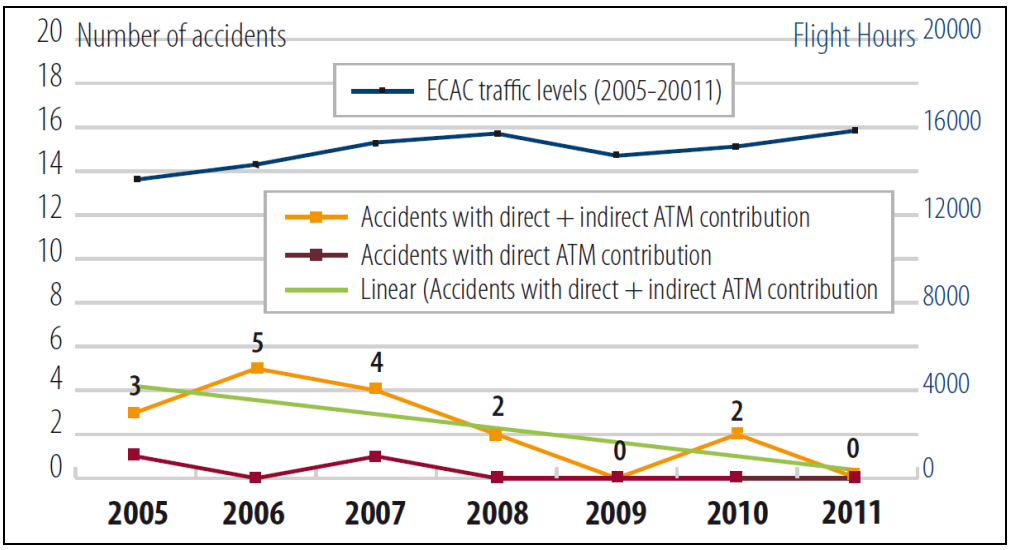


Figure 43 Accidents in ECAC with ATM contribution and traffic levels – aircraft above 2250 kg MTOM (2011 preliminary data) (Source: Eurocontrol)

3.3 Other sources

According to the International Air Transport Association (IATA), 2012 was one of the safest years on record with 0.20 hull losses per million sectors flown. In fact, the industry rate has been decreasing consistently since 2008 (see figure 44). In 2011, this figure was 0.37. This equates to 1 Western-built jet hull loss accident per 5 million flights in 2012 compared with 1 per 2.7 million flights in 2011. The rate for the IATA members for 2012 was 0.00 (compared to 0.41 in 2011).

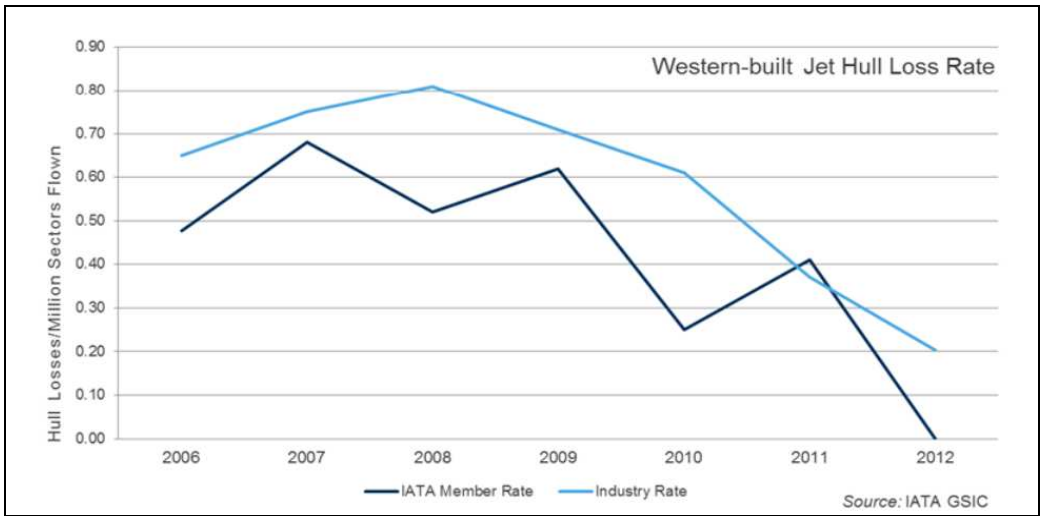


Figure 44 Global accident rate western-built jet hull losses per million flights (Source: IATA)

Figure 45 shows the western-built jet hull losses per million sectors for 2012, in comparison with 2011. Africa remains the region with the highest accident rate while Asia did not record any hull losses in both 2011 and 2012. Europe saw a slight deterioration in its rate for 2012.

Figure 45 Regional accident rates western-built jet hull losses per million sectors as of 31 December 2012 (Source: IATA)

One of the accidents which occurred in the Asia-Pacific region in 2012 was the Air Bagan Fokker 100 which crashed on a domestic flight in Myanmar when it struck power lines while attempting to land at Heho airport. Of the 65 passengers, only one person was killed.

Image 4 Air Bagan Fokker 100 crashed while attempting to land at Heho airport in Myanmar in 2012 (Source: The Telegraph)

According to Boeing, only 11 % of all accidents from 2002 to 2011 occurred during cruise despite exposure to this phase of flight being over half of the total for a typical flight. However, when an accident occurs during cruise, the chances of survival are extremely remote and this is shown by the 1001 fatalities which resulted from the 9 accidents which occurred from 2002 to 2011. About 40 % of all fatal accidents occur during final approach and landing (see figure 46).

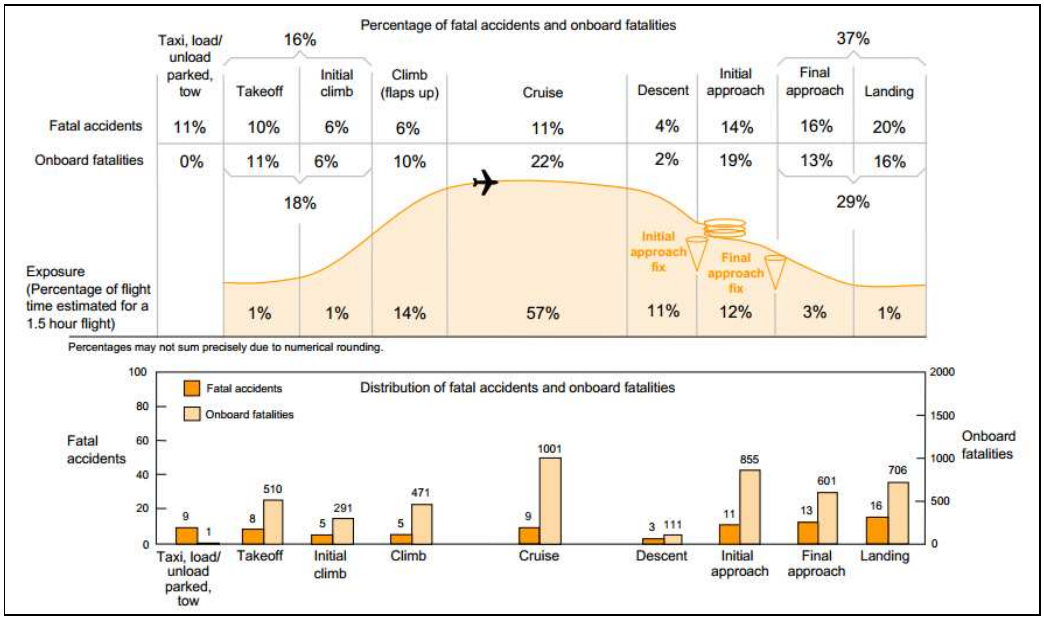


Figure 46 Fatal accidents and on-board fatalities by phase of flight, worldwide commercial jet fleet – 2002 through 2011 (Source: Boeing)

3.4 Summary of results

Analysis of EASA and Eurocontrol annual safety reports shows a consistent enhancement of safety over the last 2 decades. This is true both in terms of the number of fatalities and also the number of accidents. Europe has consistently experienced a low rate of fatal accidents compared with many other regions of the world and there have been recent years where there have been no fatal accidents within the region.

Globally, the average rate of accidents involving fatalities has stagnated at around 5 accidents per 10 million flights, suggesting that a great deal more needs to be done with regards to further improving aviation safety for the future. The introduction of system-wide safety management systems and a greater recognition of the role of human factors (including fatigue) in accidents is expected to bring about the next step-change in safety, particularly as traffic volume increases.

Helicopter operations in the European MS have also seen improvements in safety over the years although EMS (Emergency Medical Service) operations still account for most fatal accidents. Business aviation has improved similarly.

Among the accident categories for EASA MS operated aircraft, abnormal runway contact is one of the most frequent together with runway excursions, ground incidents and non-powerplant system or component failures. Nevertheless, the accident categories which result in the most fatalities are loss of control in-flight, powerplant system or component failures, post-impact fire/smoke and controlled flight into terrain.

About 40 % of all fatalities occur in accidents which happen during the approach and landing phases of flight. Furthermore, loss of control accidents in-flight result in higher numbers of fatalities when compared, for instance, to abnormal runway contact events (such as hard landings and runway excursions) despite being rarer occurrences. This explains the focus of the EASp on these and other events categories such as CFIT, mid-air collisions and ground collisions.

The introduction of ESARRs and the collection of ATM safety data by Eurocontrol have shown an increase in reporting by ATM agencies across Europe although there are still obstacles for the full implementation of safety standards across the entire ATM system in Europe. The main safety issues identified correspond to those which are also followed by EASA and established in the EASp as the key operational safety issues. EU Commission regulation 390/2013 which lays down a performance scheme for ATM services will hopefully remove any remaining barriers for the full implementation of standard safety management regulations and further enhance operational safety for the future.

4 Baseline risk level

To satisfy the objective to create a baseline risk picture of the various parts of the total aviation system, quantification of accident scenarios has been performed according to the Event Sequence Diagram (ESD) methodology used in the Causal model for Air Transport Safety (CATS), which is explained further in Section 2.4, and which was improved as part of the ASCOS Project. Further background information on the improvements made to the CATS model (and the ESD methodology) is included in ASCOS D3.2 [22]. Within the remainder of this study, this improved version is used to establish a total aviation system baseline risk picture.

4.1 Data source and scope

The NLR Air Safety database, which is a large database with data related to aviation safety maintained by NLR, is used as data source. The database uses ECCAIRS to collect, store, and analyse detailed information on accidents, serious incidents and incidents of fixed wing aircraft and helicopters (covering commercial operations and General Aviation) from 1960 onwards. Currently, the Air Safety Database contains information on more than 200,000 accidents, serious incidents and incidents that occurred worldwide. Furthermore, the Air Safety Database contains a large collection of worldwide non-accident related data, flight exposure data, weather data, fleet data, and more. The Air Safety Database is updated frequently using reliable sources including data from official reporting systems, insurance claims, accident investigation boards, aircraft manufacturers, and civil aviation authorities. Table 3 defines the basic ASCOS data query.

Table 3 Basic ASCOS data query

Data	**Criteria**
Time interval	Between 1-1-1995 to 31-12-2011
Occurrence class	Accidents and Serious incidents
Operation type	Scheduled revenue ops, Non-scheduled revenue ops
Aircraft category	Fixed wing
Aircraft mass group	> 5,701 kg maximum take-off weight
Aircraft propulsion type	Turboprop, Turbofan, Turbojet
State or area of occurrence	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Iceland, Liechtenstein, Norway, Switzerland.

The basic ASCOS data query resulted in a total of 1161 relevant accidents and serious incidents. An additional check for empty fields in the NLR Air Safety Database revealed additional relevant accidents and incidents, which were included in the final dataset. The final dataset on which the quantification of the main operational issues was based contains 1209 accidents and serious incidents. Appendix A contains a list of all 1209 accidents and incidents of the final dataset.

4.2 Quantification process

The basic principle of the quantification process is that each accident or serious incident has to be assigned to a single accident scenario. For example, the accident scenario ESD 13 'flight control system failure' is chosen when a flight control system failure leads to an unstable approach, which causes the aircraft to land long and fast, eventually resulting in a runway excursion.

The narratives of all 1209 accidents and serious incidents were reviewed by subject matter experts and each of the accidents and serious incidents has been assigned to one of the accident scenarios of the CATS model. When insufficient information was available, the original investigation report was retrieved or other sources on the internet were consulted. For seven runway excursions and one collision with ground the available information was insufficient to assign the accident to a specific scenario. These accidents and serious incidents were equally distributed over the accident end states of 'runway excursion' and 'collision with ground' respectively.

Of the 1209 accidents and serious incidents, 146 could not be assigned to one of the accident scenarios. There are two main reasons:

- The accident was considered out of scope, for instance because it had no significance for flight safety. Examples are injuries of ramp personnel.
- The consequences of the initiating events did not progress beyond the level of the Fault Trees in the model, e.g. because existing safety barriers prevented the scenarios from developing into accidents.

4.3 Baseline risk level derived from ESD scenarios

The European Aviation Safety Plan (EASp) of the European Aviation Safety Agency (EASA) identified main risk areas of commercial air transport operations. These risk areas are classified according to the type of issues they highlight, amongst which are operational issues. Operational issues are brought to light by the reporting and analysis of safety occurrence data. Safety occurrences are events where the available safety margin towards accidents or serious incidents has been reduced. Accidents and serious incidents are unrecoverable and represent end states in a series of events that include safety occurrences.

The EASp lists the following operational issues as being of primary importance: runway excursions, mid-air collisions, controlled flight into terrain (CFIT), loss of control in flight (LOC-I), and ground collisions.

To calculate the probability of occurrence of the main operational issues, the total number of accidents and serious incidents related to a specific operational issue has been divided by the exposure data corresponding to the data scope in table 2. The exposure data of flights in EASA member states with commercially operated (scheduled and non-scheduled) turbine aircraft with a maximum take-off mass of 5700 or heavier has been calculated to be 108.866.747 flights. Table 5 provides the number of occurrences and corresponding frequencies for each of the accident end states.

Table 4 Number of occurrences and corresponding frequency

ESD	ESD name	Accident end state code	Accident end state name	Number of occurrences[2]	Number of occurrences not assigned to accident scenario and distributed over total number of end states[3]	Frequency per flight
1	Aircraft system failure during take-off	ASC01d1	Runway excursion	2	0.39	$2.19 \cdot 10^{-8}$
2	ATC related event during take-off	ASC02d1	Runway excursion	0	0.39	$3.57 \cdot 10^{-9}$
3	Aircraft directional control by flight crew inappropriate during take-off	ASC03d1	Runway excursion	2	0.39	$2.19 \cdot 10^{-8}$
3	Aircraft directional control by flight crew inappropriate during take-off	ASC03d3	Runway excursion	2	0.39	$2.19 \cdot 10^{-8}$
4	Aircraft directional control related system failure during take-off	ASC04d1	Runway excursion	3	0.39	$3.11 \cdot 10^{-8}$
4	Aircraft directional control related system failure during take-off	ASC04d3	Runway excursion	1	0.39	$1.28 \cdot 10^{-8}$
5	Incorrect configuration during take-off	ASC05d1	Runway excursion	1	0.39	$1.28 \cdot 10^{-8}$
5	Incorrect configuration during take-off	ASC05d3	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
6	Aircraft takes off with contaminated wing	ASC06c1	Collision with ground	2	0.05	$1.88 \cdot 10^{-8}$
8	Aircraft encounters windshear after rotation	ASC08d1	Collision with ground	0	0.05	$4.59 \cdot 10^{-10}$
9	Single engine failure during take-off	ASC09d1	Runway excursion	3	0.39	$3.11 \cdot 10^{-8}$

ESD	ESD name	Accident end state code	Accident end state name	Number of occurrences[2]	Number of occurrences not assigned to accident scenario and distributed over total number of end states[3]	Frequency per flight
9	Single engine failure during take-off	ASC09d3	Runway excursion	2	0.39	$2.19 \cdot 10^{-8}$
10	Pitch control problem during take-off	ASC10d1	Runway excursion	2	0.39	$2.19 \cdot 10^{-8}$
10	Pitch control problem during take-off	ASC10d3	Runway excursion	0	0.39	$3.57 \cdot 10^{-9}$
10	Pitch control problem during take-off	ASC10e1	Collision with ground	0	0.05	$4.59 \cdot 10^{-10}$
11	Fire, smoke, fumes on-board aircraft	ASC11c2	Aircraft continues flight damaged	12	0.00	$1.10 \cdot 10^{-7}$
11	Fire, smoke, fumes on-board aircraft	ASC11d1	Collision with ground	0	0.05	$4.59 \cdot 10^{-10}$
11	Fire, smoke, fumes on-board aircraft	ASC11e1	Personal injury	2	0.00	$1.84 \cdot 10^{-8}$
11	Fire, smoke, fumes on-board aircraft	ASC11e2	Aircraft damaged	78	0.00	$7.16 \cdot 10^{-7}$
12	Flight crew member spatially disoriented	ASC12c1	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
13	Flight control system failure	ASC13c1	Collision with ground	2	0.05	$1.88 \cdot 10^{-8}$
14	Flight crew incapacitation	ASC14c1	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
15	Ice accretion on aircraft in flight	ASC15c1	Collision with ground	0	0.05	$4.59 \cdot 10^{-10}$
16	Airspeed, altitude or attitude display failure	ASC16c1	Collision with ground	4	0.05	$3.72 \cdot 10^{-8}$
17	Aircraft encounters thunderstorm, turbulence or wake vortex	ASC17c1	In-flight break-up	7	0.00	$6.43 \cdot 10^{-8}$
17	Aircraft encounters thunderstorm, turbulence or wake vortex	ASC17d1	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
17	Aircraft encounters thunderstorm, turbulence or wake vortex	ASC17e1	Aircraft continues flight with injury	30	0.00	$2.76 \cdot 10^{-7}$
18	Single engine failure in flight	ASC18d1	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$

ESD	ESD name	Accident end state code	Accident end state name	Number of occurrences[2]	Number of occurrences not assigned to accident scenario and distributed over total number of end states[3]	Frequency per flight
18	Single engine failure in flight	ASC18d3	Collision with ground	8	0.05	$7.39 \cdot 10^{-8}$
18	Single engine failure in flight	ASC18e1	Aircraft lands off runway	6	0.00	$5.51 \cdot 10^{-8}$
19	Unstable approach	ASC19d1	Collision with ground	11	0.05	$1.02 \cdot 10^{-7}$
19	Unstable approach	ASC19d3	Collision with ground	6	0.05	$5.56 \cdot 10^{-8}$
19	Unstable approach	ASC19f1	Runway excursion	21	0.39	$1.96 \cdot 10^{-7}$
19	Unstable approach	ASC19g2	Runway excursion	4	0.39	$4.03 \cdot 10^{-8}$
19	Unstable approach	ASC19g3	Aircraft continues landing roll damaged	11	0.00	$1.01 \cdot 10^{-7}$
21	Aircraft weight and balance outside limits during approach	ASC21c1	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
23	Aircraft encounters windshear during approach or landing	ASC23d1	Collision with ground	4	0.05	$3.72 \cdot 10^{-8}$
23	Aircraft encounters windshear during approach or landing	ASC23d3	Collision with ground	1	0.05	$9.64 \cdot 10^{-9}$
23	Aircraft encounters windshear during approach or landing	ASC23f1	Runway excursion	1	0.39	$1.28 \cdot 10^{-8}$
25	Aircraft handling by flight crew inappropriate during flare	ASC25d1	Runway excursion	15	0.39	$1.41 \cdot 10^{-7}$
25	Aircraft handling by flight crew inappropriate during flare	ASC25e1	Runway excursion	4	0.39	$4.03 \cdot 10^{-8}$
25	Aircraft handling by flight crew inappropriate during flare	ASC25e2	Aircraft continues landing roll damaged	49	0.00	$4.50 \cdot 10^{-7}$
26	Aircraft handling by flight crew inappropriate during landing roll	ASC26c1	Runway excursion	40	0.39	$3.71 \cdot 10^{-7}$

ESD	ESD name	Accident end state code	Accident end state name	Number of occurrences[2]	Number of occurrences not assigned to accident scenario and distributed over total number of end states[3]	Frequency per flight
27	Aircraft directional control related system failure during landing roll	ASC27c1	Runway excursion	25	0.39	$2.33 \cdot 10^{-7}$
31[1]	Aircraft are positioned on collision course in flight	ASC31d1	Collision in mid-air	4	0.00	$3.67 \cdot 10^{-8}$
32[1]	Runway incursion	ASC32d1	Collision on runway	7	0.00	$6.43 \cdot 10^{-8}$
33	Cracks in aircraft pressure cabin	ASC33c1	In-flight break-up	0	0.00	0
33	Cracks in aircraft pressure cabin	ASC33c2	Aircraft damage	0	0.00	0
35	TAWS alert	ASC35d1	Collision with ground	4	0.05	$3.72 \cdot 10^{-8}$
36[1]	Conflict on taxiway or apron	ASC36d1	Collision on taxiway or apron	120	0.00	$1.10 \cdot 10^{-6}$
38	Loss of control due to poor airmanship	ASC38c1	Collision with ground	0	0.05	$4.59 \cdot 10^{-10}$

[1] To ensure correct use of the exposure data, collisions between two aircraft are considered as two separate occurrences.

[2] Note that only 502 occurrences and 51 types of accident end states codes have been filed in Table 4 while 1055 occurrences corresponding to 79 types of end states codes have been identified in Appendix A. The reason for the difference is that only 502 occurrences actually led to 'accidents' (the other occurrences led to at most 'serious incidents'). Only occurrences with accident end state are used to quantify 'risk frequencies per flight'.

[3] One 'collision with ground' accident that could not be assigned to an accident scenario has been equally distributed over all 'collision with ground' end states. Seven 'runway excursion' accidents that could not be assigned to an accident scenario have been equally distributed over all 'runway excursion' end states.

Based on the results of table 3, the frequencies of the key operational safety issues as identified by EASA can be calculated. The results are presented in Table 5.

Table 5 Frequency of key operational safety issues

Key operational safety issue	Associated ESD end state that matches the key operational safety issue	Frequency
Runway excursion	ASC01d1, ASC02d1, ASC03d1, ASC03d3, ASC04d1, ASC04d3, ASC05d1, ASC09d1, ASC09d3, ASC10d1, ASC10d3, ASC19f1, ASC19g2, ASC23f1, ASC25d1, ASC25e1, ASC26c1, ASC27c1.	$1.24 \cdot 10^{-6}$
Mid-air collision	ASC31d1	$3.67 \cdot 10^{-8}$
CFIT	ASC35d1	$3.72\ 10^{-8}$
Loss of control in flight	ASC05d3, ASC06c1, ASC08d1,ASC10e1, ASC11d1, ASC12c1, ASC13c1, ASC14c1, ASC15c1, ASC16c1, ASC17d1, ASC18d1, ASC18d3, ASC19d1, ASC19d3, ASC21c1, ASC23d1, ASC23d3, ASC38c1	$4.13 \cdot 10^{-7}$
Ground collision	ASC32d1, ASC36d1	$1.17 \cdot 10^{-6}$

4.4 Comparison with Eurocontrol's Integrated Risk Picture

It is interesting to compare the frequencies of the key operational issues as presented in Table 4 with the results from Eurocontrol's Integrated Risk Picture IRP [27]. Similar to the CATS model, the IRP is the output of a risk model, representing the risk of aviation accidents, with particular emphasis on ATM contributions. The IRP for 2005 was quantified using historical experience from 1990 to 2004. To obtain the risk picture for 2012, the effect of a set of ATM changes that (in 2005) were expected to be in place by 2012, were estimated by the IRP project team and Eurocontrol experts. The comparison between the results from the updated CATS model and the IRP are presented in Table 5 for the main operational issues.

The IRP does not provide estimates for the frequency of runway excursions. Note that the Eurocontrol frequencies related to fatal accidents only, while the updated CATS model includes all accidents. For the accident types with a high fatality rate (mid air collisions, CFIT and loss of control in flight), the results from the updated CATS model correspond well with the IRP results. For ground collisions the estimated probability from the updated CATS model is much higher than those of the IRP model, but this can be explained by the fact that the fatality rate of this type of accident is much lower and the fact that the CATS model includes collisions on the apron, while the IRP model is restricted to collisions on the runway and taxiways.

Table 6 Comparison with Eurocontrol IRP

Main operational issue	Accident frequency according to updated CATS model	Fatal accident frequency for 2005 according to Eurocontrol IRP	Fatal accident frequency for 2012 according to Eurocontrol IRP
Mid-air collision	$3.67 \cdot 10^{-8}$	$5.4 \cdot 10^{-9}$	3.1·10-9
CFIT	$3.72 \cdot 10^{-8}$	$5.4 \cdot 10^{-8}$	1.5·10-8
Loss of control in flight	$4.13 \cdot 10^{-7}$	$1.3 \cdot 10^{-7}$	9.3·10-8
Ground collision	$1.17 \cdot 10^{-6}$	$6.6 \cdot 10^{-8}$	6.4·10-8

4.5 Risk Picture for SESAR

The Integrated Risk Picture from Eurocontrol [27] is further improved by using the Accident Incident Model (AIM), developed within SESAR [28, 29, 30]. Similar to the CATS model and the Eurocontrol IRP, the SESAR AIM [28] consists of a risk model, which shows the risks of aviation accidents and provides a structured breakdown of their causes, with particular emphasis on ATM contributions (both positive and negative). Using the AIM, a risk picture for SESAR is being developed to represent the combined effects of the set ATM changes that are expected to be in place by 2013, 2017 and 2020. Each ATM change is modelled through adjustments representing its expected impacts on appropriate elements of the risk model. These effects, together with the effects of changes in traffic levels, can then be summed to estimate the total risks and contributory / causal breakdown for 2013, 2017 and 2020. This approach allows investigation of the improvements that are necessary to satisfy the ECAC wide safety targets. However, a Risk Picture for SESAR is still under development.

5 Conclusions

Analysis of the EASA and Eurocontrol annual safety reports shows a significant overall improvement in safety in the last 2 decades. Europe has consistently experienced a low rate of fatal accidents compared with many other regions of the world and there have been recent years where there have been no fatal accidents within the region.

However, a pick-up in air traffic following the economic downturn of 2008, may also result in an increase in fatal and non-fatal occurrences.

About 40 % of all fatalities occur in accidents which happen during the approach and landing phases of flight. Furthermore, loss of control accidents in-flight result in higher numbers of fatalities when compared, for instance, to abnormal runway contact events (such as hard landings and runway excursions) despite being rarer occurrences. This explains the focus of the EASp on these and other events categories such as CFIT, mid-air collisions and ground collisions.

The baseline risk level for the total aviation system, which has been derived on the basis of air safety data from the NLR Air Safety database and accident scenarios – represented by an improved version of the Causal model for Air Transport Safety – for the key operational safety issues established in the EASp, shows that of the 5 event categories, runway excursions and ground collisions are more frequent than CFIT, mid-air collisions and loss of control in-flight. However, this relationship in inversely proportional to the rate of fatalities associated with these types of accidents.

The introduction of ESARRs and the collection of ATM safety data by Eurocontrol have shown an increase in reporting by ATM agencies across Europe although there are still obstacles for the full implementation of safety standards across the entire ATM system in Europe. The main safety issues identified correspond to those which are also followed by EASA and established in the EASp as the key operational safety issues. EU Commission regulation 390/2013 which lays down a performance scheme for ATM services will hopefully remove any remaining barriers for the full implementation of standard safety management regulations and further enhance operational safety for the future.

Helicopter operations in the European MS have also seen improvements in safety over the years although EMS (Emergency Medical Service) operations still account for most fatal accidents. Business aviation has improved similarly.

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7	European Aviation Safety Agency, Annual Safety Review 2011, 2012
8	European Aviation Safety Agency, Annual Safety Review 2012, 2013
9	Eurocontrol SRC, Annual Safety Review 2003, 2003
10	Eurocontrol SRC, Annual Safety Review 2004, 2004
11	Eurocontrol SRC, Annual Safety Review 2005, 2005
12	Eurocontrol SRC, Annual Safety Review 2006, 2006
13	Eurocontrol SRC, Annual Safety Review 2007, 2007
14	Eurocontrol SRC, Annual Safety Review 2008, 2009
15	Eurocontrol SRC, Annual Safety Review 2009, 2010
16	Eurocontrol SRC, Annual Safety Review 2010, 2011
17	Eurocontrol SRC, Annual Safety Review 2011, 2012
18	Eurocontrol SRC, Annual Safety Review 2012, 2013
19	IATA, 2012 Aviation Safety Performance, 2012
20	Boeing, Statistical Summary of Commercial Jet Airplane Accidents – Worldwide Operations 1959 – 2011, 2012
21	ASCOS D2.1; Framework for Safety Performance Indicators, 2013
22	ASCOS D3.2; Risk models and accident scenarios, 2013
23	CATS Final Report, Dutch Ministry of Transport, March 2009
24	A.L.C. Roelen, B.A. van Doorn, J.W. Smeltink, M.J. Verbeek, R. Wever. Quantification of Event Sequence Diagrams for a causal risk model of commercial air transport, NLR-CR-2008-646, NLR Amsterdam. 2008.
25	EASA; European Aviation Safety Plan (EASp) 2013 – 2016, 3rd Edition, Version 1.0, 2013
26	Commission implementing regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions
27	Main report for the 2005/2012 Integrated Risk Picture for air traffic management in Europe, EEC Note No. 05/06, Eurocontrol Experimental Centre, Brétigny, France. Eurocontrol (2006)
28	E. Perrin (Eurocontrol) et al.; SESAR Safety Reference Material, SESAR JU, Project ID 16.06.01, D06

29	E. Perrin (Eurocontrol) et al.; Guidance to apply the SESAR Safety Reference Material, SESAR JU, Project ID 16.06.01, D06
30	K. Slater (NATS) et al; Lagging and leading indicators in ATM, SESAR JU, Project ID 16.01.01, D05

Appendix A Accident and serious incident sample

State file number	Local date	Manufacturer/model	End state
95005170	5-1-1995	50	ASC26c1
95000630	10-1-1995	737-200	ASC36d1
95000100	20-1-1995	FALCON 20	ASC18d3
95000720	31-3-1995	A310	ASC18d3
95001110	8-4-1995	747-100/200	ASC13c2
95001340	22-4-1995	50	ASC17e1
95001090	27-4-1995	MD80 SERIES	ASC27c2
95001310	24-5-1995	110 BANDEIRANTE	ASC16c1
95002040	25-5-1995	ATP	ASC11e2
95002930	2-9-1995	MD80 SERIES	ASC25e2
95003020	16-9-1995	767-300	ASC04d2
95005490	16-10-1995	DC-9-30	out of scope
95005000	23-11-1995	757-200	ASC36d1
95003870	13-12-1995	AN-24	ASC06c1
95004720	15-12-1995	ATR 42 - NO SERIES SPECIFIED	ASC36d1
95003960	19-12-1995	DC-10	ASC17e1
96001480	14-2-1996	330	ASC25e2
96000560	19-2-1996	550/551 SP CITATION II	ASC16c1
96003260	19-5-1996	146-200	out of scope
96002710	28-5-1996	TU-154M/TU-164	ASC36d1
96001600	6-7-1996	HS748	out of scope
96003130	15-7-1996	L1011-1/L1011-100/200	ASC09d2
96003230	30-7-1996	188 ELECTRA	out of scope
96003050	13-8-1996	25	ASC19f1
96003390	29-8-1996	TU-154M/TU-164	ASC35d1
96006302	27-9-1996	727-200	ASC36d1
96006301	27-9-1996	FALCON 10	ASC36d1
96004100	8-10-1996	AN-124	ASC19d3
96005220	8-12-1996	F27 MK 500	ASC27c2
96005280	12-12-1996	146-100	ASC36d1
96001720	21-12-1996	DC-10-30	ASC17e1
97000690	3-1-1997	330	ASC25e1
97004270	18-1-1997	737-300	out of scope
97000400	8-2-1997	737-300	ASC13c2
97000770	2-5-1997	228 1/2	ASC19d1
97001480	6-5-1997	F27 MK 500	ASC25e2
97000910	14-5-1997	340	ASC25e2

97012550	14-5-1997	777-200	ASC36d1
97002450	18-5-1997	ATR 72 - NO SERIES SPECIFIED	out of scope
97003180	24-6-1997	TU-154B	ASC36d1
97002580	10-7-1997	747-100/200	ASC04d2
97001320	30-7-1997	ATR 42 - NO SERIES SPECIFIED	ASC19f1
97001770	31-7-1997	A320	out of scope
97001890	12-8-1997	727-200	ASC19f1
97002290	16-8-1997	FH227	ASC17c1
97004970	24-8-1997	757-200	ASC27c1
97001960	11-9-1997	146-300	ASC36d1
97004550	20-10-1997	L1011-1/L1011-100/200	ASC01d2
97002140	5-11-1997	A340-300	ASC27c2
97005090	21-11-1997	ONE-ELEVEN	ASC04d4
97005120	6-12-1997	747-100/200	ASC18d4
97003270	7-12-1997	F27 MK 500	ASC25d1
97002830	17-12-1997	YAK-42	ASC35d1
97003140	24-12-1997	757-200	ASC19g2
98010750	9-1-1998	767-300	ASC11e2
98002660	16-1-1998	650 CITATION III	out of scope
98000210	20-1-1998	ATR 42 - NO SERIES SPECIFIED	ASC23e2
98000310	26-1-1998	31 JETSTREAM	ASC36d1
98000230	9-2-1998	360	ASC19g3
98002670	15-2-1998	ATP	ASC36d1
98001000	22-2-1998	ATR 72 - NO SERIES SPECIFIED	out of scope
98004110	27-2-1998	340	ASC04d3
98000610	17-3-1998	737-300	ASC36d1
98000970	30-3-1998	HS748/AVRO 748	ASC09d1
98002040	5-4-1998	747-400	ASC10e2
98004510	7-4-1998	550/551 SP CITATION II	ASC27c2
98003070	9-5-1998	ATP	ASC36d1
98000640	21-5-1998	A320	ASC27c1
98004860	21-6-1998	747 SP	ASC17e1
98002540	19-7-1998	L1011-1/L1011-100/200	ASC25e2
98002240	28-7-1998	MERLIN III	ASC18d3
98002311	30-7-1998	1900	ASC31d1
98004980	14-8-1998	A321	ASC25e2
98002800	27-8-1998	A340-200	ASC27c1
98004770	11-9-1998	747-100/200	ASC01d1
98003300	14-11-1998	707-300	ASC18d4
98005320	14-10-1998	DC-9-40	ASC11e2
99000020	12-1-1999	F27 FRIEND/FREIGHT SHIP	ASC21c1

99000280	15-1-1999	767-300	ASC25e2
98004990	25-11-1998	L1011-500 SERIES	out of scope
99000300	28-1-1999	MD80 SERIES	ASC23d3
99000410	7-2-1999	707-300	ASC10d1
99004080	13-2-1999	340	ASC25e2
99000340	25-2-1999	328	ASC27c1
99000850	28-2-1999	DHC8	ASC25e2
99000350	1-3-1999	188 ELECTRA	ASC27c2
99001000	4-3-1999	737-200	ASC27c1
99001040	24-3-1999	A300-600	ASC19f1
99004980	3-6-1999	A321	ASC25e2
99007520	27-6-1999	737-400	ASC36d1
99008470	30-6-1999	228 1/2	ASC36d1
99008280	13-7-1999	DC-8-62	ASC19g3
99008180	22-1-1999	737-200	out of scope
99003641	25-7-1999	737-500	ASC36d1
99001570	28-7-1999	SA227AC/METRO III	ASC19d1
99002720	23-6-1999	DC-10-30F	out of scope
99005070	3-9-1999	737-800	ASC25e2
99003460	14-9-1999	757-200	ASC19g2
99999999	19-9-1999	MD-11	ASC19f1
99004020	20-7-1999	DC-8-62	out of scope
99004680	7-11-1999	100	ASC27c1
99004700	19-11-1999	737-300	ASC09d3
99004560	30-11-1999	CL-600	ASC27c1
99004970	12-8-1999	DHC8	out of scope
99004480	11-12-1999	ATP	ASC35d1
99006470	13-12-1999	777-200	ASC17e1
99004850	16-12-1999	A310	ASC31d2
99006710	18-12-1999	DC-10-30F	ASC09d2
99004720	22-12-1999	747-100/200	ASC16c1
20	10-1-2000	340	ASC12c1
7530	17-1-2000	50	ASC17e1
2530	20-1-2000	A320	ASC09d4
160	31-1-2000	AN-12	ASC19g3
99022990	1-10-1999	A310	out of scope
99007640	4-12-1999	757-200	out of scope
740	26-4-2000	DC-9-40	ASC18d4
790	2-5-2000	35 TRANSCONTINENTAL	ASC18d3
850	16-5-2000	ATP	ASC27c2
971	25-5-2000	330	ASC32d1

980	27-5-2000	DHC8	ASC25e2
2510	1-7-2000	F27 MK 500	ASC19f1
2350	4-7-2000	TU-154B	ASC19d4
1920	12-7-2000	A310	ASC18e1
2570	25-7-2000	DC-10	ASC04d4
2970	17-8-2000	757-200	ASC31d2
7850	14-9-2000	MD90-30	ASC36d1
5730	10-10-2000	DC-10-30	ASC17e1
7030	10-10-2000	ATR 72-200	ASC19f2
4090	22-10-2000	DHC8	ASC25e2
7630	29-10-2000	50	ASC27c1
4460	5-11-2000	747-100/200	ASC26c1
7600	18-11-2000	DC-10-30F	ASC04d4
4510	30-11-2000	737-800	ASC27c2
99004550	6-12-1999	DC-10-10	not specified - Runway excursion
1004910	4-2-2001	360	ASC25e1
1000180	7-2-2001	A320	ASC23d4
1007890	11-2-2001	767-300	ASC36d1
1000290	27-2-2001	360	ASC18e1
7510	21-2-2000	A321	out of scope
1000720	18-4-2001	A321	ASC23e2
550	27-3-2000	737-700	out of scope
1001100	10-5-2001	MD80 SERIES	ASC27c2
1002560	29-5-2001	SA227AC/METRO III	ASC25e2
1004100	7-6-2001	350 SUPER KING AIR	ASC19d1
1002610	14-6-2001	DHC8	ASC19g2
930	22-4-2000	747-300	out of scope
1003020	6-7-2001	L1011-1/L1011-100/200	ASC17c1
1004500	21-7-2001	MD80 SERIES	ASC17c1
1003130	24-8-2001	A330-200	ASC18e2
1006550	14-1-2001	737-400	out of scope
1002960	29-8-2001	CN 235	ASC18e1
1004871	8-10-2001	MD80 SERIES	ASC32d1
1005130	18-10-2001	CL-600	ASC36d1
1006700	22-11-2001	DHC8	ASC19g3
1006330	23-11-2001	AN-28	ASC19d1
1005580	24-11-2001	AVRO RJ100	ASC19d1
1006390	30-11-2001	31 JETSTREAM	ASC15c2
2000070	14-1-2002	120 BRASILIA	ASC35d1
2000620	12-4-2002	SA227AC/METRO III	ASC19d1

2001330	14-6-2002	A330-300	ASC10e2
BFU 3X128-02	24-6-2002	717-200	ASC36d1
BFU AX001-02	1-7-2002	757-200	ASC31d1
2001810	10-7-2002	2000	ASC19g3
1000530	19-3-2001	DHC8-300	out of scope
2005750	6-8-2002	737-700	ASC36d1
2001910	17-8-2002	737-700	ASC17e1
BFU 1X002-02	14-9-2002	CL-600	ASC27c2
2004420	14-9-2002	747-300	ASC36d1
1001090	30-4-2001	560 CITATION V	not specified - Runway excursion
2005440	16-10-2002	747-100/200	ASC19g3
2004120	16-10-2002	228 1/2	ASC13c2
2004460	2-11-2002	F27 MK 500	ASC19f1
2004330	6-11-2002	F27 MK 500	ASC18d1
2006740	6-12-2002	550/551 SP CITATION II	ASC36d1
2005600	9-12-2002	737-700	ASC36d1
2005850	12-12-2002	146-200	ASC13c2
2005540	24-12-2002	SA227 III	ASC18d3
2006350	25-12-2002	ATR 72-200	ASC36d1
3000230	6-1-2003	DHC8	ASC26c1
3000840	12-1-2003	737-800	ASC10d2
3004700	16-1-2003	747 SP	ASC36d1
3000070	17-1-2003	50	ASC19f1
3000280	20-1-2003	550/551 SP CITATION II	ASC27c1
3000190	10-2-2003	AN-28	ASC18d3
1002460	28-6-2001	757-200	out of scope
3001980	2-6-2003	DHC8-300	ASC17e1
3002110	16-6-2003	A320	ASC25e2
3002120	17-6-2003	MD80 SERIES	ASC05d1
1004210	24-8-2001	A319	out of scope
3002130	22-6-2003	CL-600	ASC19d1
2001880	27-7-2002	737-700	out of scope
3002780	15-8-2003	737-700	ASC17c1
3003130	17-9-2003	31 JETSTREAM	ASC18d3
3003490	17-9-2003	31 JETSTREAM	ASC19f2
3003260	23-9-2003	145 (145ER)	ASC27c1
3003520	1-10-2003	747-100/200	ASC25d1
3003420	7-10-2003	145 (145ER)	ASC36d1
3003880	4-12-2003	228 1/2	ASC13c1
3004510	22-12-2003	737-700	ASC36d1

3004800	22-12-2003	737-300	ASC17e1
2006560	17-9-2002	ATR 42-500	out of scope
4000050	5-1-2004	70	ASC18d3
4004320	12-1-2004	CITATION BRAVO	ASC36d1
4000120	19-1-2004	A320	ASC36d1
4000630	24-1-2004	757-300	ASC36d1
4004010	13-3-2004	737-400	ASC25e2
4000750	19-3-2004	REGIONAL JET SERIES 100/200	ASC36d1
4001120	20-4-2004	MD80 SERIES	ASC36d1
4002170	11-5-2004	A320	ASC18d4
4001410	14-6-2004	A321	ASC25e2
4002030	23-7-2004	A320	ASC17e1
4002580	3-9-2004	A320	ASC17c1
98003720	25-11-1998	MD80 SERIES	ASC11c2
4003260	25-11-2004	35 TRANSCONTINENTAL	ASC04d1
4003630	28-11-2004	737-400	ASC27c1
4003640	6-12-2004	G IV	ASC25d1
4003720	22-12-2004	ATR 72-200	ASC26c1
5001280	23-1-2005	MD80 SERIES	ASC25e2
5000130	24-1-2005	747-100/200	ASC26c1
5000180	27-1-2005	L410VP-E	ASC19d3
5000320	31-1-2005	ATR 42 - NO SERIES SPECIFIED	ASC10e2
2006530	25-11-2002	A300-B2/B4	out of scope
99008220	28-12-1999	ATR 42-300	ASC11e2
5001490	18-4-2005	ATR 72 - NO SERIES SPECIFIED	ASC25e2
5002130	1-5-2005	DHC8	ASC23d4
5002040	18-5-2005	A320	ASC27c1
5001890	26-5-2005	MD80 SERIES	ASC36d1
309999	16-6-2003	737-800	out of scope
5003160	8-7-2005	737-400	ASC04d4
5002790	29-7-2005	737-500	ASC17e1
5002880	6-8-2005	ATR 72-200	ASC18e1
5002960	14-8-2005	737-300	ASC14c1
5003310	29-8-2005	ATR 42-500	ASC25e1
5003450	19-9-2005	SA227 III	ASC04d1
5004240	7-10-2005	DHC8-300	ASC36d1
3000610	15-2-2003	747-100/200	ASC19f1
5118410	6-11-2005	A340-300	ASC36d1
5005200	20-11-2005	A340-300	ASC17e1
5005050	28-12-2005	737-500	ASC17e1
6004630	9-1-2006	MD80 SERIES	ASC27c2

2006-0041	13-1-2006	ATR 42-500	ASC36d1
7500	15-4-2000	MD80 SERIES	ASC11e2
6000640	10-3-2006	AVRO RJ85	ASC27c2
6001160	18-3-2006	737-600	ASC19g2
3002160	19-6-2003	AN-124	out of scope
6001750	17-5-2006	G IV	ASC36d1
6001730	19-5-2006	757-200	ASC25e2
6002040	14-6-2006	60	ASC27c1
6002500	15-6-2006	737-300	ASC19d3
6003100	15-7-2006	747-400	ASC36d1
6999903	17-7-2006	747-100/200	ASC04d4
6006330	2-8-2006	737-300	ASC25e2
6003240	13-8-2006	382B/100 HERCULES	ASC13c1
6003370	16-8-2006	737-500	ASC17c1
6003470	24-8-2006	MD80 SERIES	ASC36d1
3004730	13-7-2003	737-200	out of scope
6003720	13-9-2006	100	ASC27c2
6003950	10-10-2006	146-200	ASC27c1
7100059	2-1-2007	DHC8-400	ASC26c2
7000770	24-1-2007	REGIONAL JET SERIES 100/200	ASC26c2
7100020	25-1-2007	100	ASC06c1
7000420	8-2-2007	MD80 SERIES	ASC36d1
70057	11-2-2007	AN-124	ASC36d1
7002260	15-2-2007	777	ASC36d1
7490	5-6-2000	MD80 SERIES	ASC11e2
4000110	2-1-2004	A320	out of scope
7002600	20-3-2007	747-400	ASC25e2
7000840	13-4-2007	747-400	ASC36d1
4004400	1-2-2004	A321	out of scope
7001330	25-6-2007	747-100/200	ASC36d1
4001280	26-4-2004	146-100	out of scope
7001310	26-6-2007	A320	ASC17e1
7100195	27-7-2007	777-200	ASC36d1
7100245	4-8-2007	MD 83	ASC36d1
4001470	22-6-2004	IL-62M/IL-62K	not specified - Runway excursion
7100214	18-8-2007	AVRO RJ100	ASC25e2
7003140	28-8-2007	A321	ASC27c2
7001930	9-9-2007	DHC8-400	ASC27c1
7001950	12-9-2007	DHC8-400	ASC27c1
7002200	15-9-2007	ATR 72-200	ASC36d1

7100268	21-9-2007	DHC8-400	ASC27c2
7002790	2-10-2007	737-800	ASC10d2
4002600	29-9-2004	228 1/2	out of scope
7002610	4-10-2007	A330-300	ASC18d4
7002470	27-10-2007	DHC8-400	ASC27c1
7002460	28-10-2007	737-800	ASC19d1
7100352	28-10-2007	717-200	ASC36d1
7100414	11-12-2007	SA227AC/METRO III	ASC36d1
7003160	12-12-2007	757-300	ASC36d1
7100354	12-12-2007	767-300	ASC36d1
7100339	30-12-2007	737-300	ASC32d1
8000030	9-1-2008	146-200	ASC26c2
8000020	9-1-2008	A340-300	ASC36d1
8000110	17-1-2008	777-200	ASC18e1
8100065	1-2-2008	F27 MK 500	ASC36d1
8002050	4-2-2008	737-600	ASC17e1
1004680	30-1-2001	146-300	ASC11e2
5000370	31-1-2005	737-600	out of scope
8000490	1-3-2008	A319	ASC17e1
8100100	1-3-2008	747-400	ASC26c2
8100099	19-3-2008	328	ASC25d1
8100176	25-5-2008	747-100/200	ASC09d1
8100703	28-5-2008	DHC8-400	ASC19d1
8001300	16-6-2008	A340-300	ASC36d1
8001370	22-6-2008	DHC8-400	ASC25e2
8001350	23-6-2008	737-800	ASC36d1
8100513	28-6-2008	737-300	ASC36d1
8100260	2-7-2008	777-200	ASC17c1
8001610	18-7-2008	A321	ASC25e2
8003760	28-7-2008	A320	ASC36d1
8003750	28-7-2008	A321	ASC25e2
8003770	6-8-2008	A319	ASC36d1
8001670	13-8-2008	228 1/2	ASC27c2
8100375	20-8-2008	MD80 SERIES	ASC05d3
1007750	1-2-2001	2000	ASC11e2
8002600	17-10-2008	737-300	ASC36d1
8100566	27-10-2008	747-100/200	ASC10e2
8003780	3-11-2008	737-800	ASC36d1
8002680	5-12-2008	REGIONAL JET SERIES 100/200	ASC36d1
8002710	9-12-2008	BOEING 757-236F - (not coded)	ASC25e2
9000360	5-2-2009	737-800	ASC17e1

9100126	13-2-2009	AVRO RJ100	ASC27c2
9100127	25-2-2009	737-800	ASC16c1
9100725	25-2-2009	146-200	ASC36d1
9100355	2-3-2009	AVRO RJ85	ASC36d1
9000960	8-5-2009	747-400	ASC13c2
5000290	1-2-2005	A319	out of scope
2009-06-13-02	13-6-2009	737-300	ASC17d1
5002390	16-4-2005	100	out of scope
9001700	24-7-2009	A319	ASC17e1
9100737	4-8-2009	A320	ASC25e2
9100704	1-9-2009	A320	ASC10e2
9003200	1-9-2009	Embraer\ ERJ190 - (not coded)	ASC36d1
9002010	14-9-2009	100	ASC27c2
51111111	23-5-2005	ATP	out of scope
9002710	28-10-2009	747-400	ASC04d4
9100907	1-11-2009	DHC8	ASC23d1
5002180	1-6-2005	A321	out of scope
9002640	18-11-2009	FALCON 900	ASC25d1
10000090	16-1-2010	A300-600	ASC09d1
10100177	6-2-2010	MD 82	ASC25e2
10100116	10-2-2010	MD80 SERIES	ASC09d4
10000430	28-2-2010	REGIONAL JET SERIES 700	ASC36d1
10100175	18-3-2010	AN-26/AN-26B	ASC18e1
10000880	19-3-2010	146-200	ASC27c2
1007780	19-7-2001	A320	ASC11e2
10000770	22-4-2010	DHC8-400	ASC09d4
10001010	1-5-2010	DHC8-300	ASC19d1
BEA f-bf100524	24-5-2010	145 (145ER)	ASC19g3
10000940	31-5-2010	747-400LCF Dreamlifter	ASC27c2
10001240	6-6-2010	737-400	ASC18d4
10001260	7-6-2010	170	ASC04d4
5002290	26-6-2005	757-200	out of scope
10100585	18-6-2010	A320	ASC36d1
10100728	23-8-2010	737-600	ASC17e1
10100624	25-8-2010	AN-26/AN-26B	ASC04d2
N2010-03334	15-9-2010	DHC8	ASC23d1
ANSV-10-1836	24-9-2010	A319	ASC23d1
10100746	3-10-2010	767-300	ASC25e2
5002780	29-6-2005	CL-600	out of scope
BEA f-jd101030	30-10-2010	A380	ASC36d1
10100893	30-11-2010	747-400	ASC36d1

BFU AX001-10	2-12-2010	A321	ASC36d1
BEA od-a101217	17-12-2010	A330-200	ASC36d1
11100016	12-1-2011	A320	ASC17e1
AET/AC-2011/1	20-1-2011	DHC8-400	ASC25e2
11100050	4-2-2011	41 JETSTREAM	ASC27c2
904610781	10-2-2011	SA227AC/METRO III	ASC19d3
5003300	19-8-2005	737-300	out of scope
J2011007	24-2-2011	A320	ASC25e2
2137224257	2-3-2011	SA227 III	ASC27c1
BFU 6X001-11	27-3-2011	737-800	ASC10d2
5003320	1-9-2005	737-400	out of scope
xxx	14-4-2011	767-300	ASC36d1
1476907110	17-4-2011	777-200	ASC25e2
2005130	30-11-2002	145 (145ER)	ASC11e2
N2011-01831	5-5-2011	737-800	ASC36d1
11100676	12-5-2011	737-800	ASC36d1
J2011028	20-5-2011	767	ASC25e2
2011-16-EBBR-SP-LLB	26-5-2011	Boeing B737-45D - (not coded)	ASC27c2
AAIASB/994	25-6-2011	737-800	ASC25e2
5003660	30-9-2005	340	out of scope
835/11	14-7-2011	ATR 72-200	ASC36d1
IRL00911067	17-7-2011	ATR 72-200	ASC25e1
BEA g-ld110723	23-7-2011	737-300	ASC27c2
A-029/2011-1361	30-7-2011	REGIONAL JET SERIES 100/200	ASC19g3
5003970	30-10-2005	L410UVP	not specified - Collision with ground
BEA f-at110912	12-9-2011	A321	ASC19g3
BFU 1X002-11	7-10-2011	737-800	ASC17e1
BFU 2X001-11	9-10-2011	A320	ASC17e1
PKBWL/PL 1400/11	1-11-2011	767-300	ASC27c2
BEA f-he111124	24-11-2011	A319	ASC36d1
BFU 1X003-11	7-12-2011	A320	ASC17e1
BFU AX001-11	14-12-2011	DHC8-300	ASC36d2
11100816	23-12-2011	A321	ASC19d3
2011/062	26-12-2011	146-200	ASC36d1
6001640	4-6-2006	A320	ASC17e1
5117050	6-11-2005	767-200	out of scope
BFU 1X001-08	19-3-2008	328	ASC19f1
8100625	4-9-2008	SN 601	ASC27c2
4000910	23-3-2004	BOEING 747	ASC36d1
BFU 5X001-95	19-1-1995	A310	ASC03d4

BFU 5X003-95	14-7-1995	F27 FRIEND/FREIGHT SHIP	ASC26c1
BFU 5X002-96	13-8-1996	MD-11	ASC25d1
BFU EX003-97	6-11-1997	737-500	ASC26c2
97005140	20-12-1997	737-300	ASC36d1
98004820	9-2-1998	HS748/AVRO 748	ASC04d4
98000560	2-4-1998	FALCON 20	ASC19f1
98005170	25-5-1998	CONCORDE	ASC13c2
98004680	31-5-1998	A310	ASC36d1
98005110	29-9-1998	120 BRASILIA	ASC13c2
3048850	2-10-2003	747-100/200	ASC11c2
5004770	16-12-2005	737-800	not specified - Runway excursion
98005161	10-12-1998	767-300	ASC32d2
99000260	20-1-1999	747-400	ASC19d3
BFU 5X001-99	5-2-1999	Boeing\ B737-46J - (not coded)	ASC26c1
99006000	13-2-1999	330	ASC27c2
6000040	5-1-2006	767-200	out of scope
BFU 5X004-99	6-7-1999	ATR 42-300	ASC27c1
991111100	11-9-1999	747-300	ASC26c1
6000330	24-1-2006	ATR 42-300	out of scope
3004180	13-12-2003	AVRO RJ100	ASC11e2
8000	11-1-2000	2000	ASC31d2
7560	24-1-2000	A320	ASC32d2
7181	1-2-2000	737-400	ASC32d2
6000530	11-2-2006	737-400	out of scope
660	1-4-2000	737-800	ASC25e2
7070	5-4-2000	100	ASC01c2
4001570	22-1-2004	A320	ASC11c2
4004340	8-6-2004	A300-600	ASC11e2
7520	13-7-2000	AVRO RJ100	ASC27c1
BFU EX004-00	27-8-2000	A300-B2/B4	ASC26c1
BFU 5X010-00	20-10-2000	Fokker\ F27,MK600 - (not coded)	ASC26c1
7540	8-11-2000	50	ASC31d2
7590	13-11-2000	A319	ASC32d2
4002390	20-8-2004	MD80 SERIES	ASC11e2
4003300	19-11-2004	A340-600	ASC11e2
1002430	2-2-2001	757-200	ASC11c2
1000600	4-2-2001	747-300	ASC27c2
1007760	20-2-2001	A321	ASC18d4
1121530	27-3-2001	767-300	ASC13c2
1121550	23-4-2001	767-300	ASC13c2

1121580	8-7-2001	A310	ASC36d1
5000540	1-3-2005	777-200	ASC11e1
1007790	3-8-2001	145 (145ER)	ASC19f1
1008100	11-12-2001	737-300	ASC31c2
1007820	18-12-2001	2000	ASC36d2
1007800	24-12-2001	145 (145ER)	ASC13c2
BFU 5X001-02	2-1-2002	Fokker\ F27,MK600 - (not coded)	ASC26c1
2000210	3-2-2002	MD-11	ASC26c1
2006650	16-2-2002	70	ASC09d4
2006640	22-2-2002	146-200	ASC19f1
2005910	2-3-2002	A321	ASC19g3
2006570	28-6-2002	145 (145ER)	ASC13c2
2001870	6-7-2002	A320	ASC09d2
2007100	22-8-2002	DA 40 DIAMOND STAR	ASC31c2
2006630	12-9-2002	31 JETSTREAM	ASC31c2
2006590	13-9-2002	737-800	ASC14c2
2005321	1-10-2002	145 (145ER)	ASC31d2
2006550	8-10-2002	ATR 42-500	ASC26c1
2006540	9-10-2002	100	ASC25d1
2005191	5-11-2002	A320	ASC31d2
6000550	21-2-2006	767	out of scope
5001480	19-4-2005	146-100	ASC11e2
2005220	3-12-2002	A300-600	ASC13c2
3004710	18-1-2003	747-400	ASC36d1
3004780	4-2-2003	135	ASC13c2
3004720	23-3-2003	A319	ASC31d2
BFU 5X002-03	10-4-2003	146-200	ASC27c1
3002561	27-4-2003	A321	ASC31d2
3002760	28-5-2003	560 CITATION V	ASC19f1
3003780	14-6-2003	747-100/200	ASC17e2
6000850	12-3-2006	737-600	out of scope
3002820	2-7-2003	737-800	ASC36d1
3002411	12-7-2003	TU-154	ASC31c2
BFU 6X014-03	13-7-2003	A321	ASC31d2
5004280	25-7-2005	757	ASC11e2
3004670	17-11-2003	737-800	ASC31c2
3004920	25-11-2003	145 (145ER)	ASC14c2
3051550	7-12-2003	737-800	ASC10e2
5004430	17-11-2005	2000	ASC11e2
5000340	5-12-2005	AVRO RJ100	ASC11c2
4000160	26-1-2004	328JET	ASC25d1

4002470	27-1-2004	145 (145ER)	ASC27c1
4004410	31-1-2004	120 BRASILIA	ASC35d2
6002080	4-5-2006	BOEING 737	out of scope
4004370	18-2-2004	A330-200	ASC31c2
4003470	29-2-2004	A321	ASC32d2
4000540	2-3-2004	737-400	ASC31c2
4000610	21-3-2004	737-800	ASC25e2
4002370	21-3-2004	MD80 SERIES	ASC19d4
4001580	29-3-2004	CL-600	ASC13c2
4001270	15-4-2004	737-400	ASC09d4
6001440	15-5-2006	747-400	out of scope
4000920	27-4-2004	737-300	ASC32c2
4004280	4-5-2004	A320	ASC32d2
4001070	19-5-2004	DHC8	ASC18d4
6000390	26-1-2006	AVRO RJ100	ASC11c2
4001420	12-6-2004	146-100	ASC31c2
4004150	22-6-2004	737-800	ASC32d2
6001990	22-5-2006	A320	out of scope
4001390	28-6-2004	A321	ASC31d2
4001720	30-6-2004	BOEING 737	ASC32c2
4001680	6-7-2004	L1011-1/L1011-100/200	ASC09d2
4001710	16-7-2004	767-300	ASC18d4
4001980	18-7-2004	70	ASC31d2
4001810	19-7-2004	A320	ASC31c2
4002240	4-8-2004	120 BRASILIA	ASC31c2
4002090	9-8-2004	AVRO RJ100	ASC18d4
4002230	20-8-2004	A310	ASC31c2
BFU AX001-06	15-2-2006	FALCON 20	ASC11e2
4002670	16-9-2004	REGIONAL JET SERIES 100/200	ASC31c2
4666666	21-9-2004	747-400	ASC10e2
6001580	28-5-2006	MD80 SERIES	out of scope
4002810	2-10-2004	A320	ASC32d2
4002930	5-10-2004	748	ASC32c2
4002820	6-10-2004	120 BRASILIA	ASC16c2
4002890	9-10-2004	A319	ASC31d2
4002860	19-10-2004	737-300	ASC14c2
4002960	31-10-2004	A330-200	ASC31c2
4003550	4-11-2004	747-300	ASC19f1
4003610	2-12-2004	146-200	ASC32c2
4029950	12-12-2004	747-100/200	ASC19d1
4003800	21-12-2004	REGIONAL JET SERIES 100/200	ASC18d4

4004420	29-12-2004	737-500	ASC17e1
5004250	17-1-2005	2000	ASC13c2
5100820	19-1-2005	767-300	ASC18d4
5000170	20-1-2005	CL-600	ASC23d4
6002550	18-6-2006	A320	out of scope
5000600	8-2-2005	777-200	ASC32c2
5000500	9-2-2005	F28 MK 1000	ASC31c2
5000550	9-2-2005	A319	ASC31c2
5000560	14-2-2005	TU-154M/TU-164	ASC31c2
5100840	20-2-2005	747-400	ASC18d4
5000720	28-2-2005	747-100/200	ASC31c2
5000790	1-3-2005	170	ASC19g3
5004260	1-3-2005	737-600	ASC31c2
5000920	6-3-2005	BOEING 737	ASC31c2
BFU 5X007-05	12-3-2005	146-300	ASC13c2
5000890	13-3-2005	50	ASC32c2
5001240	30-3-2005	AVRO RJ85	ASC13c2
BEA f-zd050401	1-4-2005	A321	ASC31d2
BFU 5X009-05	1-4-2005	172 RG	ASC32c2
6001910	22-6-2006	A340-300	out of scope
5002550	18-4-2005	ATR 72-200	ASC10e2
BFU 5X010-05	18-4-2005	DHC8-300	ASC26c1
6000800	19-3-2006	AVRO RJ100	ASC11e2
5001590	22-4-2005	A320	ASC31c2
5001470	23-4-2005	737-300	ASC10e2
5001710	29-4-2005	2000	ASC31c2
5108750	12-5-2005	757-200	ASC10e2
6002690	3-7-2006	100	out of scope
5002370	18-6-2005	A320	ASC14c2
5002240	18-6-2005	737-800	ASC31c2
6007220	24-8-2006	737-300	out of scope
5999901	29-6-2005	A300-B2/B4	ASC09d2
5002620	30-6-2005	A321	ASC31c2
5003840	1-7-2005	ATR 42-500	ASC31d2
5002610	16-7-2005	737-800	ASC31c2
BFU EX005-05	18-7-2005	Embraer\ EMB145 - (not coded)	ASC19f1
5002630	21-7-2005	737-700	ASC14c2
6002350	25-3-2006	ATP	ASC11e2
BFU EX006-05	14-8-2005	145 (145ER)	ASC25d1
5003290	17-8-2005	2000	ASC13c2
5004300	18-8-2005	737-800	ASC31c2

5004290	18-8-2005	A300-B2/B4	ASC18d4
2006101933	8-11-2006	767-200	out of scope
5004310	20-8-2005	A340-300	ASC31c2
N2005-00001	21-8-2005	50	ASC31d2
5003100	22-8-2005	F28 MK 1000	ASC35c2
5004320	22-8-2005	737-300	ASC31d2
6006690	12-12-2006	AVRO RJ100	out of scope
5004440	10-9-2005	146-100	ASC31c2
5003610	11-9-2005	737-800	ASC32c2
5004020	14-9-2005	ATR 42-300	ASC15c2
5003410	14-9-2005	G V	ASC31c2
7000350	11-1-2007	757-200	out of scope
5004040	30-10-2005	A320	ASC32c2
5004330	2-11-2005	737-800	ASC18d4
7000810	7-2-2007	CL-600	out of scope
5004520	17-11-2005	ATR 42-300	ASC18d4
2006-0071	27-3-2006	50	ASC11e2
5004840	24-11-2005	DHC8-400	ASC13c2
5004610	27-11-2005	70	ASC32d2
6000790	29-3-2006	ATR 42-300	ASC11e2
5004870	6-12-2005	747-300	ASC31c2
7001790	4-3-2007	A319	out of scope
5005010	28-12-2005	767-300	ASC18d4
6001420	7-1-2006	MD80 SERIES	ASC14c2
6000190	10-1-2006	A321	ASC32c2
6000240	12-1-2006	737-600	ASC31c2
6000100	12-1-2006	747-100/200	ASC32c2
6000350	20-1-2006	145 (145ER)	ASC26c1
6001660	23-1-2006	F27 FRIEND/FREIGHT SHIP	ASC18d4
7001410	22-3-2007	AVRO RJ100	out of scope
6000320	25-1-2006	737-400	ASC14c2
6000300	26-1-2006	145 (145ER)	ASC26c1
6002010	3-5-2006	A320	ASC11e2
6000540	30-1-2006	757-200	ASC31d2
6000340	6-2-2006	737-800	ASC26c1
6000630	9-2-2006	MD80 SERIES	ASC09d4
7100101	22-4-2007	757-200	out of scope
6000520	21-2-2006	DHC8	ASC18d4
6000780	21-2-2006	145 (145ER)	ASC13c2
7003400	23-4-2007	A321	out of scope
6000590	4-3-2006	A310	ASC09d3

6002230	7-3-2006	757	ASC17e2
6000650	8-3-2006	AVRO RJ85	ASC02c2
6002260	8-3-2006	HS748/AVRO 748	ASC25d1
7100147	10-5-2007	MD 83	out of scope
6001490	8-5-2006	CL-600	ASC11e2
6000760	21-3-2006	45	ASC31c2
6000740	23-3-2006	146-200	ASC14c2
6004580	23-3-2006	737-800	ASC19d4
6000750	24-3-2006	ATR 42-300	ASC09d2
6001770	1-6-2006	50	ASC11e2
6000730	26-3-2006	DHC8	ASC13c2
6002780	28-6-2006	145 (145ER)	ASC11e2
6000920	28-3-2006	737-400	ASC31c2
6003090	27-7-2006	737-500	ASC11e2
6000770	30-3-2006	146-300	ASC13c2
6000990	6-4-2006	DHC8-400	ASC18d4
6007500	7-4-2006	R44	ASC02c2
6001480	23-4-2006	DHC8-400	ASC31d2
6001760	3-5-2006	BOEING 737	ASC04d1
6003700	24-8-2006	BOEING 737	ASC11e2
6003800	17-9-2006	767-300	ASC11e2
6001450	11-5-2006	737-700	ASC02c2
6001720	15-5-2006	CL-600	ASC32c2
6055555	16-5-2006	70	ASC13c2
6999901	22-5-2006	MD80 SERIES	ASC25e2
6001740	22-5-2006	737-400	ASC02c2
7003260	16-5-2007	A320	out of scope
7001130	14-6-2007	747-400	out of scope
6000000	28-5-2006	A320	ASC17e1
6003920	22-9-2006	777-200	ASC11e2
6008170	5-6-2006	737-500	ASC31d2
6001950	8-6-2006	737-400	ASC13c2
6002540	13-6-2006	757	ASC14c2
6002620	17-6-2006	737-800	ASC31d2
7100383	17-6-2007	RJ-85 AVROLINER	out of scope
7003280	22-6-2007	757-200	out of scope
6002900	22-6-2006	328	ASC27c1
7003350	19-2-2007	146-300	ASC11e2
6002760	28-6-2006	146-300	ASC14c2
6002790	30-6-2006	A319	ASC14c2
2006100921	7-7-2006	737-300	ASC13c2

6002890	13-7-2006	737-700	ASC32d2
6000000	17-7-2006	747-100/200	ASC04d4
2006-0190	18-7-2006	A321	ASC25e2
6003570	24-7-2006	560 CITATION V	ASC31c2
6003030	26-7-2006	A320	ASC18d4
7100090	26-2-2007	777-200	ASC11e2
6999902	12-8-2006	737-900	ASC26c1
6003350	17-8-2006	737-400	ASC32c2
7003230	9-3-2007	70	ASC11e2
6003560	1-9-2006	A320	ASC32c2
6004230	7-9-2006	737-800	ASC32c2
6003650	10-9-2006	737-500	ASC36d1
6003740	11-9-2006	737-800	ASC32c2
6003710	14-9-2006	525 CITATIONJET	ASC31c2
7003410	10-5-2007	145 (145ER)	ASC11e2
6004070	19-9-2006	ATP	ASC26c1
6003940	21-9-2006	A321	ASC31c2
7002420	11-5-2007	360	ASC11e2
6004150	23-9-2006	737-800	ASC02d2
6003960	24-9-2006	737-800	ASC31c2
6004050	13-10-2006	A340-600	ASC31c2
6004100	16-10-2006	PANAVIA / PA200 ("Tornado") - (not coded)	ASC31d2
6004290	30-10-2006	145 (145ER)	ASC32d2
6004320	6-11-2006	A321	ASC09d2
6004420	6-11-2006	A319	ASC32d2
6006820	7-11-2006	MD-11	ASC27c2
7001320	24-6-2007	146-200	out of scope
6004600	8-11-2006	2000	ASC31c2
6004370	13-11-2006	430	ASC31c2
6004380	19-11-2006	F27 FRIEND/FREIGHT SHIP	ASC10d1
6004840	5-12-2006	AN-124	ASC31d2
6006710	5-12-2006	2000	ASC32d1
2006101906	7-12-2006	747-400	ASC16c2
7003440	25-6-2007	737-500	out of scope
7003180	11-1-2007	41 JETSTREAM	ASC13c2
7100179	26-6-2007	41 JETSTREAM	out of scope
7003190	12-1-2007	41 JETSTREAM	ASC13c2
7000210	15-1-2007	TB 200 TOBAGO XL	ASC31d2
7003200	17-1-2007	REGIONAL JET SERIES 100/200	ASC26c1
7003330	18-1-2007	ATR 42-300	ASC13c2

7000230	18-1-2007	146-300	ASC14c2
7003210	20-1-2007	737-800	ASC10e2
7000260	23-1-2007	35 TRANSCONTINENTAL	ASC26c1
7000330	24-1-2007	A320	ASC15c2
7000340	25-1-2007	DHC8-400	ASC14c2
7000410	28-1-2007	146-300	ASC14c2
7000360	31-1-2007	170	ASC32d2
7000090	31-1-2007	A321	ASC14c2
7000380	6-2-2007	146-300	ASC32c2
7003340	6-2-2007	A319	ASC16c2
7100226	13-7-2007	A320	out of scope
7	8-2-2007	50	ASC31c2
7000080	8-2-2007	TU-154	ASC31c2
7000390	12-2-2007	120 BRASILIA	ASC13c2
7003220	12-2-2007	737-400	ASC31d2
7001100	22-5-2007	A320	ASC11e2
7003360	20-2-2007	146-200	ASC19f1
7000530	23-2-2007	146-300	ASC31c2
7003370	26-2-2007	41 JETSTREAM	ASC13c2
7000750	27-2-2007	737-600	ASC32c2
7200180	3-3-2007	767-300	ASC01d2
700002222	5-3-2007	A319	ASC32c2
700	6-3-2007	737-800	ASC31d2
7000520	8-3-2007	ATR 72 - NO SERIES SPECIFIED	ASC18d4
7003430	10-6-2007	737-500	ASC11e2
7000550	12-3-2007	146-200	ASC31c2
7003380	19-3-2007	188 ELECTRA	ASC18d4
7001580	19-7-2007	767-300	out of scope
7000630	28-3-2007	145 (145ER)	ASC31c2
7000620	4-4-2007	560 CITATION V	ASC14c2
7000660	9-4-2007	A321	ASC27c1
7003250	10-4-2007	747-100/200	ASC18d4
7000730	11-4-2007	A320	ASC14c2
7000820	13-4-2007	A320	ASC32c2
7003390	18-4-2007	A319	ASC03d3
7100247	10-8-2007	757-200	out of scope
7100248	11-8-2007	737-300	out of scope
7000920	4-5-2007	737-800	ASC31c2
7000720	5-5-2007	A320	ASC32c2
7003290	14-7-2007	747-100/200	ASC11e2
7001020	10-5-2007	CL-600	ASC14c2

7000990	10-5-2007	A321	ASC31c2
7001570	18-7-2007	146-200	ASC11e2
7200494	13-5-2007	737-800	ASC16c2
7001030	15-5-2007	A320	ASC31c2
7001750	17-8-2007	A330-200	out of scope
20073038	18-5-2007	50	ASC19f1
7001050	20-5-2007	747-100/200	ASC27c2
7001640	28-7-2007	A300-600	ASC11e2
7001340	29-5-2007	AN-26/AN-26B	ASC09d4
7001180	3-6-2007	560 CITATION V	ASC31c2
7003420	4-6-2007	737-500	ASC16c2
7001160	5-6-2007	CL-600	ASC31c2
7003300	30-7-2007	737-700	ASC11e2
7003580	11-6-2007	LAK 17 - (not coded)	ASC31d2
7002050	10-9-2007	737-800	out of scope
7003150	3-10-2007	777-200	out of scope
7003520	6-11-2007	737-800	out of scope
7002930	11-12-2007	SA227 III	not specified - Runway excursion
7001350	25-6-2007	737-500	ASC31c2
7003030	16-12-2007	146-200	not specified - Runway excursion
7003450	27-6-2007	45	ASC31c2
7001290	30-6-2007	737-300	ASC14c2
7001390	30-6-2007	145 (145ER)	ASC32c2
N2007-00042	1-7-2007	DHC8-400	ASC13c2
7001370	3-7-2007	DHC8-300	ASC31c2
N2007-00062	3-7-2007	DHC8-400	ASC31d2
N2007-00069	5-7-2007	737-700	ASC31d2
7003470	5-7-2007	A320	ASC25e2
N2007-00067	5-7-2007	737-700	ASC31d2
7001380	8-7-2007	146-300	ASC14c2
7001550	9-7-2007	A320	ASC31c2
7003130	11-7-2007	737-400	ASC32c2
8003740	17-2-2008	A321	out of scope
7001740	20-8-2007	767-300	ASC11e2
7001510	15-7-2007	146-200	ASC32c2
7001630	15-7-2007	UNKNOWN	ASC31c2
7002090	16-7-2007	737-800	ASC31c2
N2007-00189	17-7-2007	MD80 SERIES	ASC31d2
7002720	11-11-2007	AVRO RJ85	ASC11e2
8100514	28-4-2008	L410UVP	out of scope

8003690	4-2-2008	777-200	ASC11e2
8000770	19-3-2008	2000	ASC11e2
7001660	31-7-2007	737-800	ASC32d2
7100454	2-8-2007	T-6 HARVARD	ASC31c2
8000960	13-5-2008	A319	out of scope
8100174	19-5-2008	ATR 72-200	out of scope
7001850	13-8-2007	BOEING 737	ASC32c2
7002010	16-8-2007	MD80 SERIES	ASC19d4
N2007-00346	19-8-2007	BAE-3200 JETSREAM SUPER 31	ASC36d1
8001950	7-4-2008	737-300	ASC11c2
N2007-00169	21-8-2007	50	ASC31d2
N2007-00247	29-8-2007	737-300	ASC32d2
N2007-00294	9-9-2007	737-600	ASC31d2
7002080	9-9-2007	MD 83	ASC10e2
8100180	27-5-2008	A319	out of scope
7002060	11-9-2007	A320	ASC31d2
7003110	11-9-2007	737-300	ASC31d2
N2007-00314	12-9-2007	DHC8	ASC32d2
7002140	13-9-2007	UNKNOWN	ASC31d2
7003310	14-9-2007	737-800	ASC18d4
N2007-00327	16-9-2007	737-300	ASC13c2
7002240	16-9-2007	REGENT (DR400/180)	ASC31c2
7002150	21-9-2007	500/501 CITATION	ASC31c2
7201459	23-9-2007	737-300	ASC19d4
70000000	27-9-2007	747-400	ASC25e2
7003560	3-10-2007	340	ASC31d2
7002270	4-10-2007	AN-26/AN-26B	ASC19f1
7003500	15-10-2007	A340-300	ASC36d1
7002510	23-10-2007	A319	ASC31d2
7002630	23-10-2007	A321	ASC18d4
7002530	24-10-2007	A320	ASC02c2
7003510	28-10-2007	HS125 DOMINIE 1-600	ASC31c2
7002740	30-10-2007	55/95-55 BARON	ASC31c2
8100322	20-7-2008	737-800	out of scope
7002660	9-11-2007	ATR 42-300	ASC10e2
7002710	10-11-2007	REGIONAL JET SERIES 100/200	ASC14c2
8001320	24-6-2008	757-200	ASC11e2
7002870	12-11-2007	A319	ASC32c2
7002690	13-11-2007	A320	ASC14c2
7002700	13-11-2007	737-500	ASC16c2
7002820	15-11-2007	REGIONAL JET SERIES 100/200	ASC32c2

7201789	22-11-2007	767-300	ASC18d4
7002860	22-11-2007	CL-600	ASC31c2
7002850	29-11-2007	A319	ASC31c2
7002940	6-12-2007	737-900	ASC31d2
7003020	7-12-2007	AVRO RJ85	ASC32c2
70000011	10-12-2007	737-800	ASC25d4
8001690	28-8-2008	PREMIERE I	not specified - Runway excursion
7003320	12-12-2007	A320	ASC18d4
8002320	22-10-2008	MD 83	out of scope
7002970	17-12-2007	A 109 HIRUNDO SWALLOW	ASC31d2
HCLJ510-000467	26-12-2007	A321	ASC16c2
8100004	3-1-2008	737-400	ASC26c1
BFU 5X001-08	14-1-2008	A300-B2/B4	ASC04d2
8100015	15-1-2008	A300-600	ASC26c1
8100053	21-1-2008	50	ASC18d4
8000320	25-1-2008	737-600	ASC14c2
8002540	28-1-2008	767-300	ASC14c2
8000000	31-1-2008	340	ASC27c1
8000180	31-1-2008	CL-600	ASC06c2
8000220	4-2-2008	A300-600	ASC31c2
8200103	13-2-2008	737-500	ASC25e2
8100077	1-3-2008	A320	ASC25e2
8200279	14-3-2008	550/551 SP CITATION II	ASC13c2
8100364	12-7-2008	A320	ASC11c2
8000610	21-3-2008	146-300	ASC13c2
8100105	21-3-2008	737-800	ASC23f1
8000620	21-3-2008	AVRO RJ85	ASC15c2
8100704	19-8-2008	SHORT SD3-60 VARIANT 100 - (not coded)	ASC11e2
8000970	8-4-2008	550/551 SP CITATION II	ASC32c2
8100140	22-4-2008	146-200	ASC26c1
8002780	13-12-2008	757-200	out of scope
8001960	9-5-2008	360	ASC14c2
9000290	9-1-2009	737-400	out of scope
8001030	14-5-2008	C-160	ASC32c2
8001090	19-5-2008	REGIONAL JET SERIES 100/200	ASC32c2
9000390	10-2-2009	A321	out of scope
8001170	21-5-2008	146-300	ASC14c2
9003270	18-2-2009	A319	out of scope
8001230	5-6-2008	A319	ASC17e1
8001140	9-6-2008	GLOBAL EXPRESS	ASC25e2

8001340	24-6-2008	A340-300	ASC14c2
8100397	24-8-2008	ATR 72-200	ASC11e2
8001390	29-6-2008	REGIONAL JET SERIES 100/200	ASC04d4
8001570	1-7-2008	A320	ASC02c2
8100258	2-7-2008	DHC8-400	ASC14c2
8002130	29-9-2008	70	ASC11e2
8001580	19-7-2008	A319	ASC14c2
9000970	11-5-2009	767-300	out of scope
8003680	27-7-2008	2000	ASC02c2
8001700	28-7-2008	CL-600	ASC32c2
8001780	31-7-2008	SA227AC/METRO III	ASC32c2
XXXXXX	16-8-2008	737-800	ASC10e2
BFU 5X014-08	16-8-2008	A320	ASC31d2
8001880	22-8-2008	A320	ASC31d2
8001930	26-8-2008	A320	ASC31c2
9003230	20-5-2009	A319	out of scope
8001890	1-9-2008	70	ASC31c2
8002120	26-9-2008	A321	ASC19f1
8002950	11-12-2008	145 (145ER)	ASC11e2
8002280	29-9-2008	737-800	ASC31c2
8004040	30-9-2008	172 RG	ASC31c2
BEA ts-k081010	10-10-2008	737-600	ASC10d2
8002360	15-10-2008	747-400	ASC14c2
9003220	25-5-2009	ATR 42 - NO SERIES SPECIFIED	out of scope
8002410	11-11-2008	737-500	ASC31c2
8002670	19-11-2008	A320	ASC31c2
8002590	21-11-2008	A320	ASC31c2
9100115	18-2-2009	737-400	ASC11c2
8002730	11-12-2008	SA227 III	ASC26c1
9001620	28-5-2009	MD80 SERIES	out of scope
8100793	31-12-2008	737-700	ASC10e2
9000160	3-1-2009	A330-200	ASC31d2
9000040	5-1-2009	145 (145ER)	ASC26c1
9100959	25-6-2009	ATR 72-200	out of scope
9000120	15-1-2009	50	ASC26c1
9000140	17-1-2009	340	ASC25e2
9100469	6-2-2009	737-300	ASC05d2
9000400	9-2-2009	A321	ASC19f1
9001440	29-6-2009	767-300	out of scope
9000530	15-3-2009	A319	ASC11e2
9000340	21-2-2009	737-700	ASC23d1

9100210	24-2-2009	REGIONAL JET SERIES 100/200	ASC18e2
9001600	27-2-2009	PA-34 SENECA	ASC31d2
9000410	28-2-2009	2000	ASC27c2
9000500	8-3-2009	747-400	ASC32c2
9000980	12-5-2009	REGIONAL JET SERIES 100/200	ASC11e2
9000600	20-3-2009	A330-200	ASC31c2
9000630	23-3-2009	CL-600 Regional Jet CRJ-1000	ASC31c2
9000700	26-3-2009	747-400	ASC31d2
9100892	27-3-2009	A320	ASC15c2
9000740	29-3-2009	747-400	ASC31d2
9003250	2-4-2009	CL-600	ASC13c2
9000910	10-4-2009	172 (T-41)	ASC31c2
9000770	15-4-2009	ATR 72-200	ASC31c2
9003280	8-5-2009	DHC8	ASC35d2
9100277	9-5-2009	A321	ASC17e1
9201394	17-7-2009	737-700	out of scope
9001060	12-5-2009	146-300	ASC11e1
9001360	7-6-2009	737-800	ASC11e2
9003240	20-5-2009	A319	ASC14c2
9100603	5-8-2009	A320	out of scope
9001170	29-5-2009	757-200	ASC32c2
9100339	4-6-2009	757-200	ASC18d4
9201000	15-6-2009	757-200	ASC11c2
9001210	8-6-2009	737-800	ASC31d2
9001500	20-7-2009	767-300	ASC11e2
9002910	22-6-2009	A340-300	ASC04d4
9003210	28-8-2009	AN-12	out of scope
BEAxxx	4-7-2009	737-800	ASC19d4
9002000	9-7-2009	A320	ASC31c2
9002540	11-7-2009	ATR 42-500	ASC31c2
9001470	11-7-2009	P3	ASC31d2
9002460	3-10-2009	MD80 SERIES	out of scope
9001520	18-7-2009	737-700	ASC32c2
9002750	1-8-2009	A320	ASC11e2
9100529	22-7-2009	737-800	ASC32d2
9001680	27-7-2009	777-300	ASC31d2
9001750	31-7-2009	737-800	ASC32c2
9001710	1-8-2009	A320	ASC09d4
9100581	1-8-2009	A320	ASC11e2
9002250	18-8-2009	UNKNOWN	ASC31d2
9002240	27-8-2009	UNKNOWN	ASC31d2

9002470	27-8-2009	777-200	ASC14c2
9002160	29-8-2009	737-800	ASC03d3
9003170	31-8-2009	777-300	ASC31d2
9001980	2-9-2009	A321	ASC25d4
9003190	20-9-2009	TBM 700	ASC31d2
9003040	23-9-2009	A319	ASC35d2
9002190	26-9-2009	757-200	ASC01d2
9100793	29-9-2009	737-800	ASC18d4
9002290	15-10-2009	737-500	out of scope
9100855	9-10-2009	REGIONAL JET SERIES 900	ASC18d4
9002360	18-10-2009	737-800	out of scope
9002310	19-10-2009	737-700	ASC09d4
9002350	22-10-2009	737-400	out of scope
9100872	22-10-2009	DHC8-300	ASC27c2
9100884	27-10-2009	AVRO RJ100	out of scope
9100930	30-10-2009	737-500	ASC32c2
9002590	30-10-2009	172 (T-41)	ASC31d2
9003050	5-11-2009	757	ASC32c2
9002960	6-11-2009	A330-200	ASC31d2
91000000	19-11-2009	737-800	ASC25e2
9101020	19-11-2009	737-800	ASC25e2
10000370	3-1-2010	MD80 SERIES	ASC11e2
10100001	3-1-2010	737-800	ASC01d1
10000030	4-1-2010	737-800	ASC11e2
N2009-02886	7-11-2009	F172	out of scope
10000110	5-1-2010	A320	ASC31c2
10100030	6-1-2010	100	ASC32c2
10000080	8-1-2010	737-800	ASC03d1
10000180	11-1-2010	ATP	ASC10d2
10000860	19-1-2010	A320	ASC16c2
10000280	19-1-2010	REGIONAL JET SERIES 700	ASC16c2
10100055	21-1-2010	747-400	ASC32d1
10100294	5-1-2010	DHC8-400	out of scope
10000150	25-1-2010	CL-600	ASC26c1
10000190	27-1-2010	ATR 72-200	ASC26c1
10100064	23-1-2010	ATR 42-500	out of scope
10100143	28-1-2010	737-800	ASC03d1
10000220	1-2-2010	A320	ASC14c2
10000230	2-2-2010	AVRO RJ85	ASC02c2
10000270	9-2-2010	A300-B2/B4	ASC27c2
10100113	10-2-2010	737-300	ASC36c2

1573521368	14-2-2010	A319	ASC11e2
10100473	23-2-2010	DHC8-400	ASC19f4
10000410	26-2-2010	747-100/200	ASC13c2
10100181	1-3-2010	737-800	ASC13c2
10000790	9-3-2010	A320	ASC31d2
BEA hs-l100318	18-3-2010	B747-4D7 - (not coded)	ASC11e2
ANSV-10-266	26-3-2010	737-800	ASC31c2
BEA m-og100329	29-3-2010	REGIONAL JET SERIES 100/200	ASC32d2
BEA f-zk100331	31-3-2010	A319	ASC02d2
10200258	8-4-2010	747-400	ASC11e2
10100448	9-4-2010	REGIONAL JET SERIES 700	ASC14c2
10100424	10-4-2010	C 42	ASC31c2
04/sum/2010	12-4-2010	A319	ASC31d2
10100226	13-4-2010	170	ASC09d2
10000740	15-4-2010	A330-300	ASC14c2
10000820	24-4-2010	DHC8	ASC18d4
10001190	28-4-2010	F177RG CARDINAL	ASC31c2
10000970	27-1-2010	MD80 SERIES	out of scope
ANSV-10-447	4-5-2010	A321	ASC32d2
ANSV-10-413	2-5-2010	A319	out of scope
BEA f-jr100517	17-5-2010	77 SKIPPER	ASC31d2
10100337	22-5-2010	A319	ASC18d4
ANSV-10-565	23-5-2010	A320	ASC09d2
10001180	23-5-2010	UNKNOWN	ASC31c2
BEA f-nb100601	1-6-2010	M20J (201)	ASC31d2
BEA f-gj100602	2-6-2010	PC-12	ASC31d2
2010/016	6-6-2010	RJ-100 AVROLINER	ASC31c2
10201003	8-5-2010	737-800	out of scope
BEA -06100613	13-6-2010	A320	ASC32c2
10100399	15-6-2010	777-200	ASC18d4
2036	23-5-2010	A320	out of scope
BEA b-ov100408	8-4-2010	747-400	ASC11e2
10200609	16-6-2010	767-300	ASC11c2
BFU EX007-10	27-6-2010	REGIONAL JET SERIES 100/200	ASC18d4
BEA f-ha100629	29-6-2010	A319	ASC31c2
BFU EX008-10	4-7-2010	A320	ASC36d1
10001130	7-6-2010	737-800	out of scope
2010/024	8-7-2010	A319	ASC31c2
10201188	12-6-2010	757-200	out of scope
BFU 5X011-10	17-7-2010	A340-600	ASC14c2
BFU EX009-10	18-7-2010	unbekannt - (not coded)	ASC31c2

782927635	16-6-2010	146-200	out of scope
ANSV-10-1118	19-7-2010	MD 82	ASC31c2
724951180	5-7-2010	ATR 72 - NO SERIES SPECIFIED	out of scope
ANSV-10-1030	10-7-2010	DH8C - (not coded)	out of scope
BFU EX010-10	6-8-2010	737-800	ASC31c2
2010057	6-8-2010	RJ-85 AVROLINER	ASC31d2
795021138	20-6-2010	737-700	ASC11e2
10100580	11-8-2010	DC-8-63	ASC10e2
10100605	16-8-2010	A319	ASC18d4
ANSV-10-1478	20-8-2010	747-400	ASC31c2
BFU 5X013-10	20-8-2010	A340-300	ASC32c2
ANSV-10-1085	18-7-2010	A320	out of scope
1653510694	23-8-2010	PA-28	ASC31c2
BEA tc-e100907	7-9-2010	737-400	ASC19d4
ANSV-10-1687	9-9-2010	AN-124	ASC09d2
2010/039	10-9-2010	PC-7	ASC31d2
10100702	11-9-2010	DHC8-400	ASC16c2
10100707	15-9-2010	31 JETSTREAM	ASC18d4
BEA n-fe100918	18-9-2010	777-200	ASC32c2
1109617177	19-9-2010	145 (145ER)	ASC14c2
ANSV-10-1824	23-9-2010	45	ASC31d2
BFU EX011-10	24-9-2010	747-100/200	ASC09d2
2010-185	21-7-2010	170	out of scope
476109527	2-10-2010	737-400	ASC25d1
1963674619	5-10-2010	A321	ASC31d2
BFU 5X015-10	12-10-2010	737-300	ASC32c2
ANSV-10-1978	12-10-2010	A320	ASC31d2
BEA f-qp101012	12-10-2010	777-300	ASC14c2
BFU EX012-10	17-10-2010	Schleicher - ASW 27-18E - (not coded)	ASC31c2
ANSV-10-2001	18-10-2010	A321	ASC31c2
ANSV-10-1149	23-7-2010	737-400	out of scope
2010/041	25-10-2010	A340-600	ASC31c2
ANSV-10-2114	31-10-2010	MD 82	ASC18d4
ANSV-10-2186	6-11-2010	FALCON 900	ASC36d1
XXX0034	6-11-2010	737-800	ASC36d1
BFU 5X012-10	8-8-2010	CL-600	ASC11e2
ANSV-10-1488	20-8-2010	737-400	out of scope
516289115	26-11-2010	REGIONAL JET SERIES 100/200	ASC32c2
10100850	30-9-2010	680 CITATION SOVEREIGN	out of scope
1692171438	6-12-2010	777-200	ASC18d4
1096897843	20-10-2010	737-600	out of scope

IN-040/2010-04	16-12-2010	210 CENTURION	ASC31d2
BFU 5X014-10	9-11-2010	747-400	ASC11e2
A-039/2010-010	27-10-2010	737-800	out of scope
BFU EX013-10	16-11-2010	AVRO RJ100	ASC11e2
1958395328	14-1-2011	737-500	ASC18d4
BEA f-pm110117	17-1-2011	777-200	ASC14c2
809993776	21-1-2011	REGIONAL JET SERIES 100/200	ASC02c2
L-08/11	5-2-2011	737-800	ASC32c2
EX004-11	10-2-2011	AN-124	ASC31d2
11100067	13-2-2011	777-300	ASC32c2
10100923	19-12-2010	A319	ASC11e2
546486826	14-2-2011	A320	ASC31d2
11100140	24-2-2011	A320	ASC25e2
1649942998	27-2-2011	A320	ASC14c2
117383030	27-2-2011	737-800	ASC31c2
BFU 5X001-11	27-2-2011	A320	ASC14c2
ANSV-10-2233	21-11-2010	MD 82	out of scope
BEA f-ae110310	10-3-2011	A321	ASC19d4
BFU EX003-11	12-3-2011	737-800	ASC31c2
BFU 5X016-10	26-11-2010	747-400	out of scope
2011/011	15-3-2011	A320	ASC02d2
11100264	15-3-2011	737-800	ASC14c2
1069/UUB/LF/2010	11-12-2010	747-400	out of scope
BFU TX002-11	24-3-2011	A380	ASC17e2
BFU 6X001-11	27-3-2011	737-800	ASC10d2
ANSV-11-0437	28-3-2011	AVRO RJ85	ASC18d4
03/31032011	31-3-2011	L410VP-E	ASC31c2
1496192467	3-1-2011	145 (145ER)	out of scope
454740917	7-4-2011	737-800	ASC27c2
IN-010/2011	9-4-2011	REGIONAL JET SERIES 100/200	ASC32c2
BFU EX001-11	4-1-2011	737-300	ASC11e2
IN-011/2011	14-4-2011	737-800	ASC36d1
BEA f-zg110424	24-4-2011	ATR 72-200	ASC14c2
BFU 6X007-11	24-4-2011	MD-11	ASC14c2
BEA f-gc110222	22-2-2011	A318	out of scope
BFU EX006-11	27-4-2011	525 CITATIONJET	ASC31d2
11100430	1-5-2011	737-800	ASC31c2
2081405821	14-2-2011	777-300	ASC11e2
BFU 6X004-11	17-5-2011	AT45 - (not coded)	ASC31c2
ANSV-11-0809	20-5-2011	737-800	ASC31d2
ANSV-11-0815	25-5-2011	A320	ASC31d2

XXXX	29-5-2011	A321	ASC10e2
BFU EX007-11	2-6-2011	145 (145ER)	ASC14c2
11100299	4-6-2011	747-400	ASC31d2
2011/024	10-6-2011	PREMIERE I	ASC31d2
BFU 6X006-11	10-6-2011	RAYTHEON - 390 - (not coded)	ASC31c2
2011-120-4 POL	17-6-2011	ATR 42-500	ASC18d4
BFU 5X008-11	1-7-2011	146-200	ASC31c2
BFU 6X008-11	4-7-2011	737-800	ASC14c2
1824429385	5-3-2011	A320	out of scope
IN-021/2011-1182	6-7-2011	737-800	ASC14c2
11100619	8-7-2011	Liberty Aerospace Incorporated XL2 - (not coded)	ASC31c2
XXXX-212	26-7-2011	A300-B2/B4	ASC38c2
BFU EX005-11	13-4-2011	747-400	ASC11e2
BEA f-yo110801	1-8-2011	8KCAB DECATHION	ASC31d2
2011/037	6-8-2011	A321	ASC31c2
92859381	13-3-2011	737-800	out of scope
BEA f-zh110815	15-8-2011	REGIONAL JET SERIES 700	ASC09d4
BEA ei-j110419	19-4-2011	ATR 72-200	ASC11e2
ANSV-11-1519	16-8-2011	A320	ASC01c2
BFU 6X009-11	17-8-2011	A320	ASC31c2
2011/036	17-8-2011	A320	ASC31c2
BFU 6X010-11	26-8-2011	MD 82	ASC31c2
ANSV-11-1580	26-8-2011	ATR 42-300	ASC31d2
11100135	18-3-2011	145 (145ER)	out of scope
BEA oh-i110513	13-5-2011	A319	ASC11e2
L 96/11	8-9-2011	AVRO RJ85	ASC32c2
BFU 1X001-11	12-9-2011	737-700	ASC36d1
11100547	13-9-2011	ATR 72-200	ASC09d4
ANSV-11-481	2-4-2011	MD 82	out of scope
ANSV-11-1740	15-9-2011	TORNADO	ASC31d2
BEA f-le110920	20-9-2011	CL-600 Regional Jet CRJ-1000	ASC14c2
BEA - Italy I-MLHT	21-9-2011	F27 MK 500	ASC18d4
IN-040/2011-1706	1-10-2011	737-800	ASC32c2
ANSV-11-1826	3-10-2011	ATR 72-200	ASC18d4
BFU 6X013-11	6-10-2011	CASA - C-101 Aviojet - (not coded)	ASC31c2
BFU 5X010-11	7-10-2011	A320	ASC14c2
BFU EX009-11	16-10-2011	A380	ASC17e1
BFU 5X005-11	31-7-2011	757-200	ASC11e2
IRL00911095	24-10-2011	737-800	ASC13c2
PKBWL/PL 1391/11	29-10-2011	AVRO RJ100	ASC32c2

BFU EX010-11	3-11-2011	777-300	ASC26c1
BFU EX011-11	6-11-2011	MD80 SERIES	ASC13c2
BFU 5X007-11	15-8-2011	A330-300	ASC11c2
PL1465/11	15-11-2011	ATR 42-500	ASC36c2
XX	16-11-2011	DHC8-400	ASC19d4
BEA f-pp111116	16-11-2011	777-200	ASC38c2
AAIASB/1688	7-9-2011	757-200	ASC11e2
BFU 5X011-11	20-10-2011	737-700	ASC11e2
BFU 5X012-11	18-11-2011	737-700	ASC14c2
IN-050/2011-2133	20-11-2011	KESTREL AIRCRAFT COMPANY	ASC31d2
ANSV-11-2150	20-11-2011	A320	ASC32c2
BEA c-vm110410	10-4-2011	777-300	out of scope
BFU XXX	13-12-2011	A320	ASC02d2
BEA f-hs111213	13-12-2011	A319	ASC25e2
BFU 5X013-11	13-12-2011	A320	ASC02c2
2011/061	16-12-2011	CITATION MUSTANG	ASC31c2
11100819	20-12-2011	A321	ASC14c2
ANSV-11-539	13-4-2011	550/551 SP CITATION II	out of scope
BFU EX012-11	29-12-2011	A320	ASC14c2
11100823	29-12-2011	340	ASC32c2
L-30/11	25-4-2011	737-800	out of scope
ANSV-11-2351	30-12-2011	737-800	ASC10e2
BEA e-18111230	30-12-2011	CL-600	ASC19d4
ANSV-11-1205	5-7-2011	A320	out of scope
6000050	6-1-2006	737-600	ASC26c1
6004220	20-10-2006	170	ASC32d2
BFU EX006-04	3-5-2004	ATR 42-500	ASC32d2
7001480	9-7-2007	404 TITAN	ASC31c2
8003730	1-11-2008	Boeing\ B737-330 - (not coded)	ASC31c2
BFU EX005-04	22-4-2004	DC-10	ASC25d1
BFU 5X002-99	10-2-1999	Israel Ind.\ IAI-1125 - (not coded)	ASC26c1
BFU 5X016-01	27-9-2001	Swearingen\ SA227AT - (not coded)	ASC26c1
BFU 5X009-99	11-11-1999	Swearingen\ SA227AT - (not coded)	ASC26c1
BFU 5X005-00	27-6-2000	SA227AC/METRO III	ASC26c1
BFU 5X028-07	11-12-2007	SA227AC/METRO III	ASC26c1
BFU EX004-99	29-5-1999	C.A.S.A.\ CASA 352A3 - (not coded)	ASC25d1
BFU EX001-01	28-4-2001	Junkers\ JU52 - (not coded)	ASC26c1
BFU EX014-05	16-12-2005	Boeing\ B737-800 - (not coded)	ASC26c1
BFU EX004-08	26-9-2008	A321	ASC25d1
L-7411	11-7-2011	BOEING 737	out of scope
5001840	13-5-2005	A300 - NO SERIES SPECIFIED	ASC32d2

4000910	23-3-2004	BOEING 747	ASC36d1
5001900	29-5-2005	100	ASC31c2
6000610	24-2-2006	FALCON 900	ASC31c2
2005740	22-1-2002	757-200	ASC35d2
4000190	19-1-2004	DC-10	ASC26c1
4003830	30-12-2004	146-300	ASC10e2
5001880	27-5-2005	A320	ASC31c2
5002480	11-7-2005	A321	ASC31c2
5003960	20-10-2005	747-100/200	ASC32c2
5004470	29-9-2005	C-17	ASC31c2
BFU 5X006-11	8-8-2011	757-300	out of scope
6002680	3-7-2006	145 (145ER)	ASC04d2
ANSV-11-1589	29-8-2011	737-800	out of scope
ANSV-11-1647	5-9-2011	A300-B2/B4	out of scope
BEA ec-j110917	17-9-2011	A320	ASC36d1
5005440	15-10-2005	737-300	ASC32c2
5005500	7-5-2005	A320	ASC31c2
IN-046/2011-1977	12-11-2011	757-200	ASC11e2
6600000	11-12-2006	ATR 42-500	ASC26c1
BFU EX008-11	14-9-2011	737-300	out of scope
9001530	27-2-2009	A320	ASC01d2
9001960	7-4-2009	UNKNOWN	ASC31d2
11100750	18-11-2011	A319	ASC11e2
2011-272	23-11-2011	737-800	out of scope
9002130	7-8-2009	A320	ASC31d2
2000000	3-9-1998	MU-2B-40 (SOLITAIRE)	ASC25d1
BEA hb-b100310	10-3-2010	A319	ASC31d2
10000700	30-3-2010	A320	ASC14c2
2020a and b	15-5-2010	A320	ASC04d4
2033	21-5-2010	A320	ASC13c2
ANSV-11-2335	28-12-2011	DHC8-400	out of scope
2140/11	18-11-2011	A319	ASC11e2
BEA ec-l111230	30-12-2011	737-800	out of scope