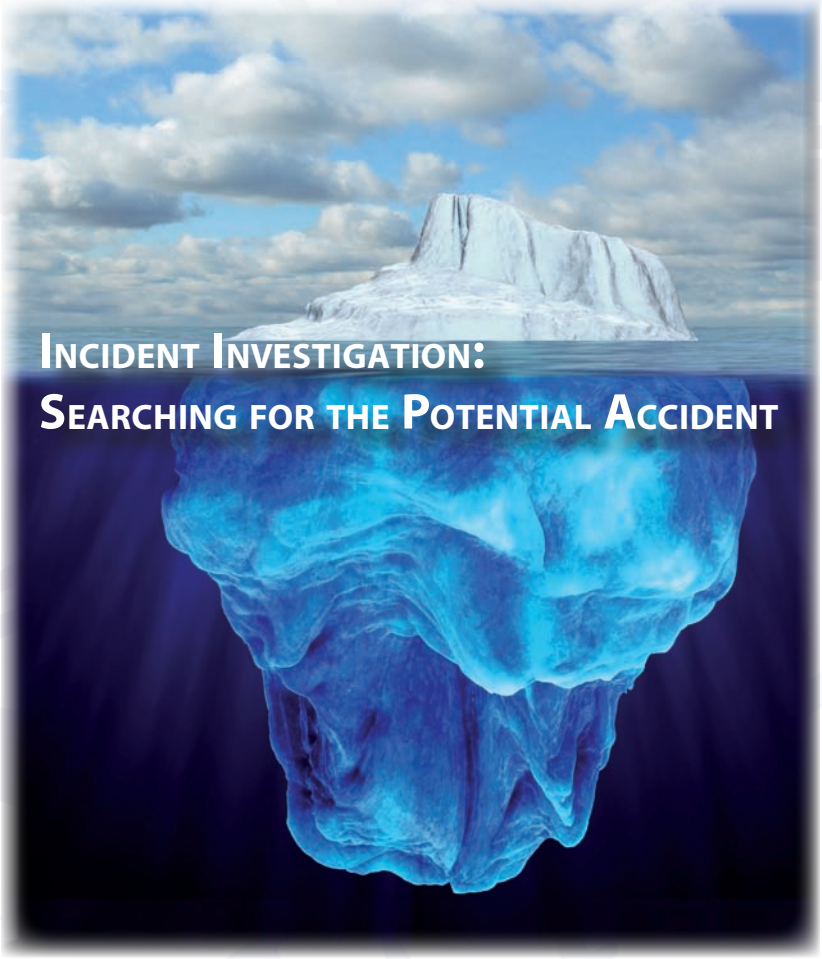
# Report of Workshop on the Treatment of Incidents

**Roskilde, Denmark**

**15-16 May 2012**




**ECAC Expert Group on**
**Aviation Accident and Incident Investigation**

# Foreword

### By the Chairman of the ECAC Expert Group on Aviation Accident and Incident Investigation

**Jurgen Whyte**
**Head of the Irish Air Accident Investigation Unit (AAIU)**

*The results of safety investigations are critical in driving continuous improvements in aviation safety. Mercifully, accidents involving major public transport aircraft are relatively rare, and greatly outnumbered by "incidents", defined in ICAO Annex 13 as "an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation."*

*The relative rarity of such accidents makes it all the more necessary to be sure that the safety lessons which may lie buried in incidents are not missed or ignored. They represent a rich source of safety information, with the potential to save lives in the future. The question which next follows is self-evident: how, during the initial assessment stage, to isolate from amongst the mass of incidents those which are likely to have the most potential to enhance safety? The resources available for investigations are finite, especially at a time when public budgets are under pressure, and they must be allocated carefully. Investigators need to have confidence that their choices of incidents to be subjected to detailed examination are well-based.*

*In May 2012, ECAC's Accident and Incident Investigation Expert Group (ACC) held a two-day workshop to explore the issues surrounding the treatment of incidents, bringing together national safety investigation authorities, representatives of national, regional and global regulators, airlines, aircraft manufacturers, and flight crew. All shared their approaches to the collection, management and use of incident data, enabling an exploration of both the common ground they share, and the ways in which their practices diverge.*

*The workshop was hosted in Roskilde by the Danish Accident Investigation Board, and specifically by its Chief Inspector of Air Accidents Mr Martin Puggaard and his team. I myself and ACC more generally very much appreciate this generosity, and are likewise grateful to all of those who contributed to what was an exceptionally rich and thought-provoking set of presentations in the workshop. ACC attaches great importance to its engagement with the wider international safety investigation community, and the high level of interest stimulated by the Roskilde workshop, which saw the participation of some eighty persons, from thirty-nine States and five different continents, was evidence of that community's recognition of the importance of the issues being addressed.*

*I sincerely hope that you will find the information contained in this report useful, and that it will provide you with some "food for thought" with regard to the initial assessment of incidents and the need to investigate those that have the potential to enhance safety and preserve lives in the future.*

# Contents

# INTRODUCTION

The Workshop had been designed and developed by a Steering Group of ACC members (1). Its programme, reproduced at Attachment A, was divided into four sessions.

The **first session** served a context-setting purpose, providing a framework for what would follow. Entitled *The role of the safety investigation in a changing environment* and moderated by the ACC's Chairman Mr Jurgen Whyte, it provided an overview of the considerable changes taking place at the global and European level in relation to aviation safety regulation. This gave participants an opportunity to consider the implications of these changes for safety investigation authorities, as they address aviation incidents and seek to derive from them proposals for proactive changes to the safety system.

Discussion was fuelled by presentations from the ICAO Secretariat, the European Commission and the European Aviation Safety Agency (EASA), in the course of which there came under consideration the implications of the advent of such concepts as the Continuous Monitoring Approach, and risk-based safety analysis and regulation.

The workshop's **second session** was moderated by ACC's Deputy Chairman Mr Jean-Paul Troadec, Director of the *Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile* (BEA). Because it is not possible to investigate more than a fraction of aviation incidents and irregularities, they must be categorised, to allow decisions to be made on priorities. Issues around data fragmentation, simple memory loss, and the validation of information about incidents mean that their categorisation, as a first step towards the identification of those meriting investigation, is sometimes a considerable challenge in itself.

This second session explored how that challenge is being met by different parties, and also how a better understanding of past accidents can help safety analysts and investigators derive lessons from the investigation of incidents. This was done with the support of a series of very rich presentations from national practitioners from Denmark, France, the USA, Ireland, the United Kingdom, Canada, Spain and Singapore, and from EUROCONTROL, Airbus and Boeing.

In the **third session**, once again moderated by Mr Troadec, the workshop's participants turned their attention to the factors or "safety nets" which might prevent an incident from developing into an event with more serious consequences, or indeed into an accident.

National and international regulation typically distinguishes between an incident and a serious incident by reference to its actual or potential consequences (2). But this is very much of course a post-facto judgement. The incidents most deserving of investigation are those which, had matters fallen out perhaps just a little differently, would have had serious or even fatal consequences.

This makes it very important to understand the nature of the key safety nets, and how they work, and thus to find a way of capturing in incident databases not only what went wrong but also the positive factors which came into play – what went right, as it were. What was it that prevented this or that incident being more serious?

Discussion here was fuelled by presentations from the US Federal Aviation Administration (FAA), the Australian Transportation Safety Bureau (ATSB), Italy's *Agenzia Nazionale per la Sicurezza del Volo* (ANSV), and the European Commission's Joint Research Centre (JRC).

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1 Paul Farrell (Ireland), Geraint Herbert (United Kingdom), Philippe Plantin de Hugues (France), Martin Puggaard (Denmark), Andrew Robinson (United Kingdom), Olivier Ferrante (European Commission), and Peter Kirk (ECAC Secretariat)

2 ICAO Annex 13 defines a "serious" incident as one "involving circumstances indicating that an accident nearly occurred."

In the **fourth** and final **session**, participants were led by the ACC Chairman Jurgen Whyte, and by Mr Olivier Ferrante of the European Commission's DG-MOVE, in reflecting on what the workshop discussions to that point had highlighted as key learning points. They then separated into six break-out groups to test this learning against a set of ten case studies, fictional but derived from actual incidents. Each of the groups was tasked with assessing the incidents, identifying the safety nets/positive factors which were in play in each case, and then with taking a view on which of them warranted an Annex 13 investigation. In doing so, each group followed the principles, criteria or guidelines, explored earlier in the workshop, that it considered most appropriate.

Each break-out group then fed back to participants re-assembled in plenary, and the results of their assessments and classifications were compared and contrasted. This made it possible for some tentative conclusions to be drawn, for further consideration both in discussion within the ACC group, and at an individual State level.

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# WORKSHOP SESSION 1

# THE ROLE OF THE SAFETY INVESTIGATION IN A CHANGING ENVIRONMENT

1.1 The session moderator Mr Jurgen Whyte introduced the workshop's first session, as one which would set the overall context for the workshop, and provide a picture of the role of safety investigation in what was very much a changing environment for the aviation safety community.

1.2 Discussion during the session was fuelled by presentations by **Marcus Costa**, Head of the AIG Section in the ICAO Secretariat; **Olivier Ferrante** of the European Commission's DG-MOVE; and **Bernard Bourdon**, of the Safety Analysis and Research Department within EASA. Copies of slides used in these presentations can be found at Attachment E to this report.

1.3 In the course of the presentations and in the ensuing discussion, the following information, perspectives and observations, grouped here by broad category, were advanced.

### *Obligations on States to investigate serious incidents*

1.4 The obligation under Annex 13 to investigate serious incidents, which had its origins in AIG 2008, has left it to the State to determine whether a given incident is to be considered "serious". Attachment C to Annex 13 provides a list of examples of serious incidents, and an ICAO State Letter of 29 February 2012 sought views on amendments proposed by the Air Navigation Commission to Attachment C. (3)

1.5 It is clearly necessary to understand the factors behind accidents, and in particular accidents of the kind identified by ICAO as the "main killers": runway excursions, loss of control in-flight, and controlled flight into terrain. It follows that there is also a need to examine any incidents that might be associated with these types of accident, in order to understand both their precursors and what had prevented a more serious outcome. It is in these areas that an argument was made for gathering certain kinds of serious incident in an Appendix. As an Attachment, the Annex 13 list has the status of guidance, whereas an Appendix is to be considered as part of the SARPs, and in this case would establish an obligation to investigate those serious incidents identified as being potential precursors to the "main killers".

1.6 The Air Navigation Commission had not recommended the upgrading of Attachment C into an Appendix, on the grounds that this would limit States' flexibility in modifying their list of serious incidents to meet their needs, and could also have an effect on the resources allocated to investigations.

1.7 Those arguments were echoed in concerns expressed by some workshop participants at the possibility that the guidelines offered by Attachment C might be made mandatory. Flexibility and State discretion in this area were considered by those holding this concern to be very valuable, not least because of the resource implications if this were not so. If investigation of some of the instances listed in Appendix C was made mandatory, it was judged important that operators be mandated to report immediately any qualifying events.

1.8 Regret was expressed by participants at the poor rate of response to ICAO State Letters in relation to accident and incident investigation.

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3 Attachment C to Annex 13, as adopted by the Council on 25 February 2013 and due to become applicable in November 2013, is at Attachment C to this report.

### *Occurrence reporting in the European Union*

1.9 Directive 2003/42/EC, taken together with Regulations 1321 and 1330 of 2007, has placed an obligation on EU States to arrange for the collection, storage and dissemination of information about occurrences. The *European Co-ordination Centre for Accident Incident Reporting Systems* (ECCAIRS), based on the ADREP methodology, held some 570,000 such occurrences, in the "*European Common Repository*". Work is needed on the system to make data recovery and analysis easier.

1.10 The European Common Repository is managed by the JRC, a part of the European Commission. Regulation (EU) No 996/2010 has given EASA a more important role in the field than hitherto, but whether that role should extend to the reporting and hosting of occurrence data is a matter for discussion in the passage of the new legislation which will succeed Directive 2003/42/EC.

1.11 At the time of the review of Directive 94/56/EC, which had led to the development of Regulation (EU) No 996/2010, States had been reluctant also to embark on a review of 2003/42/EC, but that has since gone forward. A need for more pro-activity has been identified: the present Directive fails, for example, to require the analysis of the occurrence data collected, and although some analysis does nonetheless take place, it needs to be done on a more consistent and standardised basis. In the meantime the "Network of Analysts" is working on the development of a common risk classification for use in Europe.

1.12 There has been a consultation of EU Member States and the public on the Commission's ideas for a new piece of legislation to replace 2003/42, together with a seminar on the 'Just Culture' dimension of the issues. State gave a general welcome for the ways in which the proposal is intended to improve upon 2003/42, many of the responses commenting upon Just Culture aspects, and expressing concerns about conflict between judicial and safety investigation authorities.

1.13 Member States expressed support during the consultation for the new legislation to take the form of a Regulation, in order to secure better standardisation of approach. Whether it would be a Regulation or another Direction is however a matter for the co-decision process, as too is the question of where within a State's national administration its Focal Point, for the purposes of occurrence reporting, should be located.

1.14 A proposal for the replacement of 2003/42 might be ready before the end of 2012 (4), after which there would follow a review of this proposal under the co-decision procedure, involving both Member States and the European Parliament.

### *Accident and incident database developments*

1.15 Within the European Union, the European Aviation Safety Agency (EASA) has responsibility for proposing rules, issuing some certificates and approvals, performing inspections and managing the European Aviation Safety Programme. States, for their part, through their National Aviation Authority, issue most certificates, approvals and licenses, oversee organisations and implement EU law.

1.16 EU legislation relevant to the workshop issues is contained in Directive 2003/42 and Regulations 1321/2007, 1330/2007 and 996/2010, taken together with Regulations 1702/03 and 1035/11 in respect of ANSP oversight. Significant within Regulation

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4 A "Proposal for a Regulation of the European Parliament and of the Council on Occurrence Reporting in Civil Aviation…." was published on 18 December 2012, as COM(2012) 776 final 2012/0361 (COD).

2042/2003 are Part M on the occurrence reporting obligations of persons and organisations with responsibilities for continuing airworthiness, and Part 145 in respect of incident analysis. EU-OPS Regulation 859/2008 bears on accident prevention and flight safety programmes, occurrence reporting, and flight data monitoring for aircraft above 27 tonnes.

1.17 States outside the EU which have a bilateral relationship with EASA also exchange occurrence reports with the Agency, as too do the USA, Canada and Brazil in respective of their aircraft manufacturing sectors.

1.18 The questions following an accident focus upon Precaution (*what* happened, addressed through information exchange, notification and precautionary action); Correction (*how* it happened, addressed through testing and research, investigation in different area of expertise, and reporting and analysis on potential unsafe conditions); and Consolidation (*why* it happened, addressed through the report and conclusions, and an impact assessment.

1.19 In reacting to an *incident* however, the Precautionary phase includes all of the what/how/why actions, as these need to be addressed earlier in the process, through information exchange, notification, the recording of the event in a database for further analysis, and assessment of the risk. Here the Correction phase embraces the SMS and the reporting and analysis of potential unsafe conditions, while Consolidation has to do with closing the loop, monitoring and traceability, oversight, standardisation and approvals.

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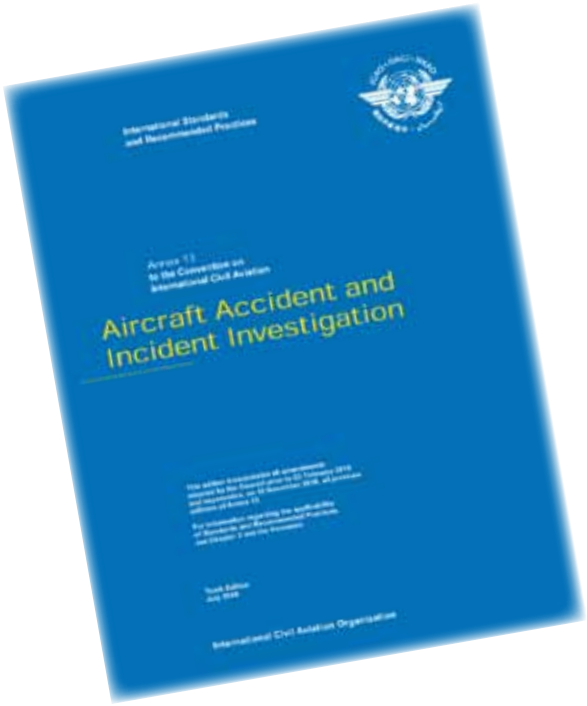

# Workshop Session 2

# The Identification of Aviation Incidents Meriting Investigation

2.1 The moderator Mr Jean-Paul Troadec introduced the workshop's second session, as one focused upon how different national safety investigation authorities were tackling the task of incident selection, and on how safety regulators, and industry looked at this issue from their own perspectives.

2.2 This session was framed around presentations by **Martin Puggaard**, Chief Investigator of Air Accidents, at the Danish Accidents Investigation Board; **Erell Ravel** and **Arnaud Desjardin** of the French BEA; **Daniel Cheney**, Safety Programme Manager in the FAA's Transport Airplane Directorate; **Paul Farrel** of the Irish AAIU; **Keith Conradi**, Chief Inspector at the UK Air Accident Investigation Branch (AAIB); **Dragica Stankovic**, Manager of EUROCONTROL Voluntary ATM Incident Reporting (EVAIR); **Luis Mijares** of Spain's *Comisión de Investigación de Accidentes e Incidentes de Aviación Civil* (CIAIAC); **Bryan Siow** of the Air Accident Investigation Bureau of Singapore; **Joji Waites** of the UK Civil Aviation Authority (CAA); **Nicolas Bardou**, Director of the Flight Safety Department at Airbus; **Brad Vardy**, Manager of Head Office Operations at the Transportation Safety Board of Canada (TSB); and **Lori Anglin**, Airplane Accident Investigator at The Boeing Company. Copies of slides used in these presentations can again be found at Attachment E to this report.

2.3 In the course of the presentations and the ensuing discussion in this second session, the following information, perspectives and observations were advanced.

### *Classifying occurrences: practices in some European and other States*

#### *….in Denmark*

2.4 The Aviation Unit within the **Danish AIB** comprises an Operative Investigation Team and an Engineering Investigation Team, each of three full time investigators, managed by a Chief Investigator with support from a Senior Investigator. Their area of responsibility encompasses mainland Denmark, Greenland and the Faroe Isles, and in 2011 they had received a total of 160 occurrence reports, 47 of which had been able to be closed after a preliminary investigation. Of the remainder, 70 had been classified as incidents, 10 as serious incidents, and 33 as accidents, including accidents involving micro-lights, gliders and balloons.

2.5 The guidelines used by the Danish AIB followed the Annex 13 definitions and the requirements of Regulation (EU) No 996/2010, and also the ECCAIRS Risk Matrix Tool which ranks occurrences in terms of their safety effect (from None, to Extremely Severe) and frequency (from Extremely Rare, to Very Frequent). Occurrences which score highly in the application of this matrix are investigated, those which scored low are subjected only to a "desktop" investigation, while those in the middle come under discussion with the Unit's Senior Investigator or Chief Investigator.

2.6 Once each week all of the Danish AIB's available investigators meet to address any cases currently unclassified. Use is also made of the Runway Incursion Severity Calculator developed by ICAO and the FAA, the FAA's Human Factors Analysis And Classification System (HFACS), and of the concepts elaborated by Reason and Rasmussen. The relatively small size of the Danish investigator group makes it easier for all of its members to take a common approach, but it is conceivable that differences in interpretation of the various guidance tools might nonetheless arise. Cases which are closed out and not taken further are nonetheless published briefly on the Danish AIB's Web site, typically drawing on a small amount of text derived from the ECCAIRS report.

***….in France***

2.7 Under EU regulation, safety investigation authorities are free to investigate incidents even if they do not qualify as a "serious" incident (there is inevitably a difficult grey area), if they expect to be able to draw safety lessons from them.

2.8 The selection of such incidents is undertaken by the **French BEA** on the basis of a risk assessment which takes into account such factors as potential consequences, probability of occurrence and the robustness of the (soft and hard) protection mechanisms. Regular meetings are held with stakeholders to provide guidance on what kinds of event to report to the BEA, and in some cases agreements have been signed with stakeholders (including seven airlines) covering this aspect. Many reports are received, a large number of them of events of minimal significance, and efforts are being made to fine-tune the arrangements so as to reduce the proportion of non-significant events and thus upgrade the efficiency of the programme overall.

2.9 An Incident Division has been established within the French BEA's Investigations Department, and an Incident Workflow system is applied to manage the arriving reports. Some clearly warranted investigation, others did not (because the risk was low, the relevant safeguards had been implemented successfully, or the issues could be addressed satisfactorily by either the operator's internal review or the oversight authority). In the middle is a set of incidents about which more information needs to be sought, before a handling decision is possible.

2.10 The BEA will investigate an incident where it judges that its involvement would add value, as a consequence for example of the crew still being present for interview, or where recorders and other avionics could be downloaded, or where it was a matter of examining issues of a systemic nature. Reports on investigations into a number of such issues are available on the BEA's Web site. Between May 2010 and April 2012 the BEA received a total of 1872 incident reports, of which 3% had warranted investigation and 15% the gathering of additional information.

***…in Ireland***

2.11 In Ireland the occurrence reporting system is operated by the **Irish Aviation Authority** (IAA), and the Irish AAIU receives copies of all reports, typically in the form of formatted spreadsheets. The AAIU has implemented an application to extract the salient details and log them in a database. The Inspector on call is alerted when new reports are logged. The sifting of reports for those warranting scrutiny is a labour intensive task, undertaken by the inspector on call. Those warranting further action are entered in ECCAIRS, and those where the State of Occurrence is not Ireland are forwarded to the relevant national safety investigation authority for its consideration.

2.12 Data quality problems sometimes encountered by the AAIU include ones of data accuracy and consistency, and failure to report the location of the occurrence, without which determining the State of Occurrence is more difficult, and analysing airspace hotspots very difficult or indeed impossible. The coding of occurrences can in itself obscure information, with operators sometimes classifying events by outcome, whereas safety investigators are concerned with cause. The crux of any report is the description of the occurrence, which does not always match the assigned coding(s).

2.13 This has led the AAIU to explore the scope for profiling reports on the basis of the text description of the occurrence. Experience has shown that it is possible in this way, including through word count analysis, to find indications of causal factors, and possibly to develop a decision support system which will identify cases meriting further attention, and to use data-mining to identify otherwise hidden trends. The task is not however straightforward, and account has to be taken of cultural and linguistic influences, as well as issues of corporate culture.

2.14 *Heinrich's triangle* is accepted as a valid model of the hierarchy of incidents, serious incidents and accidents. A corollary of *Heinrich's triangle* is that when accidents and serious incidents occur, precursor incidents and serious incidents should be identifiable in the database. If this is not the case, questions need to be asked about why not, about what was missed and why, and about how reporting system(s) might be improved. Formalising this precursor analysis affords significant opportunities to measure the effectiveness of reporting systems and SMS implementations. This inevitably leads to two fundamental questions for the community of safety investigation authorities: should ICAO mandate an Annex 13 examination of occurrence reporting systems for precursor events and missed opportunities? And is enough being done to explore occurrence report data, to proactively identify trends which require attention, and thereby to prevent accidents and serious incidents?

***….in the United Kingdom***

2.15 Priorities for the **UK AAIB** are fatal accidents to public transport aircraft carrying passengers, to non-passenger-carrying public transport aircraft (eg cargo), serious incidents to such aircraft, and then general aviation aircraft. In 2011 there were reported 2 accidents to civil air transport, 30 to general aviation aircraft, and 18 serious incidents. AAIB policy for handling serious incidents aims at consistency of treatment, the best use of available resources, with a focus on underlying trends, and consideration of the risks associated with not investigating.

2.16 Serious incidents are made the subject by the AAIB of two initial risk classification questions: what is the worst credible outcome that might have occurred, had the event escalated? And what was the effectiveness of the remaining barriers between what actually happened, and the worst credible outcome? The first of these questions is addressed by use of a risk matrix of which the axes are severity of outcome and effectiveness of the remaining barriers. Account is also taken of potential injuries to persons not on the aircraft, and of any information that comes in after the initial report which might prompt a revisiting of the risk matrix and possibly an up- or downgrading of the event's handling. The circumstance could also arise under which the steers provided by the matrix is overridden by the judgment of experienced accident investigators. The ICAO guidance, which is considered useful, is also used, and there is an intention to tackle both late reporting and under-reporting by operators.

***….in Spain***

2.17 Procedures in Spain for handling and assessing incidents bear similarity to those of other European States, deriving from both Annex 13 and EU legislation. Responsibility for aviation safety oversight in Spain lies with the ***Agengia Estatal de Securidad Aera*** (AESA), while CIAIAC conducts safety investigations. Both come under the Ministry of Public Works, but they are independent of each other.

2.18 The Occurrence Reporting System lies within AESA, and is designed to process moderate/low severity events, and unverified information, applying a safety screening technique developed in-house for the purpose. This has a twin focus, on individual occurrences and statistical analysis and is fed by a very large volume of mostly very short reports (4/5 lines of text), of variable quality. Reporting requirements are complex, and a more standardised methodology for assessing reports has been identified as desirable. AESA is currently working to make further improvements in this respect.

***….in Singapore***

2.19 Aviation safety investigation in Singapore is the responsibility of the **AAIB of Singapore**, a department of the Ministry of Transport, with around nine investigators and two support staff. Information about incidents is received either by telephone to a 24 hour duty officer or by email or fax to an investigator. After any necessary verification and information-gathering a recommendation is put to the Chief Inspector of Air Accidents on whether or not to launch an investigation, including in respect of a non-serious incident if it is judged to contain possible safety lessons. Occurrences not investigated

might nonetheless be followed up and a request made for the internal report, with a view to any learning points being shared with industry once de-identified.

2.20 As a consequence of the general aviation fleet in Singapore being small, the AAIB is required to investigate relatively few accidents or incidents: in 2011 just one accident, three serious incidents, and one other incident, and in each of the years 2008-2010 fewer than that. Recent investigations have included incidents involving lack of maintenance of an engine cowling, an engine fire attributable to fuel pooling, and runway excursions.

***….in Canada***

2.21 Canadian legislation does not differentiate between incidents and serious incidents, but instead between "Reportable" incidents and those the reporting of which is "Voluntary". The first group includes specified categories of events involving aircraft of more than 5700 kg, and rotorcraft of more than 2250 kg. The system has generated a 5-year average of 834 reported incidents per year, not all of which the **Canadian TSB** is bound to investigate. The tests applied include safety benefit, within an occurrence classification policy that takes into account resources, obligations and commitments, Canadian interests, public expectation and TSB experience. Occurrences are allocated to one of five possible classes (ranging from "Class 1–Public Inquiry" to "Class 5–Data gathering"), through the application of risk assessment criteria that address the probability of adverse consequences, the consequences of occurrence, and the potential safety value. The Canadian classification system and its related procedures do not permit the downgrading of an incident.

***Manufacturer perspectives***

2.22 Under ICAO Annex 6 there is a requirement in respect of reporting by operators to their State of Registry. In the case of UK operators this is to the UK CAA, through its Mandatory Occurrence Reporting. US operators submit "Significant Difficulty Reports" to the FAA under FAR 121.703, whereas Chinese operators submit such reports to the CAAC. Many reports are processed from Air Safety Reports issued by flight crew.

2.23 There is also some reporting from operators to aircraft manufacturers, although obligations in this area are limited. Within the EU, operators are required to report in-service events to Airbus under EU OPS 1.420. Airbus receives approximately 45 "occurrences" per week. Under EASA requirements (Part 21A.3), Airbus is obliged to report to the agency - which provides guidance in this area under AMC 20-8 - any occurrence "which has resulted in or may result in an unsafe condition".

2.24 **Airbus** has established an internal process for examining all reported events, enabling the design, operation, training, maintenance, and manufacturing dimensions of an event to be addressed. It is able in this way to develop reactive measures to improve safety, preventative measures to avoid a re-occurrence, and proactive measures to identify any adverse trends. If, in the absence of a State investigation into an event, Airbus considers that its examination might have value in relation to trend analysis, it will conduct an internal investigation of its own. In conducting risk analyses, Airbus uses a process informed by the SMS concept and articulated in a matrix not unlike those presented earlier in the workshop.

2.25 Airbus is conscious that official investigations conducted within the framework of ICAO Annex 13 may follow different methodologies and reflect different means of event classification. It considers that it would help the industry if there were instead shared definitions and harmonised working methods, within a common process. More specifically, a common understanding is felt to be needed of the investigating State's expectations of the aircraft manufacturer, when launching an Annex 13 investigation into an incident, covering a clear definition of the kind of investigation to be pursued, the kinds of data to be shared, and the nature of the involvement expected of the manufacturer. There is also felt by Airbus to be a need for a stronger focus in the course of the investigation on "why did it happen" than – as at present – on "what happened", as the latter can today generally be readily understood.

2.26 **Boeing** implements an internal Event Analysis programme, under which events which the NTSB decides not to investigate itself may instead be examined by a dedicated team within the company. An extensive data management exercise, in which were addressed the service requests from operators, represented an important early stage of the programme, enabling information needing to be passed to the FAA to be identified. The programme also allows for trend analysis, and meetings take place twice annually for the sharing of any internal safety issues which have been identified.

### *Knowledge systems and risk assessment tools*

2.27 During the 1990s and early 2000s several commercial aircraft accidents occurred which exposed errors in aircraft design, airline operations and/or maintenance programmes, and in the processes linking them. They include for example the loss of TWA flight 800, which exposed flawed assumptions regarding fuel tank components; and Swissair Flight 111, which revealed the same in respect of burn characteristics.

2.28 Concerned that the costly lessons from such accidents were being lost in the passage of time, and conscious of such barriers to learning as the fear of negative publicity, and a perception that accidents long past might today lack relevance, the **US FAA** has developed a Web-based library of Lessons Learned from Transport Airplane Accidents.

2.29 First opened in 2008 and refreshed annually, the library's cases relate *inter alia* to unstabilised approaches, incomplete checklists, maintenance errors, envelope exceedances, flawed design assumptions, and poor CRM. The library contains publicly available accident information, together with investigation and resolution content, but does not have to do with re-investigation, or with the assessment of fault or blame. Nor is it a collection of all accidents, only a sample of those judged to have most value for lesson learning. In the drive to maintain and improve safety there is always a need to guard against complacency: in reality, intellectual turnover is a continual challenge, and inexperience is continually succeeding to experience.

2.30 The FAA's "Lessons Learned…." library, intended to be a tool to help guard against those dangers, has more than 10,000 subscribers worldwide, amongst them aircraft and aero-engine manufacturers, airlines, academics, accident investigators, aviation authorities and training organisations. It is available at: http://accidents-ll.faa.gov.

2.31 Two means of supporting risk assessment for air navigation purposes - the Risk Analysis Tool (RAT, EUROCONTROL) and the Risk Analysis Process (RAP, FAA) – have been developed by **EUROCONTROL**, jointly with the FAA. Designed to be simple to understand and use but reliable across at least 80/90% of cases, these tools are intended for use both by regulators, in discharging their oversight responsibilities, and by service providers as part of their SMS. In States where EU performance scheme Regulation 691/2010 applies, they make possible the harmonised reporting of severity assessments of Separation Minimal infringements, Runway Incursions and ATM Specific Technical Events.

2.32 The RAT/RAP tools, which feature risk analysis matrices not dissimilar to others presented at the workshop, plot severity against repeatability for occurrences involving aircraft and occupants. Also able to be used by airlines, they are not a "silver bullet": they may not work well for complex incidents, and they place some reliance on the experience and knowledge of those using them. Guidelines and Standard Operating Practices have been elaborated, and a move had been made to Web-based application (for detail see slides at pages 48 to 56). Experience to date of the use of RAT has shown that it provides a means to reduce subjectivity while promoting harmonisation, transparency, discussion and easier communication, and speed of analysis. It also provides a "push" to enhance investigation, and hard facts for backing up recommendation for improvement.

2.33 The **UK CAA** has established "*The High Risk Events Analysis Team*" (THREAT), the starting point for the work of which is the Authority's Safety Risk Analysis Process. This process

seeks to identify the main risks to large commercial air transport aircraft, through an analysis of fatal accidents worldwide that allocates causal and circumstantial factors and accident consequences. This has shown that post-crash fire, loss of control, controlled flight into terrain and runway excursions are the most common causes of fatal airline accidents.

2.34 Serious events are next analysed in more detail by the THREAT team, which comprises CAA staff. THREAT analyses ocurrences that might not necessarily have resulted in fatalities, but still represent an undesirable level of risk. This had shown for example that while on a worldwide basis mid-air collisions only account for some 2% of all fatal accidents, a significant number of high-severity occurrences involve the potential for mid-air collision. The THREAT process highlights three additional risks: airborne conflict (which includes Airprox, level busts, losses of separation, etc.); ground conflict (which includes runway incursions); and ramp incidents (where the implications of aircraft damage inflicted on the ground can be expected to become more significant as the use of composite materials increases).

2.35 THREAT employs a systematic approach to analysing high-risk occurrences. Causal and circumstantial factors are allocated, if appropriate more than one for each occurrence, and an assessment is then made of whether a catastrophic outcome could have occurred, given slightly different but plausible circumstances. These catastrophic outcomes are based on the most common fatal accident types involving large commercial air transport aircraft, and the proximity of such an outcome then estimated (high/medium/low), on the basis of the team's expertise.

2.36 A taxonomy of "positive factors", derived from work done by the French BEA, is used to assess what it was that prevented the occurrence from having a more severe outcome. The assessment is given a "confidence" rating, based on the team's view of the robustness of the overall analysis of each occurrence. Observations are made where the THREAT team believes that there is an on-going safety or organisational issue, and these are grouped into generic categories, where appropriate. Finally, the team proposes actions to help mitigate some of the risks identified in these generic observations.

2.37 A taxonomy of causal factors, grouped into high-level categories, is used to record factors directly in the causal chain for each of the high-severity occurrences. THREAT has allocated at least one causal factor to 160 of the 169 high-severity occurrences (covering the period 2005 to 2009), there not having been enough information to make this possible for the remainder. Of all the high-severity occurrences that had at least one causal factor allocated, 34% involved factors from the crew-related group, 24% from the aircraft-related group, and 22% from the ATC/ground aides-related group.

2.38 THREAT has identified at least one positive factor for 76% of the 169 occurrences Those most prevalent include TCAS RAs, TCAS TAs, stickshakes, (E)GPWS warnings and take-off configuration warnings. Design requirement-related positive factors include the design of runway over-run areas, requirements for aircraft landing gear, stand-by instruments and Vmu performance. THREAT has also identified 28 cases where some form of 'providence' helped to prevent a more severe outcome. In 10 of these cases this was entirely a consequence of providence.

### *Other observations*

2.39 The workshop noted the difficulties posed when the decision to investigate an incident is taken too late for important information, notably that in the Cockpit Voice Recorder (CVR), to still be available. The **UK AAIB** accepts that CVR recordings will not untypically have been lost, but wherever there is perceived to be a possibility that contents of the Flight Data Recorder (FDR) may be needed, it asks at once for them to be downloaded. It is not an aspect of any of its formal agreements with operators, whereas the special agreements signed between the French BEA and operators do include provisions

relating to FDR, CVR and other data preservation, something identified by some present as a useful learning point.

2.40 The need was observed for issues to be addressed at a global level (the precursor events to an accident in Europe might have occurred in Africa, for example); to acknowledge the importance of information-sharing, including sharing which goes further than safety investigators; and of standardising the approach to reporting. Important too, it was noted, was making it clear to operators, for whom event reporting is expensive even for the larger carriers, exactly where reports were to be sent, and what was expected of their content. The implications of this for consistent encoding were acknowledged.

2.41 The difficulty of obtaining additional information in respect of incidents involving the aircraft of foreign carriers, which would probably have left Europe, came under discussion. The practice of the **French BEA** is to contact the carrier's national safety investigation authority, to explain that more data was needed in order to take a decision on whether to investigate the incident, and in due course to advise that regulator of the decision taken.

2.42 It being an obligation under EU-OPS for operators also to conduct an (internal) investigation into safety occurrences, the question was raised of what should be the appropriate relationship between the safety investigator and the operator in such cases. In the case of the BEA the answer lies in co-ordination, for example in the shape of joint interviews of crew members. The objective at all times is to improve safety learning: it is never a question of possible penalties. Similarly, the BEA and the French *Direction générale de l'Aviation* civile might cooperate in the conducting of safety studies.

2.43 Interest was expressed in the inclusion amongst the criteria used by the Canadian TSB, in deciding whether to investigate, of "national interest". In at least one European State the application of such a criterion is expressly forbidden.

2.44 The Canadian and Irish presentations had highlighted explicitly the challenge of investigating safety management systems. When an accident occurs, the questions "how were the previous similar incidents dealt with by the SMS" and perhaps "why did the SMS fail?" are important, something echoed in later workshop sessions, notably the Australian ATSB presentation in Session 3.

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# Workshop Session 3

# Looking for "What Went Right"

3.1 The session moderator Mr Jean-Paul Troadec explained that Session 3 would look further into the business of identifying the "safety nets" or "positive factors" which prevented an incident from becoming serious. Databases need to capture not only "what went wrong?", but also those elements of the overall safety system that had worked. It was necessary to know "what went right".

3.2 This third session was driven by presentations by the FAA's **Jay Pardee**, **Martin Dolan**, Chief Commissioner at the Australian ATSB; **Mario Colavita** of the Italian ANSV; and **Wietse Post**, ECCAIRS Action Leader with the EC JRC. Copies of the most of slides used in these presentations can once again be found at Attachment E to this report.

3.3 In the course of the presentations and the ensuing discussion in this session, the following information, perspectives and observations were advanced, once again grouped by broad category.

### *Data sharing and analysis*

3.4 The US 'Commercial Aviation Safety Team' (CAST) brings together key aviation safety stakeholders in the US to develop and implement cooperatively a prioritised safety agenda. Integrated into CAST is the **Aviation Safety Information Analysis and Sharing System** (ASIAS), which connects 131 data and information sources across industry, and has access to the flight operations quality assurance programmes of 24 operators, as well as data from flight crew, maintenance and other employees from 40 operators. It represents a collaborative Government and industry initiative in respect of data sharing and analysis, having as its objective the proactive identification of safety concerns before accidents or incidents occur, thus allowing for timely mitigation and prevention. It enables the undertaking of directed studies, the monitoring of known risks, safety enhancement assessments, the discovery of vulnerabilities, and benchmarking. By making possible 'data fusion', ASIAS also provides valuable insights into future "threats", ie precursors.

3.5 The CAST ICAO Common Taxonomy Team (CICTT) has also led the development, with ICAO, of a "positive taxonomy", in order to support the identification of technical and other safety nets. This helps the analyst consider the human factor as a safety factor, and to capture in databases successful human interventions. The monitoring of penetrations of safety barriers has been found to be an effective means of measuring overall system safety, and identifying precursors to accidents or serious incidents. To secure successful safety improvements it has been found necessary to measure both the extent of a measure's implementation, and the effectiveness of any "precursor reduction". The fusion of multiple data sources and enhanced analytical tools is becoming increasingly effective, and is allowing a prognostic approach to be taken. The FAA is happy to work with the operators of equivalent databases worldwide.

3.6 The US National Transportation Board has an obligation to investigate and issue reports on all accidents notified to it, of which there are typically some 1700 each year, mostly involving general aviation. Operators are also required to report incidents to the NTSB. The Board's assessment of which amongst these to investigate is undertaken on an essentially informal basis, and relatively few reports of incident investigations are issued.

### *Positive factors: "what went right?"*

3.7 In Australia any aviation safety event must be reported to the **ATSB**, as the safety investigation authority. Annex 13 accidents and serious incidents are investigated,

but reports are also received of events the outcome of which was not serious, but which saw or might have seen safety affected. The regulatory requirements are supplemented by a voluntary and confidential reporting scheme. In practice the ATSB often focuses on positive factors, and on "what went right", a position which makes it important to gather and analyse data of a good quality. Safety trend analyses are conducted on a quarterly basis, and risk analysis and classification have assumed increased importance.

3.8 The ATSB receives more than 15,000 notifications each year, encompassing more than 8,000 occurrences, each of which is tagged by type and causal factor. Together these provide the basis for regular safety trend analysis, with full risk classification the intended next step. Data on low-level investigations are already on-line, and will soon be presented in a publicly searchable format. There are acknowledged to be obvious risks associated with this, given the media's inevitable interest in "scare stories", but it reflects a wider government commitment to transparency and information sharing. If this access to data is abused, the ATSB nonetheless expects to react.

3.9 The Bureau allocates the events notified to one of five levels: the catastrophic event, the major event, the significant investigation, the routine Annex 13 investigation and, at Level 5, the factual-only investigation. Some 50 full investigations are conducted annually, alongside about 100 short investigations, without formal analysis. The latter establish key facts for database entry and support future trend analysis. In publishing them, the ATSB generally adds a safety message about any obvious lessons. General aviation events typically tie up around half of the investigation resource, and attempts are being made to improve safety via GA pilot licensing and education programmes. Safety improvements in this sector are nonetheless proving very hard to secure, owing in part to cultural and discipline factors.

3.10 All occurrence data are shared by the ATSB with the safety regulator, in their raw form, and information sharing between the two bodies is being undertaken reasonably successfully. The regulator is for example involved in work by the Bureau on "avoidable accidents".

3.11 In arriving at a risk rating, the ATSB addresses two questions: "If this event had escalated into an accident, what would have been the most credible accident outcome?", and "What was the effectiveness of the remaining barriers between this event and that outcome?". Two potentially significant trends identified by the ATSB are problems during the execution of normal but infrequently used procedures, such as go-arounds, and difficulties experienced in recovering from a compromised separation.

3.12 The ATSB is presently giving greater weight, in its decisions to investigate, to aircraft handling events, and has initiated a cooperative project with operators to understand better the relevant aspects of training. To date it has not investigated an event of this sort that involves more than the results of individual actions, and so the basic message is that the system worked, errors were captured and resolved. Paradoxically, this is problematic, and the ATSB has begun a safety issue investigation to see what, if anything, these single investigations might have failed to reveal.

### *Joint working by safety investigation authorities*

3.13 The **Italian ANSV** has experience of working jointly with other safety investigation authorities in dealing with serious incidents of a similar character that occurred, in different EU countries, within a period of less than four months. The investigation authorities in question decided to cooperate, in a shared effort to understand the root causes of these three events, through a sharing of information to identify together the extent of the problem while avoiding a needless duplication of effort, allowing each authority to learn from the two others in evaluating possible joint actions.

3.14 Each incident was associated with an emergency return to the departure airport due to an in-flight engine shut down following fire in the same engine type. The investigators held a joint meeting in the presence of the aircraft and engine manufacturers, and of the Accredited Representatives participating in the investigations and their technical advisors. It was established that each incident was attributable to initial distress to a rotor blade of the power turbine stage 1, causing subsequent damage and a heavy imbalance in the engine assembly and elsewhere, and finally an oil leakage onto hot parts that led to fire.

3.15 Short and medium terms actions were identified to address these issues, with draft recommendations prepared and circulated firstly amongst the three participating investigation authorities, and once refined to the parties involved, for their comments. It took some three further months to reach agreement on the format of the draft document. Safety recommendations were presented, by means of a document signed by the heads of the three authorities, to all parties involved, signed by the Italian ANSV on behalf of all three. Three separate Final Reports then followed, containing common recommendations.

***The European Co-ordination Centre for Aviation Incident Reporting Systems (ECCAIRS)***

3.16 In 2011 the EU defined the objective that the region should become the world's safest, in aviation terms. In support of that goal, the ambition for ECCAIRS is that it should assist national and European transport entities in collecting, sharing and analysing their safety information, in order to improve transport safety. ECCAIRS comprises a set of software tools and support services made available by the European Commission to transport communities in the European Union, in the context of EU legislation and in cooperation with international organisations. It encompasses a cooperative network (working *inter alia* via a Web portal), and a European Central Repository (ECR) fed by reporting through ECCAIRS.

3.17 The Repository now contains some 575,000 occurrences, accessible to all EU/EFTA competent authorities and to EASA and EUROCONTROL. Some access restrictions are in place, and work is under way to address certain data quality and reporting discipline issues. Version 4 of ECCAIRS is an established system in use world-wide and follows a traditional approach.

3.18 The latest version, ECCAIRS 5, is a multimodal common platform allowing for the customisation of the user interface and taxonomy. There has naturally been a need to find a balance, between the advantages of a tool able to be customised and the value of standardised products. In practice States tended to place most emphasis on the first of these. ECCAIRS 5's initial deployment to aviation, following testing in 2011, started in Q1 2012.

3.19 The ECCAIRS 5 taxonomy is suitable not only for answering the question "what happened and why?, but in addition ones such as "what might have happened?" and "what happened to prevent a worse outcome"?

3.20 Associated with - but for the time being functionally separate from - the Repository is the EU Safety Recommendation Information System (SRIS), which went live early in 2012 as a database of the safety recommendations made by the safety investigation authorities of the EU Member States. At present, SRIS is accessible only to those authorities, over the Internet via browsers (access does not depend upon usage of ECCAIRS tools). Consideration is to be given to widening that accessibility to organisations outside the Union.

3.21 ICAO has taken the initiative of soliciting from Member States contributions to a database of safety recommendations of global concern, being ones concerning a systemic deficiency with potential for significant consequences, and requiring timely action to improve safety.

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# Workshop Session 4
# Break-Out Discussions

### *Introduction*

4.1 As mentioned earlier, the fourth and final session of the workshop saw participants split into six break-out groups (titled A to F), in order to test the key propositions identified in the course of the previous sessions against a set of ten fictional incident case studies. These comprised:

- loss of separation
- near miss
- flight controls problem
- flight instruments failure
- incorrect V speeds and thrust
- near collision
- two quasi-CFIT events
- unpressurised aircraft
- multiple alarms in relation to pitot probe problem.

4.2 Each break-out group was asked to assess these case studies and classify the incidents according to those guidelines or criteria that it judged most appropriate. The case studies are reproduced at pages 24 to 26.

4.3 To help prepare the ground for this assessment and classification exercise, each break-out group was issued with some general guidance, and also with a copy of Attachment C to Annex 13. The guidance recalled that risk management is about identifying hazards and undesirable outcomes, and then putting and maintaining in place safety nets or positive factors, which might take one of several forms (eg hardware, procedures, emergency preparedness), the continuing effectiveness of which had to be monitored.

4.4 The break-out groups were encouraged to ask themselves the following preliminary questions when assessing the risks inherent in each of the case-study incidents, as an aide to their classification:

- Why did this incident not turn into an accident?
- Were there in place safety nets/positive factors (eg equipment, procedures) that prevented an accident from occurring?
- Were there safety nets/positive factors that reduced the incident's seriousness?
- Or was the outcome of this occurrence merely a matter of circumstance (including chance or providence)?

4.5 It was suggested to the groups that negative answers to the second and third of the questions above about the identification of safety nets/positive factors might indicate that the event should be classified as a "serious incident", the outcome having been merely a matter of luck.

4.6 The groups were also invited to consider, as possibly relevant to their decisions on which of the case study incidents to recommend for investigation, whether the incident held the possibility of lessons for the future; whether it raised issues of a systemic nature needing to be addressed at beyond the national level; whether it was an event in which keen public or media interest was likely in the event; and whether it had an international dimension.

4.7 Finally, in order to reflect the reality that the resources available to safety investigators are finite, the break-out groups were told that they could not recommend more than

five of the ten case study incidents for investigation. They were however reminded that mechanisms to delegate to local safety management systems the collection of facts, the first analysis, the drawing of primary conclusions, and data storage were also possibilities.

4.8 The slides used by Olivier Ferrante of the European Commission in briefing participants as above are reproduced at pages 27 to 32.

### *Feedback from break-out groups*

4.9 Once participants had reassembled in plenary following the break-out discussions, a rapporteur from each of the groups took them through its "scoring" of the case study incidents.

4.10 At pages 33 to 42 are the returns from each of the break-out groups, showing the decisions taken by each in respect of each case study on whether or not to investigate, the rationale for that decision, any positive factors identified, and any other comments offered.

4.11 The following table summarises these returns, showing the decisions (YES GREEN/NO RED) reached on whether or not to investigate, by each of the groups A to F, in respect of each of the ten case studies:

| CASE-STUDY | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| GROUP A | N | Y | Y | N | Y | Y | N | N | N | Y |
| B | N | Y | Y | N | Y | Y | N | N | N | Y |
| C | N | Y | N | Y | Y | Y | N | N | N | Y |
| D | N | Y | Y | Y | Y | Y | N | N | N | N |
| E | N | Y | Y | Y | Y | Y | N | N | N | N |
| F | N | N | Y | Y | N | Y | N | Y | N | Y |

4.12 In the ensuing discussion of this feedback amongst workshop participants, the following observations were advanced:

a) There remains amongst States a considerable reliance upon Attachment C to Annex 13, which was also frequently provided to airlines, notwithstanding the elaboration by a number of States of risk assessment matrices.

b) Relatively few States seem to be documenting the processes by means of which they determine which incidents merit investigation.

c) There was nonetheless an encouraging consistency across the break-out groups in their decision-making on whether or not to mount an Annex 13 investigation, and in identifying the safety nets which had applied in each case.

d) No case-study had divided opinion on a 50/50 basis, and only two of them (cases 4 and 10) had been felt to warrant investigation by a minority of more than a single group.

e) Those two relatively divisive case-studies had illustrated the importance of the volume and quality of the initial notification, and of the expertise of the person by whom it was submitted.

f) The obligation to investigate serious incidents has raised the profile of the investigation issue, putting the safety investigation authority under more pressure to make a handling decision, perhaps more quickly than is always comfortable.

g) The circumstances of the first case-study arguably prompted the question of whether an in-flight incident, which did not have serious consequences only as a consequence of avoiding manoeuvres having been taken, should always warrant an Annex 13 investigation.

*****

# Case Studies Presented to Break-Out Groups

## Case 1: Loss of separation

A Boeing 777 en route from JFK to Narita at flight level 350 was on a converging track with a Boeing 767 at flight level 350, en route from Paris to Chicago. Both aircraft received a TCAS Resolution Advisory, to which they responded. The two aircraft passed each other within 600 feet laterally and 1100 feet vertically, in radar-controlled airspace. The air traffic controllers had not detected the conflict until alerted by the air traffic control conflict alert programme. The required separation was 5 NM laterally or 2000 feet vertically.

## Case 2: Near-miss

An ATR 42-500 with 2 pilots, 1 cabin crew and 25 passengers onboard was descending to FL 90, inbound to its destination airport. Just after stabilising at FL 90, the crew informed ATC that they had just crossed another aircraft, which was approximately 300ft above them. The ATR's TCAS had not triggered any Traffic Advisory or Resolution Advisory and its crew had had no time to perform any escape manoeuvre. The ATR had just emerged from cloud when its crew saw the other aircraft. It re-entered cloud immediately after the near-miss. The other aircraft was a General Aviation type performing a cross-country flight, fitted with a GPS and with a mode-C transponder which was not turned on.

## Case 3: ATR 72 flight controls problem

On the first flight following a maintenance check, an ATR 72 experienced an uncommanded roll to the left as it accelerated through 185 kt. Control was regained by disengaging the autopilot and making opposite aileron and rudder inputs. Subsequent cockpit indications identified a fault with the rudder Travel Limiter Unit, which is designed to reduce the amount of rudder travel available above speeds of 185 kt. Switching to LO speed in manual mode did not improve matters. A safe landing was made at the departure airfield.

## Case 4: Agusta Westland AW139 flight instrument failure

During over-water flight in IMC, the crew alerting system of an Agusta Westland AW139 displayed a VNE MISCOMPARE message. This was followed by the loss of No 2 engine indications and other aircraft system parameters. A baggage compartment fire warning then ensued, followed by the loss of all altitude, airspeed and vertical speed information from the commander's Primary Flight Display. A MAYDAY call was transmitted, the helicopter descended below cloud (200 ft above the sea) and the crew actively considered ditching. There was a temporary loss of some No 1 engine parameters. Commander restored airspeed and other indications by selecting No 1 Air Data System to his Primary Flight Display. The helicopter was intercepted by another company aircraft, which confirmed lack of evidence of fire. After landing and shutting down, the faults did not recur during subsequent power-up.

## Case 5: Aircraft took off with incorrect V speeds and thrust

During pre-flight preparations for an air transport operation, the aircraft's estimated landing weight was used to calculate take-off performance, rather than take-off weight. The error was not detected and the aircraft took off with values of VR and V2 that were significantly lower than those required for the actual take-off weight. The aircraft was slow to rotate and initial climb performance was degraded but the aircraft continued to its destination.

## Case 6: Near-collision

A Pilatus PC 12, en route from Switzerland to Spain, was at indicated FL270, on the same route as an Airbus A318 that was behind, going faster and at FL290. The pilot of the PC 12 noticed that his two altimeters did not indicate the same altitude (FL270 for the left one, and FL290 for the right one), and asked the controller to clear up this uncertainty. After co-ordination with the military ATC, the controller confirmed that the PC 12 was at FL270. Ten minutes later, the A318 overtook the PC 12 at the same altitude, while making an avoidance manoeuvre to the left. The crew of the A318 stated that they had had no TCAS advisory, but had seen the other aircraft while looking outside after experiencing strange oscillations. The PC 12 pilot sought permission to descend to a level where he would be separated from all traffic. No STCA warning was triggered at the Air Traffic Control Centre. A technical malfunction was subsequently identified in the static pressure port, which caused the altimeter and the transponder to display FL270 instead of FL290.

## Case 7: Quasi-CFIT (Paris)

A wide-bodied aircraft was on final approach for runway 09L at Paris Charles de Gaulle airport. Owing to the lack of separation with the preceding aircraft, the controller proposed to the crew that they make a visual approach for runway 09R. The crew accepted this advice and started the manoeuvre, while the PF had no visual on runway 09R. The captain, who was Pilot Not Flying, inserted the new parameters in the FMGS. Due to the rising sun and the mist, the Pilot Flying was not able to see the runway. The aircraft went below the glide-slope and the crew aligned the aircraft to the right of the runway 09R on taxiway D. As the aircraft reached 400 ft, the controller realised that the aircraft was not properly aligned with the runway and instructed the crew to go-around. At the same moment, the crew realised the problem as they saw the runway threshold on their left. They went around, performed another approach and landed without any further incident.

## Case 8: Quasi-CFIT (Dublin)

A go-around instruction was given to an aircraft on short finals to runway 34 at Dublin Airport. Following the end of duty, the Tower Controller filed an Occurrence Report which indicated that the instruction had been given because the 'aircraft had veered to the left at 1.5 nm from touchdown due to pilot confusion with runway lights and apparent lighting in the vicinity of the hangar left of runway 34'. The event was logged as a reportable occurrence, but was not classed as serious. The following day, radio media highlighted the low flying of a commercial aircraft in the vicinity of Santry Cross, to the south of Dublin Airport.

## Case 9: Unpressurised aircraft

Following a "BLEEDS OFF" take-off from Reus Airport in Spain, the aircraft climbed to its cruising level of FL320 en route to Dublin Airport. Shortly after becoming established in the cruise, the "Cabin Altitude" horn sounded. Unable to prevent the cabin altitude from rising beyond its normal value, the Captain initiated an emergency descent. During this descent, the flight crew discovered that the engine bleed switches were selected in the "OFF" position. The aircraft diverted to Biarritz, in France, where it landed without further incident.

## Case 10: Multiple alarms in relation to pitot probe problem

Approaching FL170 in descent, the crew reported «IAS DISAGREE» Flags on both the Captain's and Flight Officer's Primary Flight Display. The Captain's Air Speed Indicator showed 270 knots, whilst that of the Flight Officer steadily decreased to 170Kts and remained there. The standby Air Speed Indicator indicated 270 Kts. The crew indicated that they carried out the AIRSPEED DISAGREE / AIRSPEED UNRELIABLE CHECKLIST and verified that both PROBE HEAT SWITCHES were ON and all lights were extinguished.

In accordance with the inflight performance the Captain's Artificial Horizon and Flight Director were both at 2.5 degrees. The Flight Officer's Artificial Horizon was also at 2.5 degrees, but his Flight Director showed 0 degrees. During further descent, both EEC ALT mode lights were illuminated AMBER. The crew reported having executed the EEC ALTERNATE MODE CHECKLIST, noting that there was no DISPLAY SOURCE annunciation. They also lost all information on N1 Page of Captain's Control Display Unit.

Passing through an altitude of approximately 7000 feet, conditions improved to Visual Meteorological Conditions, and the crew had a full view of the terrain in the general vicinity of the airport. At approximately 5000 feet, they observed an «ALT DISAGREE» flag on both Primary Flight Displays. That of the Captain, and the standby indicator altitudes, were in agreement but the Flight Officer's Primary Flight Display was indicating 400' lower. The crew executed the «ALT DISAGREE» QRH CHECKLIST and requested an extended downwind leg from ATC, advising them that they had an indication problem. Given that both the Captain's and the stand by instruments agreed and that the inflight performance figures also appeared to verify that the Captain's indications were correct, the crew decided to make an approach using the Captain's Air Speed Indicator as the reference speed and to hand-fly the approach.

At 230 knots on the Capain's Air Speed Indicator, flap 1 configuration was used and speed was allowed to reduce. The indication on the Flight Officer's Air Speed Indicator reduced to 113 knots,

at which point the stick shaker activated. The crew increased thrust until the Flight Officer's Air Speed Indicator showed approximately 230 knots. The Captain's Air Speed Indicator showed an airspeed of 290 knots. The crew then decided to take the Flight Officer's Air Speed Indicator as showing an accurate figure, and configured for the approach using the it as the reference. At a height of approximately 700' all flags disappeared and both Primary Flight Display (speed and altitude) were in agreement. The remainder of the approach and landing were uneventful.

In the Maintenance follow-up, both of the Flight Officer's pitot probe pins were found to be shorting to ground, and the pitot probe was replaced. All Built-In Test Equipment tested satisfactorily, and the aircraft returned to service without further incident.

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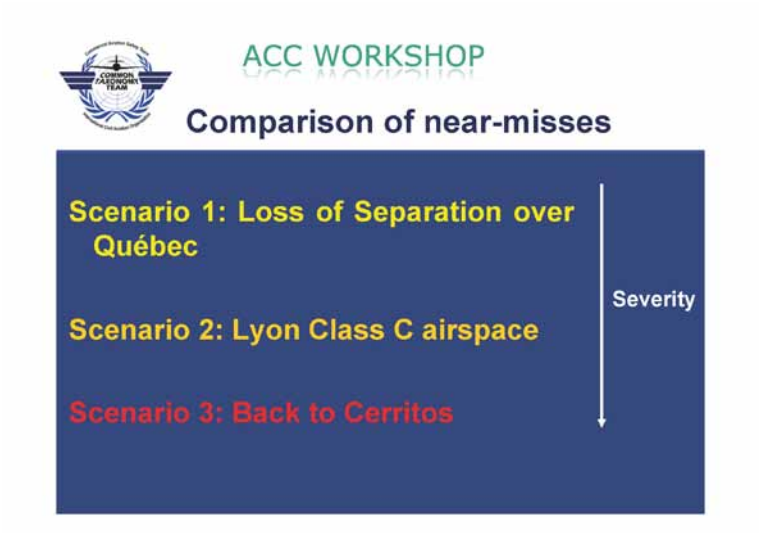
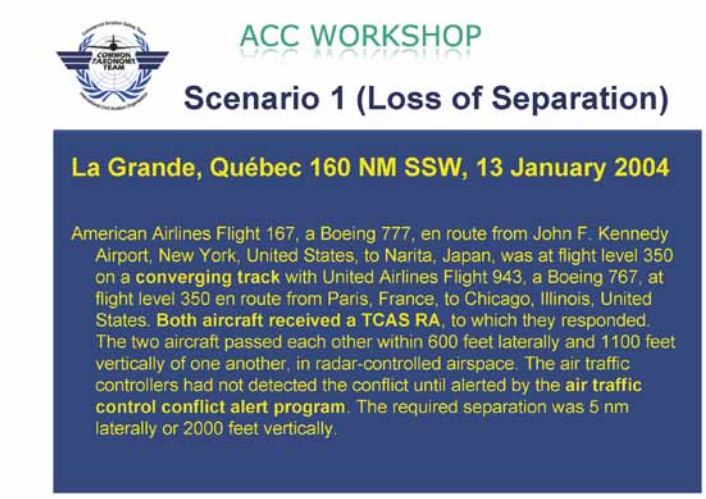
# PRESENTATION USED IN BRIEFING PARTICIPANTS FOR BREAK-OUT SESSION

## *INTRODUCTION TO FINAL SESSION, AND BRIEFING ON BREAK-OUT DISCUSSIONS*

*OLIVIER FERRANTE, DG-MOVE, EUROPEAN COMMISSION*

ACC WORKSHOP

## Scenario 1 (Québec)

What were the safety nets ?

- Both TCAS systems
- ATM STCA
- Application of emergency procedures

ACC WORKSHOP

## Scenario 2 (Near-miss)

Aircraft 1 : ATR 42-500
(2 pilots, 1 cabin crew and 25 PAX)
TCAS equipped

Aircraft 2 : Robin DR400-160
1 pilot + 2 PAX
Southbound cross-country flight
Aircraft fitted with a GPS
– no map boundaries representation
– transponder Mode C on-board

ACC WORKSHOP

## Near-miss

ATR 42 was descending to FL 90 inbound to Lyon on magnetic track 120°.

Just after stabilizing at FL 90, the crew informed ATC that they had just crossed another aircraft approx 300ft above them.

- No TA nor RA
- No time for any escape maneuver

ACC WORKSHOP

## ATR crew feedback

The ATR had just been out of clouds when the crew saw the other airplane.

They re-entered again IFR conditions just after the near-miss.

ACC WORKSHOP

## Trajectories (view of 1 /1 000 000 chart)

- In black : ATR 42
- In red : DR400


ACC WORKSHOP

## GA Pilot Testimony

- 1000 flight hours (700 on type)
- Planned his trip on ICAO chart (1/500000)
- Caution: map valid from max (SFC to 5000 AMSL , 2000 ASFC)
- Not aware of this limitation

ACC WORKSHOP

## Other Factors

- Transponder OFF (pilot forgot to turn it on)
  - Pilot generally avoided ATC communications
  - No radio contact since Take-off from Epernay
- DR 400 Pilot Instructor's statement
  - Training put emphasis on handling aspects

ACC WORKSHOP

## Remedial Actions

*Note : 56 intrusions in Lyon's Class C & D airspaces during the 6 month period preceding the serious incident*
*=> Many safety & information briefings in the Lyon area*

- Authorities informed (training program amended ?)
- Report sent to GA pilots through a bulletin
- Is it enough ? Where are the safety nets ? Any positive factor (except providence)?

ACC WORKSHOP

## Scenario 3 : Mid-Air Collision Cerritos, 31 August 1986

- 67 + 15 fatalities between 1 GA airplane (PA-28) and 1 DC-9-32

ACC WORKSHOP

## Consequences of Cerritos

Triggered TCAS development and wide implementation with other cases (such as San Diego midair collision between a B727 and a C172 on Sept 25, 1978)

ACC WORKSHOP

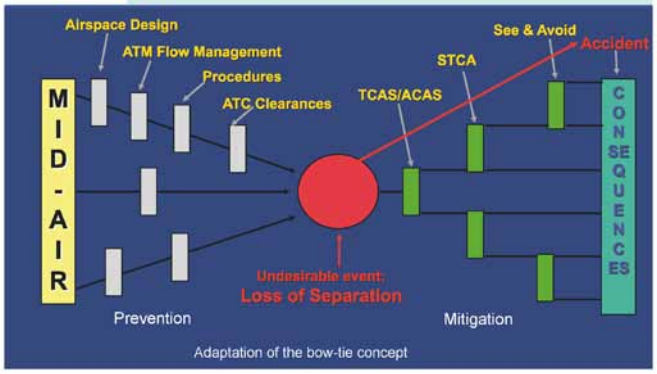
## Matrix of Scenarios

(Controlled Airspace)

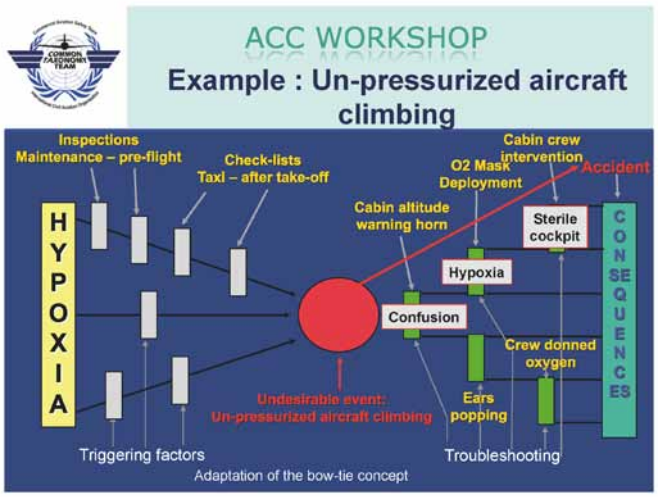
| Scenario 1 Québec | Scenario 2 Lyon | Scenario 3 Cerritos |
|---|---|---|
| Loss of Separation | Near-miss | Mid-air collision |
| Incident | Serious Incident | Accident |
| TCAS, STCA activations Controller intervention | PROVIDENCE | |

ACC WORKSHOP

## Modeling the Safety Nets




Adaptation of the bow-tie concept




ACC WORKSHOP

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## Exercise Organization

- **10** case studies sent in advance
- 6 subgroups A, B, C, D, E and F
- Review 10 occurrences and select only **5** to investigate (**resource constraints**)
- Focus on safety nets/barriers (leaflet)
- Use template to report back to the plenary session in the afternoon
- 14:00 Feedback of the subgroups

ACC WORKSHOP

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Break Out Group (A, B etc): Case Study No X

| | |
|---|---|
| Investigate? (Yes/No) | |
| Rationale | |
| Positive Factors | |
| Comments | |

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Good Work and See You in this room

at 14:30

# RETURNS FROM EACH OF THE BREAK-OUT GROUPS

## Case Study 1 (Loss of Separation)

### Group A

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | ATS internal investigation<br>Safety nets worked |
| **Positive Factors** | TCAS, STCA, Emergency procedures |
| **Comments** | Preliminary data collection<br>Monthly bulletin |

### Group B

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | 3 Positive factors still in place. |
| **Positive Factors** | TCAS, STCA, Avoidance maneuvre (Use of SOPs) |
| **Comments** | Decision is not to investigate because of the limited resources, although List in Attachment C would suggest that it should be investigated. |

### Group C

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Several safety nets |
| **Positive Factors** | Hardware Safety Nets, Avoidance Manoeuver |
| **Comments** | Local ANSP analysis |

### Group D

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Positive factors on right hand side of the bow-tie prevented a worse outcome. |
| **Positive Factors** | TCAS worked.<br>STCA worked also.<br>Crew reacted correctly. |
| **Comments** | ATC barrier failed. Put data into the database, and check for any trend information about similar events in this airspace. |

### Group E

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Sufficient safety barriers |
| **Positive Factors** | |
| **Comments** | |

### Group F

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | TCAS and STCA operated<br>Emergency procedures carried out (Safety barriers) |
| **Positive Factors** | TCAS, STCA |
| **Comments** | Internal ATC investigation would take place.<br>SR2 data entry |

## Case Study 2 (Near-miss)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Only providence prevented the accident<br>Training issues (not turning the transponder ON)<br>Severity level=HIGH<br>Frequency=MED, after having looked in database for similar events in the same area |
| **Positive Factors** | None, except Providence |
| **Comments** | Quick action to be taken in consultation with the CAA |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | No safety barriers |
| **Positive Factors** | Providence was the only remaining factor preventing the accident. |
| | |
| **Comments** | The group wonders if Providence or luck should be considered as a "Positive factor" or not. |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Safety barriers did not work |
| **Positive Factors** | Providence |
| **Comments** | Outcome of the safety investigation? |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Providence alone prevented an accident. |
| | |
| **Positive Factors** | No positive factors. |
| **Comments** | GA pilot failed to inform ATC of his presence in controlled airspace, failed to perform necessary checklist procedure, and failed to switch on his transponder. Outstanding question: could ATC see the GA aircraft on the screen, and if so, why did they send no instructions to the ATR? |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | |
| **Positive Factors** | |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Numerous similar events investigated |
| **Positive Factors** | Luck! |
| **Comments** | Potential safety study route, but:-<br>Numerous airspace infringements incidents have led to ATC (EUROCONTROL) investigations, with Safety Recs already made; action plan; Risk Reduction |

## Case Study 3 (Flight controls problem)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Risk=LOC<br>Frequency=LOW<br>Severity=HIGH/MED |
| **Positive Factors** | Good Airmanship<br>Aircraft design robustness<br>FAULT indication |
| **Comments** | Needed more info to determine the severity (control issues all the way to landing) |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Potential outcome of uncommanded rudder (if this is the case) could be catastrophic. |
| **Positive Factors** | Cockpit indication design, Decision, and use of training instructions seem still in place |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Crew managed to identify and handle the problem |
| **Positive Factors** | Problem solving + hardware |
| **Comments** | Not enough information but flight control problem and first flight raise warning bells |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Un-commanded flight control events are serious.<br>Questions about quality of maintenance, given that the event happened on first flight following maintenance check. |
| **Positive Factors** | Crew reacted well to event. |
| **Comments** | |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Flight control problems<br>Possible design issues<br>Maintenance procedure issues |
| **Positive Factors** | Crew training<br>Maintenance procedures<br>Operational procedure – disconnect AP<br>Cockpit indications |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Likely maintenance error, on flight control system |
| **Positive Factors** | Crew's skill and airmanship |
| **Comments** | Questions need to be asked on maintenance procedures and Quality System (CAMO and 145 system) |

## Case Study 4 (Flight instrument failure)

**Group A**

| | |
|---|---|
| **Investigate (Yes/No)** | No |
| **Rationale** | There was a MAYDAY call, but it was later cancelled<br>The crew considered ditching |
| **Positive Factors** | The crew applied proper procedures<br>The presence of the other helicopter is providence |
| **Comments** | Question: Were the bottles discharged?<br>Ask the operator to monitor this helicopter and report to authorities |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | It can be considered as a fault indication |
| **Positive Factors** | Design requirement (system redundancy) |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Consider ditching + Mayday message |
| **Positive Factors** | Decision |
| **Comments** | Look at aircraft type to assess the extent of the problem.<br>Ditching procedure/decision ? |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Crew sufficiently disturbed to actively consider ditching.<br>Very widely used aircraft. |
| **Positive Factors** | Crew reacted well. |
| **Comments** | Not wholly clear how high was the probability of an accident. Possible maintenance issue. Additional information also needed about possible previous such cases with this kind of aircraft. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Mayday call<br>IMC<br>Multiple warnings/failing indications<br>Consideration of ditching<br>Design/manufacturing issues |
| **Positive Factors** | Interception by other aircraft<br>Procedures<br>Operational procedures for fault identification<br>Crew training<br>Not present - GPWS |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Fairly new type, Mayday call, off-shore operation and thus potentially high profile, considered ditching |
| **Positive Factors** | Visual confirmation of no fire; restoration of air data |
| **Comments** | Similar loss of display events on type also reviewed.<br>(ATSB investigated similar event)<br>Problem traced to corrosion on module circuit board |

## Case Study 5 (Incorrect V speeds and thrust)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Potential severity=HIGH<br>Frequency= did happen before<br>Error not detected in spite of all the safety barriers (software, crew procedure) |
| **Positive Factors** | Runway long enough, but this is almost providence<br>No obstacle |
| **Comments** | Limited investigation, because you can refer to existing safety studies (ATSB, BEA) |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Worst credible outcome could be catastrophic. |
| **Positive Factors** | Providence was the only remaining factor preventing the accident. |
| **Comments** | Criticality seems exacerbated by the absence of possible technical barriers. |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Safety recurrent issue |
| **Positive Factors** | Conditions of the day/luck |
| **Comments** | Important to document for future systemic improvements |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Procedures for inputting weight and balance data failed, or were not implemented properly. High probability of an accident. |
| **Positive Factors** | None. |
| **Comments** | Aircraft need to be able to monitor their own performance, as a backstop. There is no barrier to this type of human error, once it had been made. Providence enters play: Is the runway long enough, and the airport environment benign? |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Possible outcome: accident |
| **Positive Factors** | Length of runway<br>Weight<br>Time of day<br>Obstacles<br>Procedures<br>Overhead calculations |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Issue has been informed by previous similar events |
| **Positive Factors** | Crew recognised low climb rate |
| **Comments** | Could form part of safety study;<br>Results notified to operator via results of study<br>Could delegate investigation to State of Registry |

## Case Study 6 (Near collision)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | TCAS and STCA both based on false input for the ADC<br>Severity= potential collision, HIGH<br>Frequency= |
| **Positive Factors** | Providence<br>Quick reaction of the A318 pilot |
| **Comments** | |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | The existing barriers were weak and only based on a chance base (pre-existing wake turbulence and VFR condition). |
| **Positive Factors** | Visual detection |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Safety barriers failed |
| **Positive Factors** | Sixth sense of the copilot (who looked outside) |
| **Comments** | Cross-check with ATC (a possible positive factor) |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | ATC and TCAS could not correct the error arising from the mistaken altimeter information, a consequence of static pressure port failure. Mistaken advice passed to PC12 by ATC. |
| **Positive Factors** | Airbus pilot reacted well, to implement "See and Avoid". Otherwise providence. |
| **Comments** | Questions about integrity of civil/military link. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Pure luck |
| **Positive Factors** | Visual contact<br>Positive lookout<br>Crew awareness<br>Same frequency<br>TCAS<br>STCA-system |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Very close to collision (oscillations = wake turbulence)<br>Only luck (VMC) avoided catastrophe |
| **Positive Factors** | Visual acquisition by Airbus crew of PC12 |
| **Comments** | Potential ATC issues?<br>Lack of knowledge of A/C systems by PC12 crew? |

## Case Study 7 (Quasi-CFIT – Paris)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Airline investigation launched<br>Safety net worked (ATC noticed the pb) |
| **Positive Factors** | ATC intervention<br>Visual detection |
| **Comments** | |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | |
| **Positive Factors** | Environment observation; decision to go-around, Air traffic intervention |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Barriers were effective |
| **Positive Factors** | Decision to go-around<br>ATC intervention |
| **Comments** | Part of a wider safety study + local safety investigation |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | System created the errors, tracked them, and corrected them. |
| **Positive Factors** | Controller spotted misalignment in time.<br>Pilot executed go around without difficulty. |
| **Comments** | ATC did not spot insufficient separation early enough. Operator should look at its SOPs. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Safety nets worked correctly<br>Crew reaction |
| **Positive Factors** | ATCO awareness |
| **Comments** | Safety nets:<br>ATC instructions on Go-around /ATC procedures |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Tight resources!<br>Two barriers worked |
| **Positive Factors** | Situation recognised (albeit late) by both controller and aircrew |
| **Comments** | Raises issues associated with unstable approaches and go-arounds. Event would likely stimulate ATC investigation. |

## Case Study 8 (Quasi-CFIT – Dublin)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Investigation can be launched by the ATC or the airport<br>Severity=MED (collision with hangar or another a/c on the airport)<br>Frequency=TBD |
| **Positive Factors** | ATC intervention |
| **Comments** | Additional info need to determine the frequency |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | |
| **Positive Factors** | Air traffic intervention |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | The ATC barrier was effective |
| **Positive Factors** | ATC intervention, and Go around |
| **Comments** | Should media involvement be a factor? |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Crew procedures to monitor position of aircraft on short finals failed: possible error in procedure, or in its implementation. |
| **Positive Factors** | Tower Control did its job well. |
| **Comments** | Delegate information gathering to airline, eg FDR download, and also gather radar read-out of aircraft position, height etc. Reserve judgment in the meantime on whether to investigate. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | One safety net left |
| **Positive Factors** | ATCO awareness<br>ATCO procedures<br>Crew procedures |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Confusion over 'hangar lights' could be a continuing hazard unless safety action is taken |
| **Positive Factors** | Deviation large enough to be obvious to ATC |
| **Comments** | |

## Case Study 9 (Unpressurised aircraft)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Similar to previous events already investigated (Helios)<br>Potential Severity: HIGH<br>Frequency: MED |
| **Positive Factors** | CAB ALT warning sounded<br>Crew reaction to descend |
| **Comments** | Monitor the internal investigation of the operator<br>Suggest to the CAA to monitor the operator<br>Question: Why did the Cabin ALT not sound earlier than FL320 |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | |
| **Positive Factors** | Design requirements, SOP |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Several barriers worked |
| **Positive Factors** | Hardware + decision to initiate an emergency descent |
| **Comments** | Delegation |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Foreseeable problem, which safety barriers foresaw and dealt with satisfactorily. |
| **Positive Factors** | Warning system functioned.<br>Pilot followed procedures. |
| **Comments** | This case in particular underlines the importance of the safety investigator having flexibility to decide whether to investigate, and the difficulties that could be associated with making any part of Annex 13 Attachment C mandatory. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | No, delegate to the operator |
| **Rationale** | Safety net worked |
| **Positive Factors** | Cabin altitude warning horn<br>Crew reaction<br>Checklists<br>Hardware Safety Net |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Barriers worked, crew recognised problem |
| **Positive Factors** | Cabin alt horn, crew operated according to procedures (apart from, possibly, checklist) |
| **Comments** | |

## Case Study 10 (Multiple alarms in relation to pitot probe problem)

**Group A**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Severity=HIGH<br>Frequency=MED (there are similar cases)<br>Stick Shaker activation |
| **Positive Factors** | Logical problem solving by crew (to be confirmed by investigation)<br>Providence |
| **Comments** | |

**Group B**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Complexity of the situation and multiple malfunctions |
| **Positive Factors** | Design requirements, Logical Problem solving |
| **Comments** | |

**Group C**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Very confusing (what if?) |
| **Positive Factors** | Visual conditions (luck) |
| **Comments** | Comparison with other cases |

**Group D**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Very divided between investigating this Case Study and Case Study 4 (Agusta). The decision to prefer to investigate the latter reflected the judgment that sufficient information was already held about this case, for it to be able to be resolved without investigation. |
| **Positive Factors** | Procedures and checklists worked. |
| **Comments** | Some questions about procedures followed in the cockpit. |

**Group E**

| | |
|---|---|
| **Investigate? (Yes/No)** | No |
| **Rationale** | Procedures worked |
| **Positive Factors** | Crew fault correction procedures |
| **Comments** | |

**Group F**

| | |
|---|---|
| **Investigate? (Yes/No)** | Yes |
| **Rationale** | Initial identification of faulty ASI subsequently reversed.<br>Possibility of gross overspeed landing (flap/structural damage?).<br>Lack of pitot probe failure warning. |
| **Positive Factors** | Luck (problem rectified itself at 700 ft)<br>Initial identification of faulty ASI. |
| **Comments** | More info needed on landing phase.<br>Crew procedures need looking at.<br>Crew apparently did not recognise speed/pitch angle relationship. |

*****

## CONCLUSIONS, AND CLOSURE OF WORKSHOP

Concluding the workshop, the ACC Chairman Jurgen Whyte said that it had provided much food for thought, and uncovered many very interesting issues and questions around the treatment of incidents. In particular, it was clear that the initial evaluation and assessment of the reported details of a specific incident, and the possible follow-up on such details, served to assist safety investigation authorities in determining the seriousness of the occurrence and the need to investigate or not.

These issues would no doubt now be reflected upon carefully by all concerned, not least within ACC itself. Particular attention was likely to be paid to whether States should seek to harmonise amongst themselves around a common basis for assessing how incidents should be handled, or whether Attachment C to Annex 13 represented a sufficient steer in this respect, augmented if there was a wish by the elaboration at the national level of a risk assessment matrix.

In closing the event, the ACC Chairman thanked all of its participants, in particular those who had travelled so far in order to take part, for their contributions to what had proved a most successful and thought-provoking workshop. He expressed particular appreciation to Martin Puggaard and his team for Denmark's very generous and efficient hosting of the workshop, and to the Steering Group and ECAC Secretariat for their work on its design, organisation and delivery.

*****

# Attachment A

## Workshop Programme

## ECAC ACC Workshop on the Treatment of Incidents

### Roskilde, Denmark, Tuesday 15 – Wednesday 16 May 2012

## Programme

09:00 **Opening of the Workshop**
Jurgen Whyte, Chairman of ECAC Accident and Incident Investigation Expert Group (ACC)

### Session 1: The Role of the Safety Investigation in a Changing Environment
**Rapporteur: ACC Chairman Jurgen Whyte**

Considerable change is taking place at the global and European levels in relation to the regulation of aviation safety. The first session of the workshop will review these changes, and consider their implications for safety investigation authorities, as they address aviation incidents and seek to derive from them proposals for proactive changes to the safety system.

09:15 **ICAO Developments in Incident Investigations and Safety Management Provisions**
Marcus Costa, Head of AIG Section, ICAO Secretariat

09:40 **Directive 2003/42/EC on Occurrence Reporting in Civil Aviation, and its Foreseen Revision**
Olivier Ferrante, DG-MOVE, European Commission

10:05 **Current Developments in Accident and Incident Databases**
Bernard Bourdon, European Aviation Safety Agency

10:30 **Discussion, led by Session Rapporteur**

### Session 2: The Identification of Aviation Incidents Meriting Investigation
**Rapporteur: ACC Vice-Chairman John-Paul Troadec**

Because it is not possible to investigate more than a fraction of aviation incidents and irregularities, they must be categorised in order to allow decisions to be made on priorities. Issues around data collection and fragmentation, simple memory loss, and difficulties with the validation of information about incidents mean that such categorisation, and thus the identification of those incidents meriting investigation, is sometimes a challenge.

The second session of the workshop will look at how that challenge is being met by different parties, and at how a better understanding of past accidents can help safety analysts and investigators derive important lessons from the investigation of incidents.

11:00 **Selecting Aviation Incidents for Examination: Danish Practice**
Martin Puggaard, Chief Inspector of Air Accidents, Accidents Investigation Board, Denmark

11:20 **Identification of Incidents to Investigate: French Practice**
Erell Ravel and Arnaud Desjardin, *Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile*, France

11:40 **Lessons Learned from Commercial Aviation Accidents: Creation of a Web-Based Knowledge System**
Daniel Cheney, Safety Programme Manager, FAA Transport Airplane Directorate, USA

12:00 **Finding Gold at the End of the Reporting Rainbow**
Paul Farrell, Irish Air Accident Investigation Unit

12:20 **UK AAIB's Policy for Responding to Incidents**
Keith Conradi, Chief Inspector, UK Air Accident Investigation Branch

12:40 **Discussion, led by Session Rapporteur**

14:00 **EUROCONTROL's 'Risk Analysis Tool': A Severity and Risk Assessment Methodology for Reported ATM incidents**
Dragica Stankovic, EUROCONTROL

14:20 **Co-ordination between the Spanish Occurrence Reporting System and the Spanish Safety Investigation Authority**
Luis Mijares, *Comisión de Investigación de Accidentes e Incidentes de Aviación Civil*, Spain

14:40 **Singapore's Approach to Handling Incidents**
Bryan Siow, Air Accident Investigation Bureau of Singapore

15:00 **The High Risk Events Analysis Team (THREAT)**
Joji Waites, Civil Aviation Authority, United Kingdom

15:35 **Airbus' Approach to Incident Selection**
Nicolas Bardou, Airbus

15:55 **Incident Handling in Canada**
Brad Vardy, Transportation Safety Board of Canada

16:15 **The Work of Boeing's Engineering Investigation and Safety Review Boards**
Lori Anglin, The Boeing Company

16:35 **Discussion led by Session Rapporteur, and Closing Remarks for Day 1**

## DAY 2

09:00 **Introduction to Second Day of Workshop**
John-Paul Troadec, Vice-Chairman of ECAC Accident and Incident Investigation Expert Group (ACC)

## Session 3: Looking for "What Went Right"

**Rapporteur: ACC Vice-Chairman John-Paul Troadec**

National and international texts typically distinguish between an incident and a serious incident on the basis of actual or potential consequences. Yet incidents are typically events which have been caught by elements of the overall "safety net", such that they do not develop into accidents. This makes it crucial to better understand the safety nets of the system, and their effectiveness in preventing accidents. To do so, databases need to capture not only the answer to the obvious question "What went wrong?", but also those elements of safety nets that worked – the positive factors - and thus the answer to the question "What went right, to prevent this incident becoming an accident ?"

The third session of the workshop will include presentations on these positive factors and the experience of different organisations in analysing, as part of an incident investigation, "what went right".

09:10 **Reducing Accidents by Monitoring Safety Barriers**
Jay Pardee, US Federal Aviation Administration

09:30 **Preventative Investigation: Occurrence Data and 'What Went Right'**
Martin Dolan, Australian Transportation Safety Bureau

09:50 **The Experience of Different SIAs in Dealing Jointly with Similar Serious Incidents**
Mario Colavita, *Agenzia nazionale per la sicurezza del volo*, Italy

10:10 **ECCAIRS 5**
Wietse Post, EC Joint Research Centre

10:30 **Discussion, led by Session Rapporteur**

## Session 4: Discussion, Preparation of Guidelines, and Workshop Conclusions

**Rapporteur: ACC Chairman Jurgen Whyte**

In the final session, the workshop's participants will seek to define the role of safety investigation authorities when dealing with incidents, and through the use of break-out groups to elaborate some practical guidelines on the selection of incidents for investigation.

11:15 **Introduction to Final Session, and Briefing on Break-Out Discussions**
Olivier Ferrante, DG-MOVE, European Commission

11:30 **Start of Break-Out Exercise**

15:00 **Report back from Break-Out Exercise, followed by Discussion and Elaboration of First Draft of Guidelines on Selection of Incidents for Investigation**
led by Session Rapporteur with Olivier Ferrante

16:00 **Conclusions, Next Steps and Closing Remarks**
Jurgen Whyte, Chairman of ECAC Accident and Incident Investigation Expert Group

16:30 **Close of Workshop**

*****

# Attachment B

## Workshop Participants

| Country | Name |
|---|---|
| ECAC MEMBER STATES | |
| **Albania** | Rigers Kasneci<br>Taulant Seferi<br>Anastas Kriqi |
| **Austria** | Julius Gaugush<br>Johannes Woldrich |
| **Azerbaijan** | Alexander Telegin<br>Naila Aliyeva |
| **Belgium** | Luc Blendeman<br>Sam Laureys |
| **Bulgaria** | Atanas Kostov<br>Yavor Petrov<br>Daniela Dimitrova<br>Milena Ivanova |
| **Croatia** | Vlatko Hajmburger<br>Danko Petrin |
| **Cyprus** | Ioannis Loizou |
| **Czech Republic** | Stanislav Suchy |
| **Denmark** | Martin F. Puggaard<br>Flemming B. Nielsen<br>Bo Haaning<br>Per Christensen<br>Tero Tapio Jensen<br>Thomas Bussenius Hansen |
| **Estonia** | Jans Haug |
| **Finland** | Tii-Maria Siitonen<br>Ismo Aaltonen |
| **France** (Vice Chairman) | Jean-Paul Troadec<br>Erell Ravel<br>Arnaud Desjardin |
| **Germany** | Ulf Kramer |
| **Greece** | Nikos Pouliezos |
| **Hungary** | Loràn Becske |
| **Ireland** (Chairman) | Jurgen Whyte<br>Paul Farrell |
| **Italy** | Mario Colavita |
| **Latvia** | Ivars A. Gaveika<br>Vilis Kipurs |
| **Luxembourg** | Angelo Daprile |
| **Netherlands** | Kas Beumkes<br>Maurice Peters |

| | |
|---|---|
| **Norway** | Torbjoerg Gasland<br>Edith Irgens |
| **Poland** | Wieslaw Jedynak |
| **Portugal** | Antonio Alves |
| **Slovenia** | Roman Rovansek |
| **Spain** | Juan J. Balonga<br>Arturo Yanez<br>Luis Mijares Gordun |
| **Sweden** | Stefan Christensen |
| **Switzerland** | Daniel Knecht |
| **United Kingdom** | Keith Conradi<br>Andrew Robinson<br>Geraint Herbert<br>Joji Waites |
| ECAC REGIONAL AND BILATERAL PARTNERS | |
| **ATSB (Australia)** | Martin Dolan |
| **FAA (USA)** | Daniel Cheney<br>Jay Pardee |
| **Guatemala** | Guillermo Mansilla |
| **NTSB (USA)** | Frank Hilldrup |
| **Singapore** | David Lim<br>Bryan Siow |
| **TSB (Canada)** | Bradford Vardy |
| **United Arab Emirates** | Ismail Mohamed Ahmed Abdulwahed |
| **WAEMU** | Laurent-Christophe Kielwasser |
| OTHER STATES ACCREDITED TO ICAO EUR-NAT | |
| **Russian Federation** | Kristina Byvalina |
| **Morocco** | L. Boulahcen |
| ORGANISATIONS AND INDUSTRY | |
| **ASD (Airbus)** | Nicolas Bardou |
| **BOEING (USA)** | Lori Anglin |
| **EASA** | Bernard Bourdon |
| **ECA** | Peter Granhoej |
| **EUROCONTROL** | Dragica Stankovic |
| **European Commission** | Olivier Ferrante |
| **IATA** | Giancarlo Buono |
| **ICAO** | Marcus Costa |
| **JRC (European Commission)** | Wietse Post |

SECRETARIAT
Peter Kirk — Deputy Executive Secretary
Monique Inizan — Assistant

*****

# Attachment C to Annex 13, as adopted by the Council on 25 February 2013, to become applicable in November 2013

**ATTACHMENT C. LIST OF EXAMPLES OF SERIOUS INCIDENTS**

1. The term "serious incident" is defined in Chapter 1 as follows:

***Serious incident***. An incident involving circumstances indicating that there was a high probability of an accident and associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down.

2. The incidents listed are typical examples of incidents that are likely to be serious incidents. The list is not exhaustive and only serves as guidance to the definition of serious incident.

Near collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.

Collisions not classified as accidents.

Controlled flight into terrain only marginally avoided.

Aborted take-offs on a closed or engaged runway, on a taxiway1 or unassigned runway.

Take-offs from a closed or engaged runway, from a taxiway1 or unassigned runway.

Landings or attempted landings on a closed or engaged runway, on a taxiway (5) or unassigned runway.

Gross failures to achieve predicted performance during take-off or initial climb.

Fires and/or smoke in the cockpit, in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.

Events requiring the emergency use of oxygen by the flight crew.

Aircraft structural failures or engine disintegrations, including uncontained turbine engine failures, not classified as an accident.

Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.

Flight crew incapacitation in flight.

Fuel quantity level or distribution situations requiring the declaration of an emergency by the pilot, such as insufficient fuel, fuel exhaustion, fuel starvation, or inability to use all usable fuel on board.

Runway incursions classified with severity A. The Manual on the Prevention of Runway Incursions (Doc 9870) contains information on the severity classifications.

---

5 Excluding authorised operations by helicopters

Take-off or landing incidents. Incidents such as under-shooting, overrunning or running off the side of runways.

System failures, weather phenomena, operations outside the approved flight envelope or other occurrences which caused or could have caused difficulties controlling the aircraft.

Failures of more than one system in a redundancy system mandatory for flight guidance and navigation.

The unintentional or, as an emergency measure, the intentional release of a slung load or any other load carried external to the aircraft.

*****

# Attachment D

## Glossary of Acronyms

| | |
|---|---|
| AAIB Singapore | Air Accident Investigation Bureau of Singapore |
| AAIB UK | Air Accident Investigation Branch, United Kingdom |
| AAIU Ireland | Air Accident Investigation Unit, Ireland |
| AIB Denmark | Accident Investigation Board, Denmark |
| ACC | ECAC Expert Group on Accident and Incident Investigation |
| ADREP | ICAO Accident/Incident Data Reporting System |
| AIG | ICAO Secretariat Accident Investigation Section |
| AMC | Acceptable Means of Compliance |
| ANSP | Air Navigation Service Provider |
| ANSV | *Agenzia Nazionale per la Sicurezza del Volo*, Italy |
| ASI | Air Speed Indicator |
| ASIAS | Aviation Safety Information Analysis and Sharing System |
| ATC | Air Traffic Control |
| ATCO | Air Traffic Control Officer |
| ATM | Air Traffic Management |
| ATSB Australia | Australian Transportation Safety Bureau |
| BEA | *Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile*, France |
| CAA UK | Civil Aviation Authority of the UK |
| CAST | Commercial Aviation Safety Team, USA |
| CFIT | Controlled Flight Into Terrain |
| CICTTCAST | ICAO Common Taxonomy Team |
| CIAIAC | *Comisión de Investigación de Accidentes e Incidentes de Aviación Civil*, Spain |
| CRM | Crew Resource Management |
| CVR | Cockpit Voice Recorder |
| DGAC France | *Direction générale de l' aviation civile*, France |
| DG-MOVE | Directorate-General for Mobility and Transport, European Commission |
| ECAC | European Civil Aviation Conference |
| ECR | European Common Repository |
| EASA | European Aviation Safety Agency |
| ECCAIRS | European Co-Ordination Centre for Aviation Incident Reporting Systems |
| (E)GPWS | (Enhanced) ground proximity warning systems |
| ENCASIA | European Network of Civil Aviation Safety Investigation Authorities |
| EC | European Commission |
| EU | European Union |
| EU OPS | EU regulations specifying minimum safety and related procedures for commercial passenger and cargo fixed-wing aviation. |
| FAA | Federal Aviation Administration |
| FDR | Flight Data Recorder |
| FL | Flight Level |
| GA | General Aviation |
| GPS | Global Positioning System |
| GPWS | Ground Proximity Warning System |
| ICAO | International Civil Aviation Organisation |
| IMC | Instrument Meteorological Conditions |
| JRC | Joint Research Centre |
| Kt | knots |
| LOC | Loss of Control |
| NTSB | National Transportation Safety Board, USA |
| PF | Pilot Flying |
| PFD | Primary Flight Display |
| PNF | Pilot Not Flying |
| QRH | Quick Reference Handbook |

| | |
|---|---|
| RAP | Risk Analysis Process (FAA) |
| RAT | Risk Analysis Tool (EUROCONTROL) |
| SIA | Safety Investigation Authority |
| SMS | Safety Management Systems |
| SOP | Standard Operating Procedure |
| STCA | Short-Term Conflict Alert |
| TCAS | Traffic Collision Avoidance System |
| TCAS RAs | TCAS Resolution Advisory |
| TCAS TAs | TCAS Traffic Advisory |
| THREAT | The High Risk Events Analysis Team (UK) |
| TSB | Transportation Safety Board of Canada. |
| VFR | Visual Flight Rules |
| VMC | Visual Meteorological Conditions |
| VNE | Velocity Never Exceed |

*****

# ATTACHMENT E

## SLIDES USED IN WORKSHOP PRESENTATIONS

### SESSION 1: THE ROLE OF THE SAFETY INVESTIGATION IN A CHANGING ENVIRONMENT

#### *ICAO DEVELOPMENTS IN INCIDENT INVESTIGATIONS AND SAFETY MANAGEMENT PROVISIONS*

*MARCUS COSTA, HEAD OF AIG SECTION, ICAO SECRETARIAT*

GROUP OF EXPERTS ON ACCIDENT INVESTIGATION
ACC

Roskilde, 15/16 May 2012

GROUP OF EXPERTS ON ACCIDENT INVESTIGATION
ACC

**OUTLINE**

- Serious Incidents
- New Appendix (?)
- Annex 19

GROUP OF EXPERTS ON ACCIDENT INVESTIGATION
ACC

**ATTACHMENT C. LIST OF EXAMPLES OF SERIOUS INCIDENTS**

Near collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.

Collisions not classified as accidents.

...

Fires and/or smoke in the cockpit, in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.

...

Fuel quantity level or distribution situations requiring the declaration of an emergency by the pilot, such as insufficient fuel, fuel exhaustion, fuel starvation, or inability to use all usable fuel on board.

...

System failures, weather phenomena, operations outside the approved flight envelope or other occurrences which caused or could have caused difficulties controlling the aircraft.

...

The unintentional or, as a precautionary or emergency measure, the intentional release of a slung load or any other load carried external to the aircraft.

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ACC

## OUTLINE

- Serious Incidents
- New Appendix (?)
- Annex 19

## Investigation

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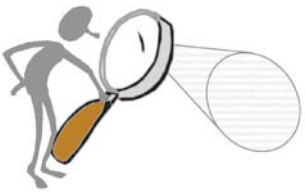
## Investigation of Serious Incidents



Upgrade to a Standard

for A/C above 2 250 kg MTOM

Text added to paragraph 5.4:

*The extent of the investigation and the procedure to be followed in carrying out such an investigation shall be determined by the accident investigation authority, depending on the lessons it expects to draw from the investigation for the improvement of safety.*

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Main Killers: CFIT; LOC-I; Runway Excursions

Appendix to Annex 13?

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ACC

## OUTLINE

- Serious Incidents
- New Appendix (?)
- Annex 19

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## SMP/Annex 19

**CHAPTER 8. ACCIDENT PREVENTION MEASURES**

*Note.— The objective of these specifications is to promote accident prevention by collection and analysis of safety data and by a prompt exchange of safety information, as part of the State safety programme.*

*Note.3— Additional information on which to base preventive actions may be contained in the Final Reports on investigated accidents and incidents.*

8.1 **Recommendation.—** *In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies. If safety recommendations are addressed to an organization in another State, they should be transmitted to that State's investigation authority.*

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## SMP/Annex 19

**ATTACHMENT F. FRAMEWORK FOR THE STATE SAFETY PROGRAMME (SSP)**

*Note:* Delete Attachment F in toto.
*Origin:SMP;*
*Rationale:* This attachment is transferred to Annex 19.

***Preliminary review by ANC on 8 May 2012:***

**Proposal accepted.**

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ACC

## SMP/Annex 19

**ATTACHMENT E. LEGAL GUIDANCE FOR PROTECTION OF SDCPS**

*Note:* Delete Attachment E in toto;
*Origin: SMP;*
*Rationale:* This attachment is transferred to Annex 19.

***Preliminary review by ANC on 8 May 2012:***

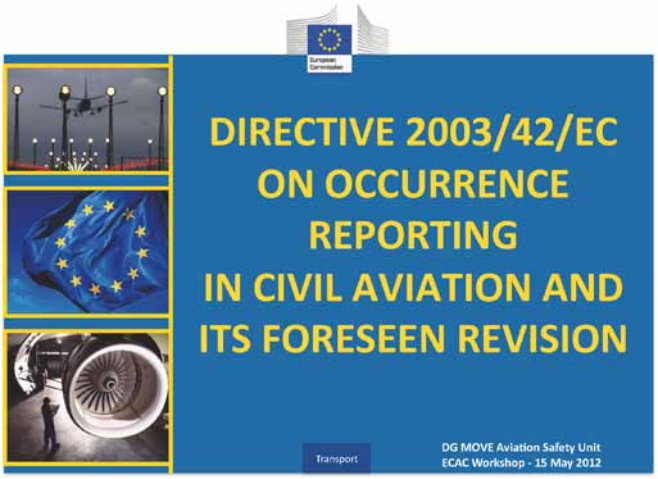
**Proposal not accepted; Attachment E to be retained in Annex 13.**

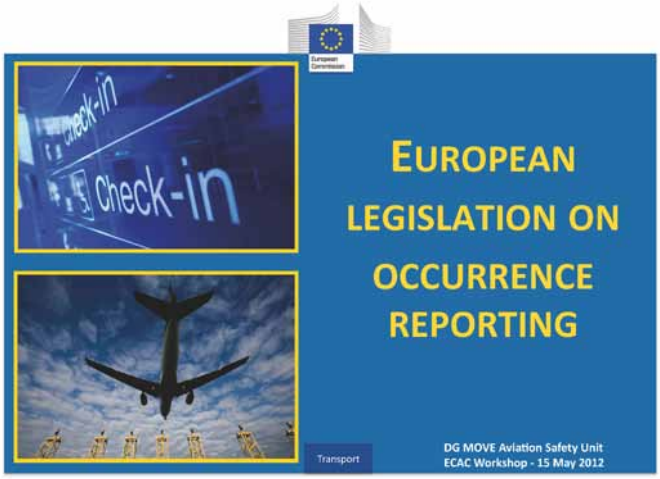
**GROUP OF EXPERTS ON ACCIDENT INVESTIGATION**
**ACC**

Roskilde, 15/16 May 2012

## DIRECTIVE 2003/42/EC ON OCCURRENCE REPORTING IN CIVIL AVIATION, AND ITS FORESEEN REVISION

OLIVIER FERRANTE, DG-MOVE, EUROPEAN COMMISSION




### International context

- ICAO Annex 13 aims at promoting accident prevention by collection and analysis of safety data and by a prompt exchange of safety information
- States have to establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies and a database to facilitate the effective analysis of these data

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## European Union legislation

- Directive 2003/42/EC requires each EU Member State to set up a mechanism to collect, evaluate, process and store occurrences in a database
- Commission Regulation N°1321/2007: set up of a European Central Repository (ECR) which contained all occurrences collected in application of the Directive
- Commission Regulation N°1330/2007 on the dissemination to interested parties of information on civil aviation occurrences

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## Objective

- The objective is to contribute to aviation safety improvement by ensuring that relevant information on safety is reported, collected, stored, protected and disseminated
- The sole objective of occurrence reporting is the prevention of accidents and incidents and not to attribute blame or liability

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## Protection in EU legislation

- Member States ensure appropriate confidentiality of the information received and use data for safety purposes only
- Names or addresses of individual persons are never recorded in the database
- MS refrain from instituting proceedings on the basis of an occurrence report, expect in case of gross negligence
- Employees who report incidents are not subject to any prejudice by their employer

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## ECCAIRS and the European Central Repository

- ECCAIRS is a system developed by the European Commission Joint Research Centre to allow the storage and exchange of information inside the EU
- It enables the collection of aircraft incidents and accidents in an ICAO compatible format using the ADREP taxonomy
- The ECR is an ECCAIRS EU database which gathers all occurrences collected by MS, it contains today more than 570,000 occurrences

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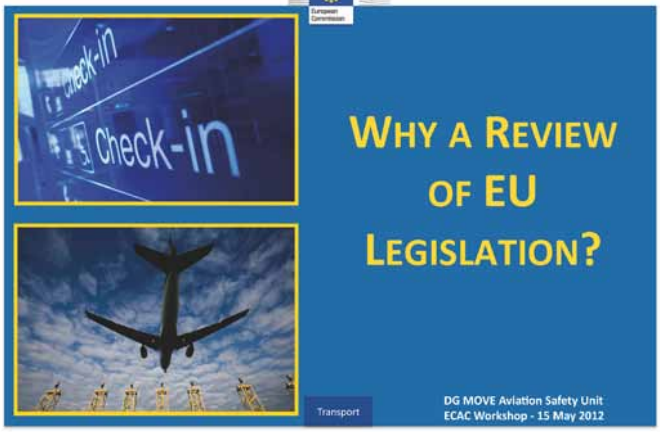


## A request from all actors

- The European Parliament and the Member States asked for a revision of current legislation in EU Regulation No 996/2010 on accident investigation and prevention
- Most of involved stakeholders requested it: 70,5% of the replies to the public consultation support a revision of the current legislation

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## A legislation incorrectly implemented and incomplete

- Current legislation is affected by a number of shortcomings limiting its usefulness for safety purposes
- It does not contain obligation to analyse data collected and to use them to correct safety deficiencies or for prevention
- It does not include mechanism for cooperation at EU level

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## A necessity for the improvement of air safety

- EC Communication on "Setting up a Safety management System for Europe" and White Paper on Transport underline the necessity to improve the existing system in order to move towards a more data driven approach
- An efficient proactive and evidence based system relies on the ability to analyse and use all available safety information including occurrence reports

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## REVISION PROCESS

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- The Commission shall draft and adopt an Impact Assessment presenting possible revision options and supporting its legislative proposal
- Broad consultations took place to feed the Impact assessment process
- MS have been consulted
- A public consultation took place notably to collect stakeholders' opinion (61 replies)
- A Seminar on the Just Culture issue was organised with strong attendance from all aviation actors representatives

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- The legislative proposal should be presented by the European Commission around October 2012
- Legislation will be negotiated under the co-decision process i.e. European Parliament and Ministers Council (Member States) should find an agreement on the provisions to be included in the text
- Final adoption of the legislation will depend of the decision making process between these two co-legislators
- If it is a Regulation, it will be directly applicable in MS and will enter into force 20 days after its publication

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## Member States consultation

- The Commission sent a questionnaire to all EU 27 Member States
- All MS but one replied to the consultation
- Wide majority of MS favour a revision of the current legislation
- Several MS expressed difficulties to apply correctly the current legislation due to understaffing

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## Member States consultation: Elements that a revision should look at

- Replace the Directive by a Regulation
- Ensure more consistency between all reporting obligations
- Review the scope the occurrences to be mandatory reported
- Improve the quality of data
- Harmonise the reporting process
- Address the Just Culture issue
- Develop provisions related to analysis and safety actions
- Define EASA role within the system
- Establish a European common risk classification scheme

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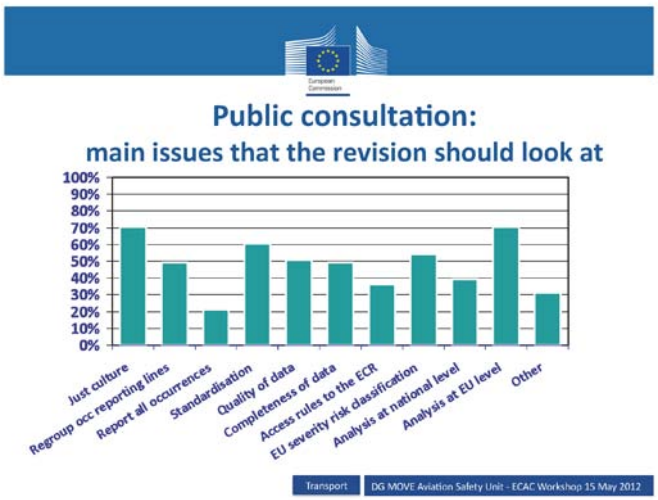
Public consultation:
main issues that the revision should look at
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Just culture
Regroup occ reporting lines
Report all occurrences
Standardisation
Quality of data
Completeness of data
Access rules to the ECR
EU severity risk classification
Analysis at national level
Analysis at EU level
Other
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Public consultation:
Are aviation professionals who report an occurrence sufficiently protected from blame or repressive action?
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Yes
No
No opinion
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Check-in
JUST CULTURE
SEMINAR
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## Just Culture in the context of occurrence reporting schemes Seminar

- Took place on 19th April in Brussels
- With all aviation players including EASA, Eurocontrol, CAAs, AIBs ANSPs, Airports, Engineers associations, Airlines and airlines associations, Pilots and Air Traffic Controllers associations, Manufacturer
- Intensive debate on how better protect reporters and information
- Adopted conclusions with suggestion of policy measures to be included in the legislation

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## Just Culture in the context of occurrence reporting schemes Seminar

All presentations, summary of discussions and adopted conclusions are available on:

http://ec.europa.eu/transport/air/events/2012-04-19-seminar-aviation-safety_en.htm

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## Thank you for your attention!

Questions?
Please contact
Delphine Micheaux Naudet:
delphine.micheaux-naudet@ec.europa.eu

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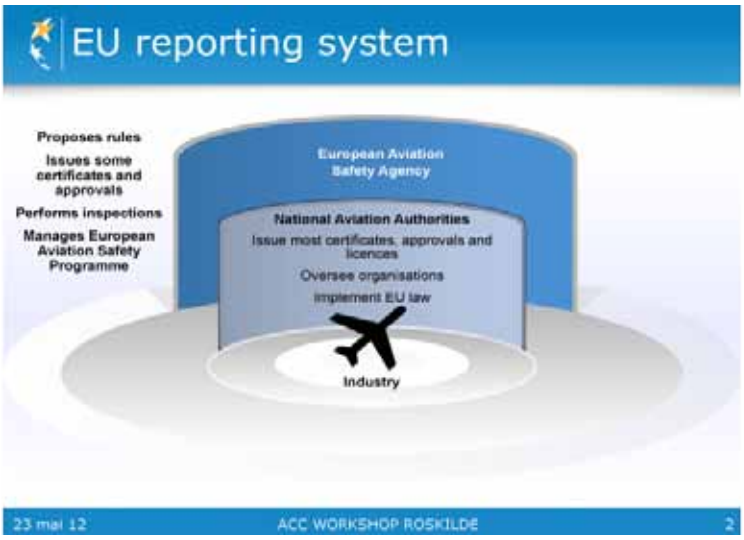
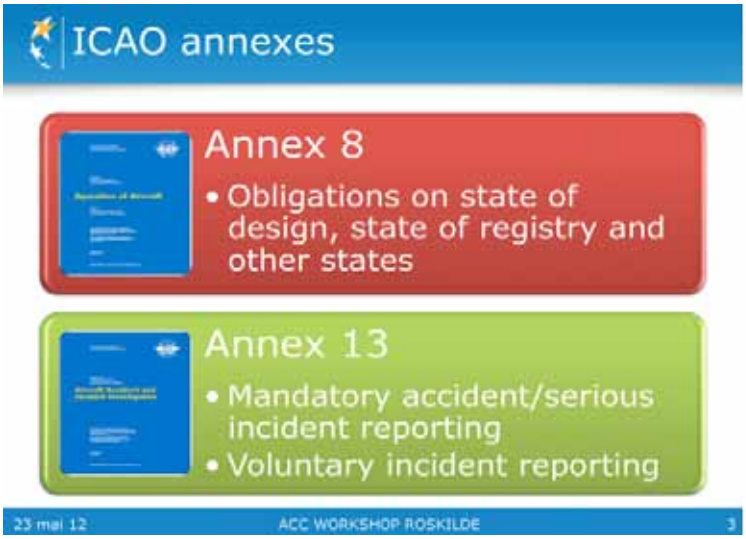
## CURRENT DEVELOPMENTS IN ACCIDENT AND INCIDENT DATABASES

BERNARD BOURDON, EUROPEAN AVIATION SAFETY AGENCY

## EU Legislation

**Directive 2003/42/EC:**
- Mandatory reporting
- Lists of reportable occurrences

**Regulation (EC)1321/2007:**
- Data integration
- Create the European Central repository

**Regulation (EC)1330/2007:**
- Dissemination of information
- Confidentiality

**Regulation (EU)996/2010:**
- Article 19 on occurrence reporting

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## EASA Regulation (1)

- Regulation EC 216/ 2008:
  - Art. 15: Information Network
- Regulation EC 1702/2003 (Part 21):
  - DAH obligation to collect occurrences, analyse them and propose corrective actions
  - Obligations to report occurrences on DOA and POA
  - Competent authorities shall exchange information and notify difficulty


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## EASA Regulation (2)

- Regulation EC 2042/2003:
  - Part M: Occurrence reporting obligations on persons or organisations having responsibilities in continuing airworthiness
  - Part 145: occurrence reporting for such organisations and incidents analysis system

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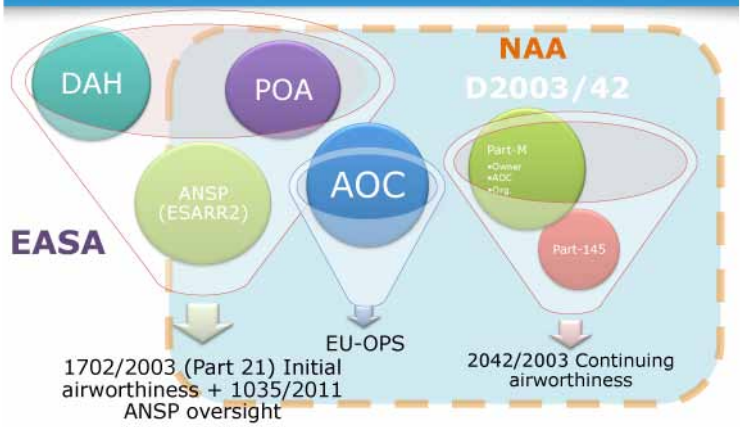
## EU-OPS - Regulation (EC) 859/2008

- OPS 1.037: accident prevention and flight safety programme
  - Occurrence reporting scheme
  - Flight Data Monitoring for aircraft above 27t
- OPS 1.420:
  - Terminology
  - Operator
  - Commander
  - Specific reports

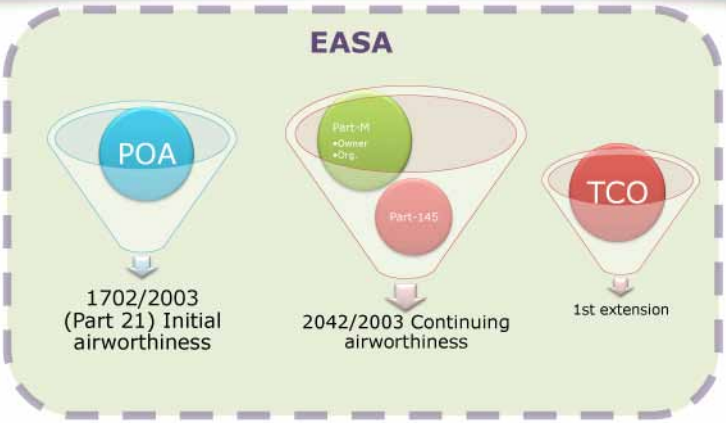
## AMC 20-8

- Acceptable Means of Compliance for Part-21, Part-145 and EU-OPS:
  - Content of a report
  - List of reportable occurrences compatible with those of Directive 2003/42/EC

## Reporting in PAN-EU



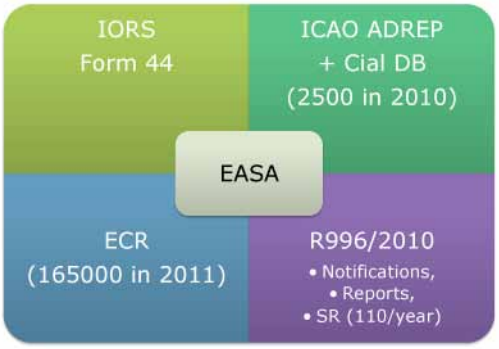
## Non EU-Organisations reporting



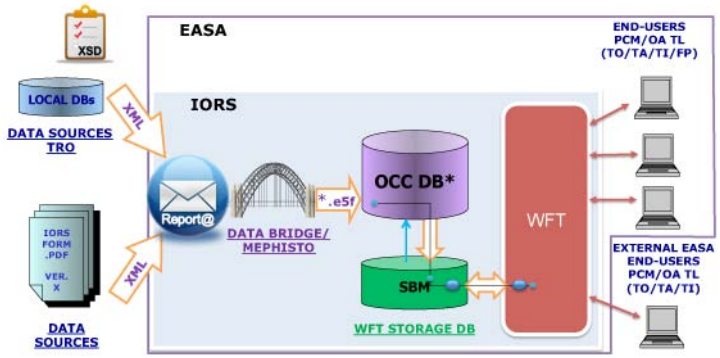

## Relevant agreements

- Bilateral Agreements
- MOU with the Performance review Body
- Global Safety Information Exchange

## Reporting sources

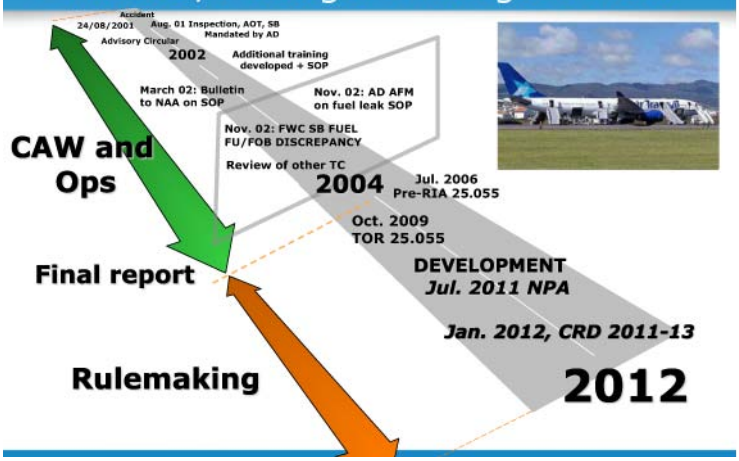


## IORS implementation: technical aspects




* - Occurrence database

## Air Transat A330 C-GITS Lajes, Azores, Portugal 24 August 2001




## Reactive approach to accident

**Precaution** What happened?

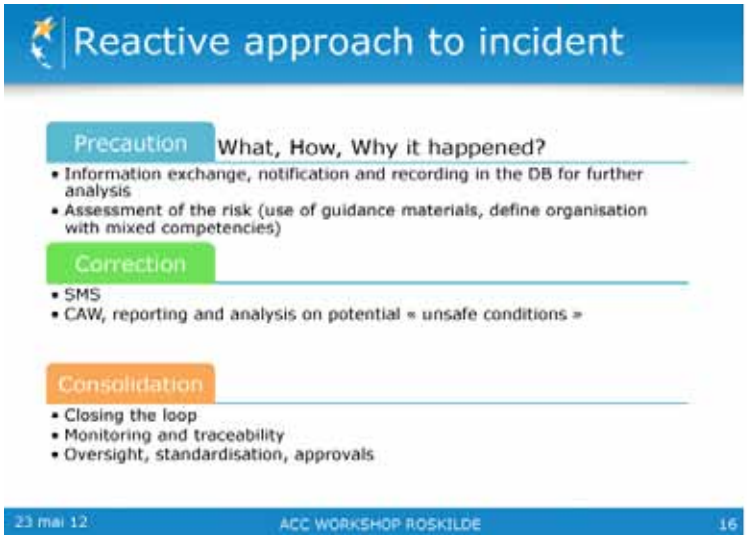
- Information exchange, notification
- Precautionary action

**Correction** How it happened?

- Test and researches, Investigation activities in different area of expertise
- CAW, reporting and analysis on potential « unsafe conditions »
- Incidents that endangers, or could endanger the safety of operation

**Consolidation** Why it happened

- Report and conclusions
- Impact assessment
- Globalisation


Reactive approach to incident
Precaution
What, How, Why it happened?
• Information exchange, notification and recording in the DB for further analysis
• Assessment of the risk (use of guidance materials, define organisation with mixed competencies)
Correction
• SMS
• CAW, reporting and analysis on potential « unsafe conditions »
Consolidation
• Closing the loop
• Monitoring and traceability
• Oversight, standardisation, approvals
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16


Questions?
- European Union Agency
- Technically Independent
- Legal and financial autonomy
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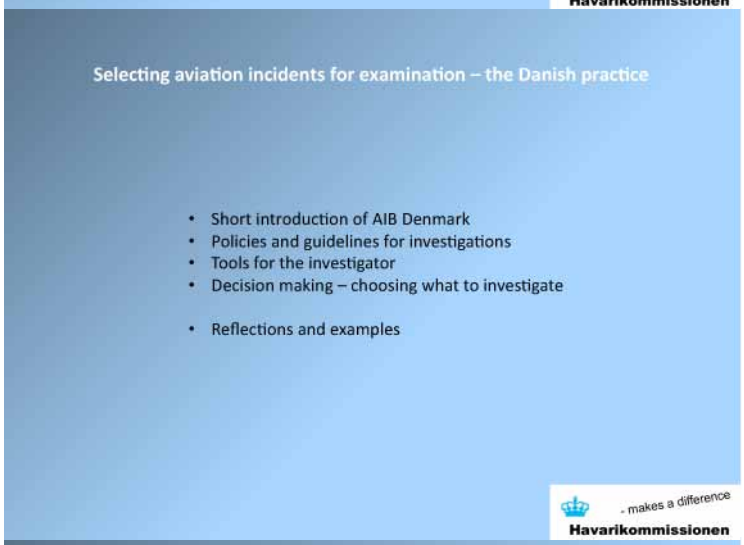
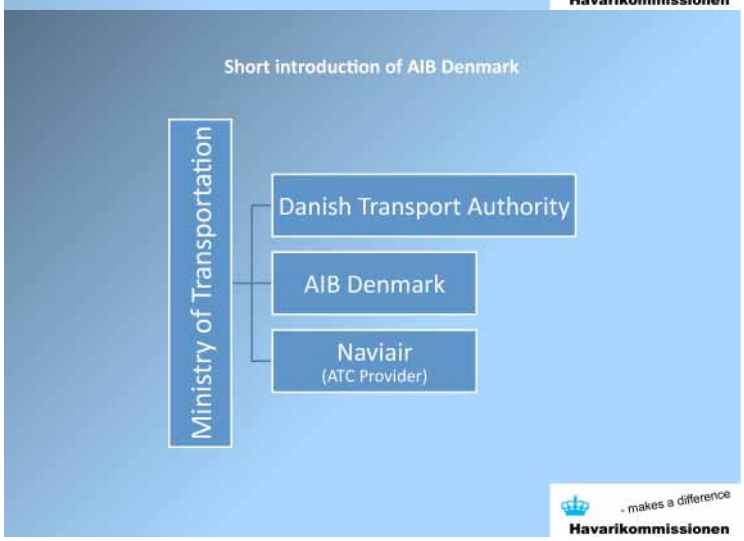
17

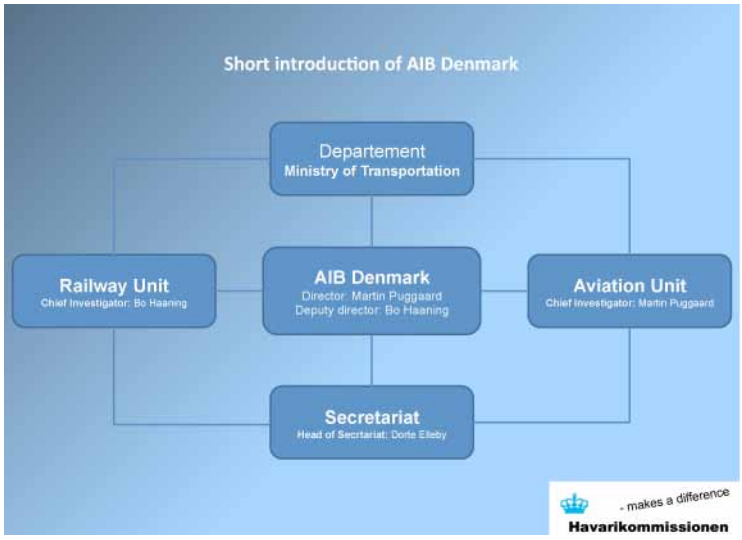
# SESSION 2: THE IDENTIFICATION OF AVIATION INCIDENTS MERITING INVESTIGATION

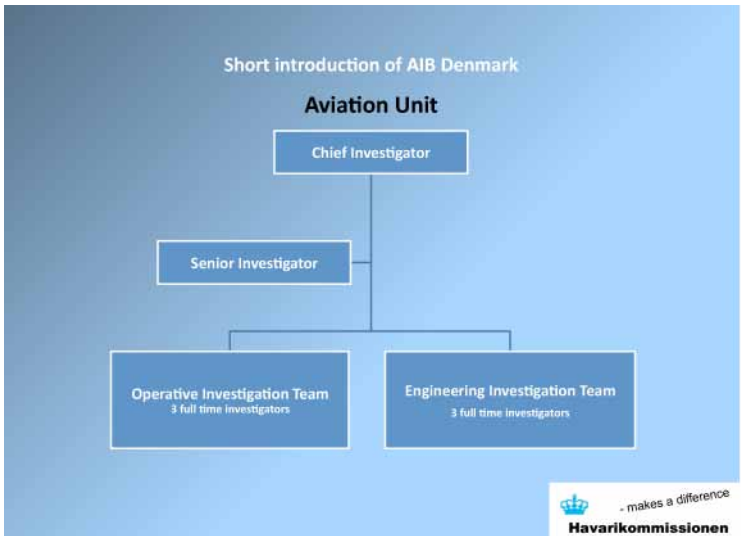
## SELECTING AVIATION INCIDENTS FOR EXAMINATION: DANISH PRACTICE

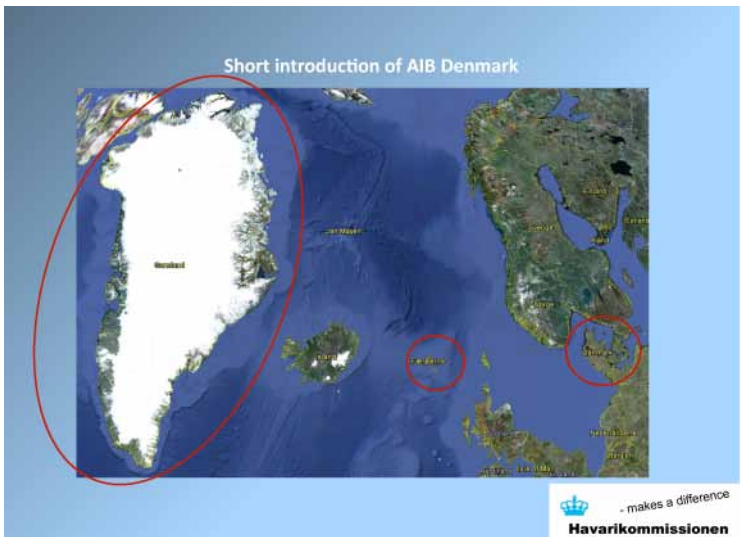
MARTIN PUGGAARD, CHIEF INSPECTOR OF AIR ACCIDENTS, ACCIDENTS INVESTIGATION BOARD, DENMARK


Short introduction of AIB Denmark
Departement
Ministry of Transportation
Railway Unit
Chief Investigator: Bo Haaning
AIB Denmark
Director: Martin Puggaard
Deputy director: Bo Haaning
Aviation Unit
Chief Investigator: Martin Puggaard
Secretariat
Head of Secrtariat: Dorte Elleby
- makes a difference
Havarikommissionen


Short introduction of AIB Denmark
Aviation Unit
Chief Investigator
Senior Investigator
Operative Investigation Team
3 full time investigators
Engineering Investigation Team
3 full time investigators
- makes a difference
Havarikommissionen


Short introduction of AIB Denmark
- makes a difference
Havarikommissionen

## Short introduction of AIB Denmark

| | 2011 | 2010 | 2009 |
|---|---|---|---|
| No. of reported occurrences | 160 | 215 | 211 |
| Closed after preliminary investigation | 47 | 93 | 85 |
| Accidents | 33 | 30 | 49 |
| Serious Incidents | 10 | 9 | 6 |
| Incidents | 70 | 78 | 71 |

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## Policies and guidelines for investigations

KVALITETSHÅNDBOG

| | | |
|---|---|---|
| Kapitel: 6<br>Afsnit : 6.3 | Titel : Havari- og hændelsesundersøgelse | Side : 3 af 3 |

| | | |
|---|---|---|
| Revision nr : 1 | Dato gyldig : 2008-11-05 | Erstatter : KHB udgave 1 |

| | |
|---|---|
| Bearbejdet af : MAP | Godkendt af : MAP |

**6.3.4 Havarikommissionens kriterier for gennemførelse af undersøgelse:**

a. Med udgangspunkt i Lov om luftfart – herunder Bekendtgørelsen om meldepligt – og EU Forordning 996/2010 samt ICAO Annex 13, foretages en indledende vurdering med henblik på at fastslå, om den pågældende sag falder ind under Havarikommissionens ansvarsområde.

b. Som led i denne proces frasorteres sager som ikke falder ind under kommissionens ansvarsområde. Disse sager arkiveres på CHA kontor under betegnelsen "no-action".

c. I sager som falder ind under Havarikommissionens ansvarsområde, gennemføres altid indledende dataindsamling og undersøgelse.
Resultatet af denne afleder - igennem en vurdering - beslutning om, hvorvidt en fuld undersøgelse skal gennemføres.

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## Policies and guidelines for investigations

KVALITETSHÅNDBOG

| | | |
|---|---|---|
| Kapitel: 6<br>Afsnit : 6.3 | Titel : Havari- og hændelsesundersøgelse | Side : 3 af 3 |

Bearbejdet af : MAP | Godkendt af : MAP

**Follow definitions in ICAO Annex 13**
**and**
**EU Regulation 996/2010**

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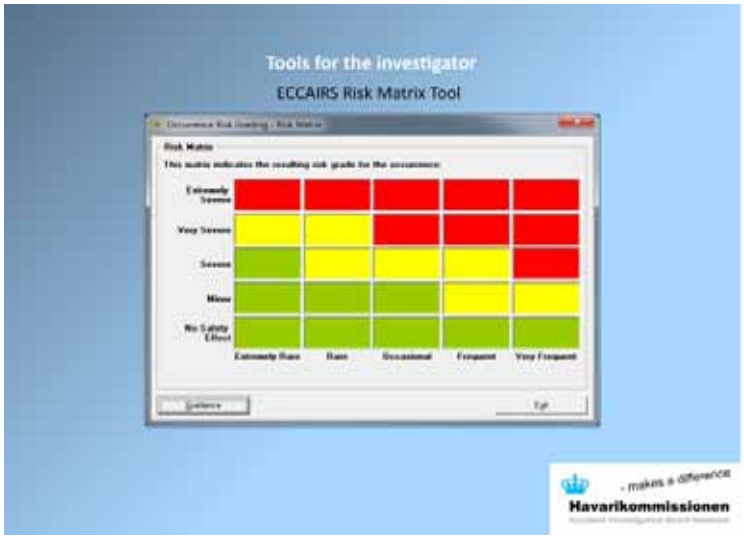
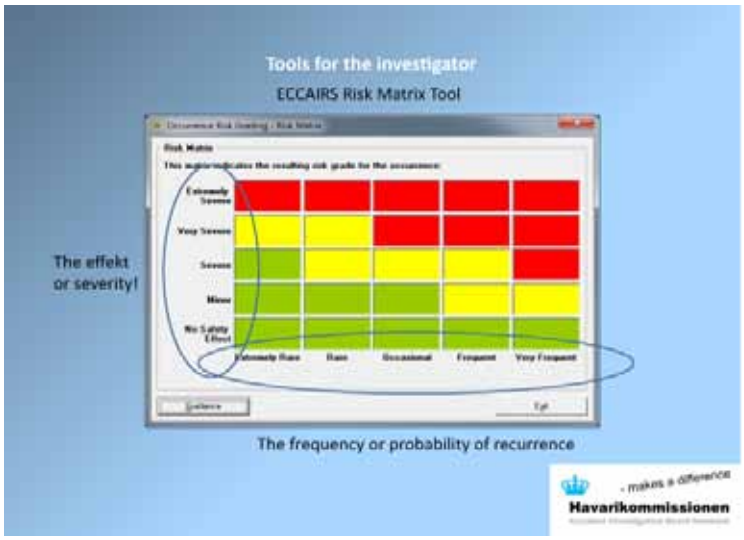
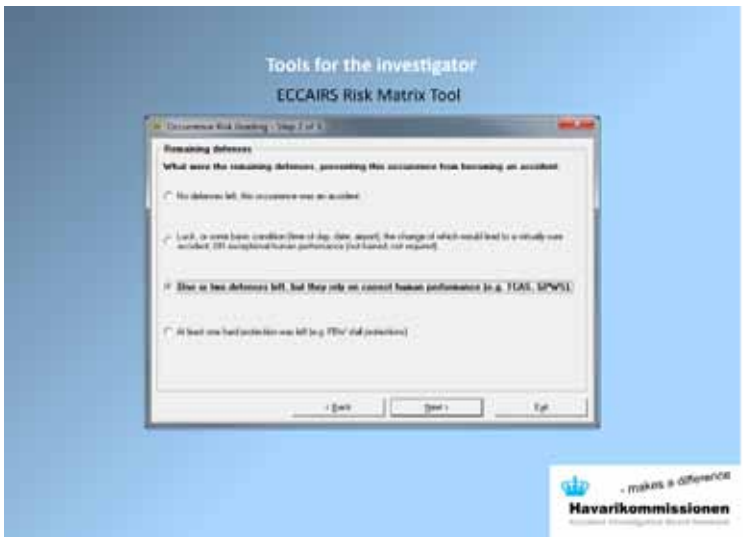
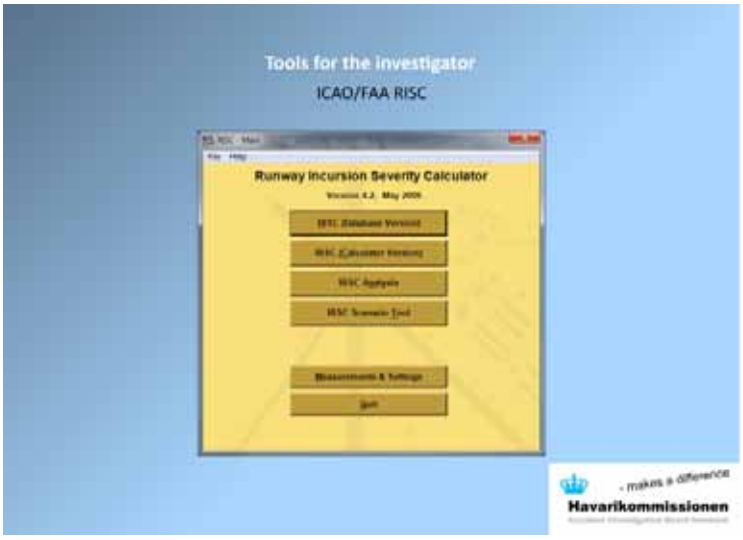
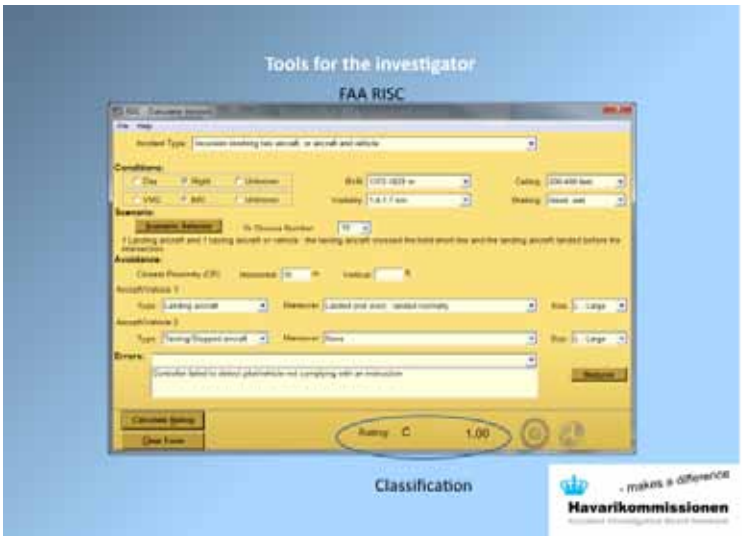
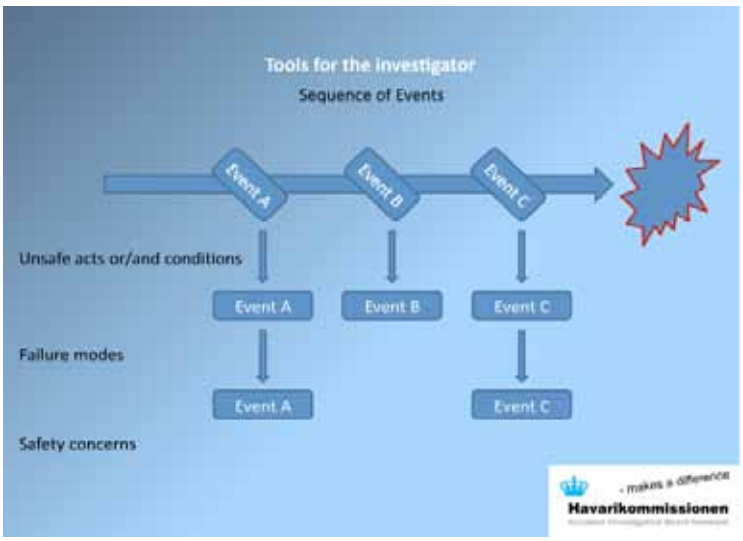

Tools for the investigator
ECCAIRS Risk Matrix Tool
Havarikommissionen


Tools for the investigator
ECCAIRS Risk Matrix Tool
The effekt
or severity!
The frequency or probability of recurrence
Havarikommissionen


Tools for the investigator
ECCAIRS Risk Matrix Tool
Havarikommissionen

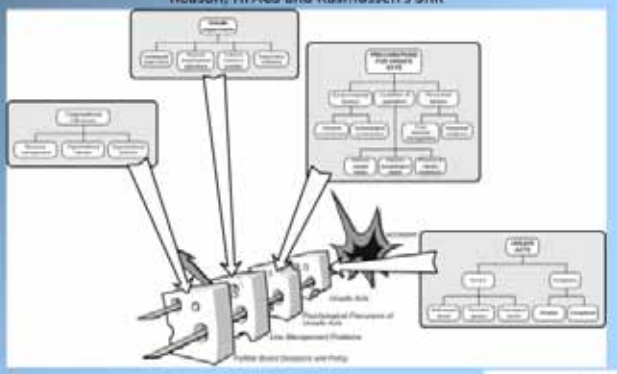

Tools for the investigator
ICAO/FAA RISC
Runway Incursion Severity Calculator
Havarikommissionen


Tools for the investigator
FAA RISC
Classification
Havarikommissionen


Tools for the investigator
Sequence of Events
Event A
Event B
Event C
Unsafe acts or/and conditions
Event A
Event B
Event C
Failure modes
Event A
Event C
Safety concerns
Havarikommissionen

## Tools for the investigator

Reason, HFACS and Rasmussen's SRK



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## Decision making – choosing what to investigate

If the tools doesn't helps you!

When an occurrence is reported

1. Investigator on duty receives the report
2. Occurrence is assessed and initial actions is decided
   *Investigator uses the helping tools if need*

If initial information/data is unclear/insufficient and tools doesn't help!

3. Back-up/Senior/Chief investigator is consulted
4. Once a week all available investigators meet and all unclassified cases are consulted.

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## Reflections and examples

- **Guidelines, procedures, checklists** *versus* **7 different approaches**
- **Use of occurrence database in order of evaluating the data collection process**
- **Constant debate /discussions of what and why we investigate different kind of occurrences and others is not to be investigated**
- **Sharing points of view (the above) with aviation community (those who reports to the AIB)**

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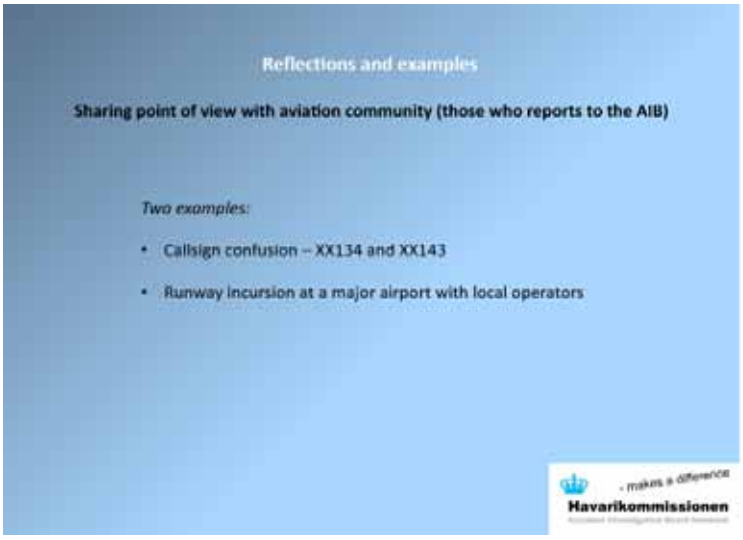
Reflections and examples
Sharing point of view with aviation community (those who reports to the AIB)
Two examples:
• Callsign confusion – XX134 and XX143
• Runway incursion at a major airport with local operators
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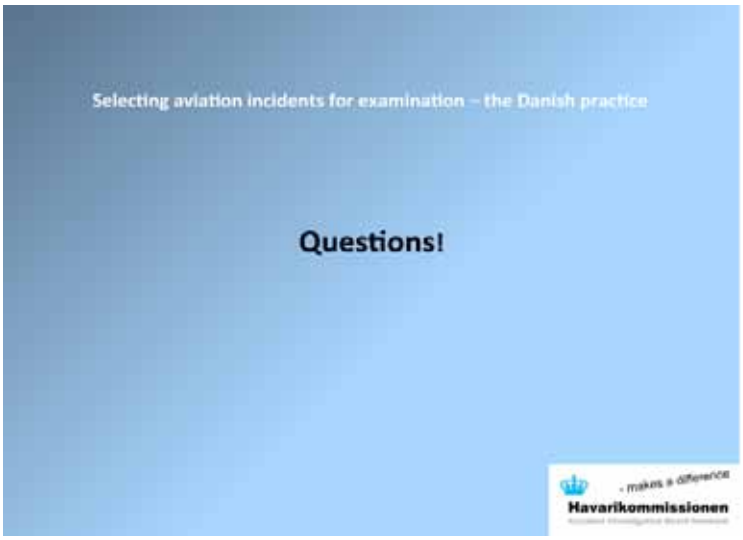
Selecting aviation incidents for examination – the Danish practice
Questions!
- makes a difference
Havarikommissionen

## IDENTIFICATION OF INCIDENTS TO INVESTIGATE: FRENCH PRACTICE

EREL RAVEL AND ARNAUD DESJARDIN, BUREAU D'ENQUÊTES ET D'ANALYSES POUR LA SÉCURITÉ DE L'AVIATION CIVILE, FRANCE

BEA

**Identification of incidents to investigate: the French practice**

ECAC ACC
Workshop on the Treatment of Incidents
Roskilde, Denmark, Tuesday 15 – Wednesday 16 May 2012

www.bea.aero

### Outline

- ✓ Context of incident treatment at the BEA
- ✓ Workflow
- ✓ Feedback & bilateral agreements with operators

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### Legal framework

- ✓ **EU 996/2010, article 2 (7)**

  (7) 'incident' means an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation;

- ✓ **EU 996/2010, article 2 (16)**

  (16) 'serious incident' means an incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft, ...

- ✓ **EU 996/2010, article 5.4**

  4. Safety investigation authorities may decide to investigate incidents other than those referred to in paragraphs 1 and 2, as well as accidents or serious incidents to other types of aircraft, in accordance with the national legislation of the Member States, when they expect to draw safety lessons from them.

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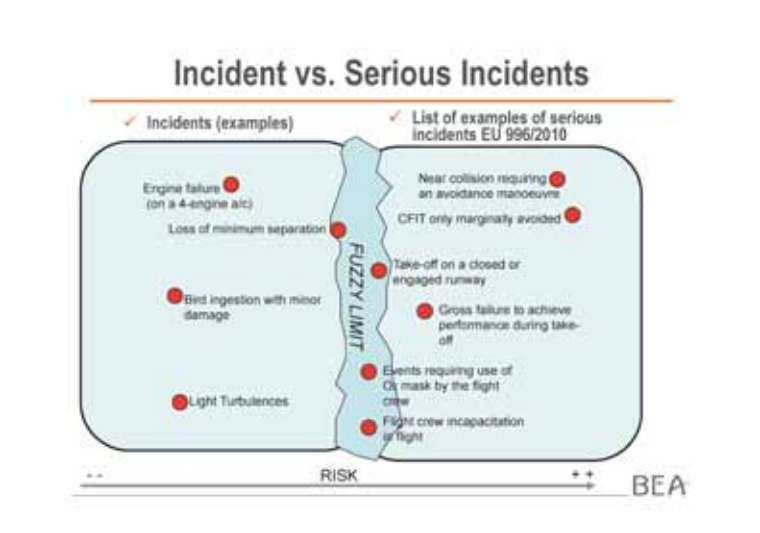


## Risk assessment

- ✓ Like for SMS
- ✓ Takes into account:
  - ✓ Consequence
  - ✓ Probability of occurrence
  - ✓ Robustness of protection mechanisms (soft and hard)
    - ✓ Procedures
    - ✓ Training
    - ✓ Best practices
    - ✓ Systems (TCAS, GPWS...)

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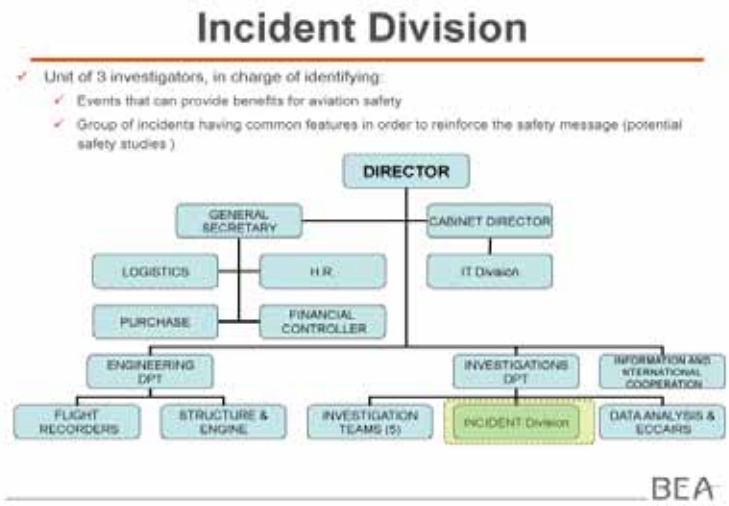

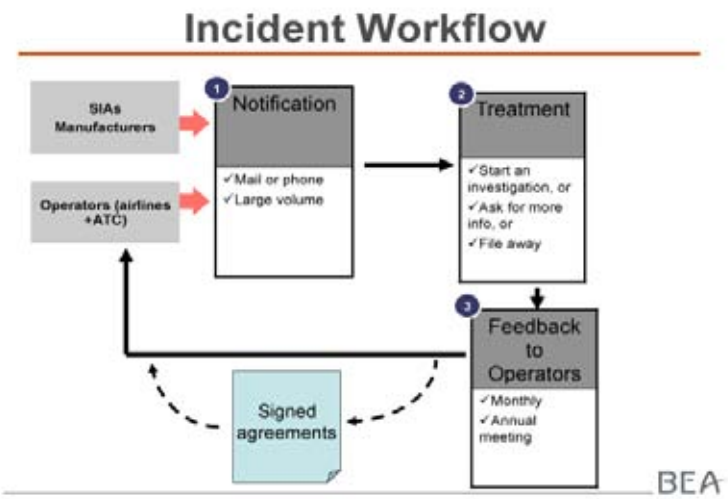


## 1 Notification of incidents

- ✓ Generally by mail; by phone in case of serious incident
- ✓ Notifications non homogeneous and in excess
- ✓ Goal : decrease the number of notifications without interest and increase efficiency of treatment

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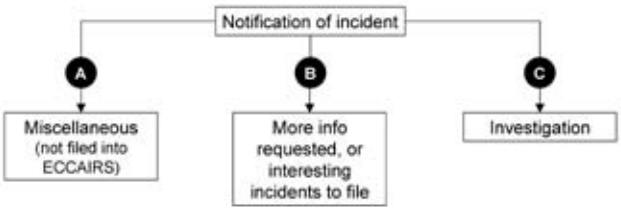
## 2 Treatment

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## Case A - Miscellaneous

- ✓ Criteria use during the daily review of new notifications:
  1. Did the appropriate procedure successfully resolve the problem?
  2. Is there an added value of the BEA compared to the
     - ✓ operator's internal review?
     - ✓ the oversight authority review?
  3. Is the risk low?
- ✓ Weekly cross check by the Incident division
- ✓ Coordination BEA/French DGAC through a "service contract"
  - ✓ State Safety Plan
  - ✓ Access to ECCAIRS database

BEA

## Case A - Miscellaneous

- ✓ Examples
  - ✓ Bird strike without any damage
  - ✓ Pressurization failure –> return to airport
  - ✓ Non stabilized approach –> Go Around
  - ✓ Alarms during TO –> rejected TO before V1
  - ✓ LG not uplocked
  - ✓ Erroneous taxiing
  - ✓ Inadvertent slide deployment

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## Case B - More info / Interesting Incidents

- ✓ Interest for safety
- ✓ Insufficient information to decide if an investigation should be launched
  - ✓ More info needed for a better risk assessment
- ✓ Daily review
- ✓ Filed in ECCAIRS
- ✓ Feedback to operators to "teach" what to notify to the BEA

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## Case B - More info / Interesting Incidents

- ✓ Examples
  - ✓ Alarm "Cargo Door" during roll
    - ✓ Q: at what level is it not possible for the door to open? REX on aeronautical noise?
  - ✓ Wake turbulence during approach
    - ✓ Q: Parameters analysis
  - ✓ Hard landing
    - ✓ Q: Parameters analysis
  - ✓ Erroneous parameters at TO
    - ✓ Q: Refer to safety study "use of erroneous parameters at TO"
  - ✓ Interception of false glide on AP
    - ✓ Q: Parameters analysis: altitude and attitude mainly

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## Case C - Investigation

- ✓ Incidents for which the BEA can bring an added value for BEA investigation
- ✓ Incident investigation: the benefits of accident investigation, without the main drawbacks:
  - ✓ The crew is still here to be interviewed
  - ✓ FDR and other avionics equipment available for download
  - ✓ Less pressure to explore systemic issues
  - ✓ BUT: CVR often overwritten!
    - ✓ Operator/BEA agreements to mitigate this aspect
    - ✓ Opened Safety Recs to extend the CVR duration

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## Case C - Investigation

- ✓ When appropriate, group incidents to analyze the systemic issues
- ✓ Safety studies currently ongoing:
  - ✓ Airplane State Awareness During Go Around
  - ✓ Loss of separation during simultaneous approach in Paris Charles de Gaulle terminal airspace
- ✓ Studies already published on the BEA's website:
  - ✓ Aerodrome traffic
  - ✓ Hydraulic failure
  - ✓ Runway incursions
  - ✓ Operating in winter conditions
  - ✓ Runway overrun upon landing
  - ✓ Turbulence in Air Transport
  - ✓ Wind gradients and turbulence
  - ✓ Tail strikes on takeoff and landing
  - ✓ TCAS events
  - ✓ Coordination with ground services
  - ✓ Icing
  - ✓ Destabilization on Landing
  - ✓ Use of Erroneous Parameters at Takeoff
  - ✓ ...

See http://www.bea.aero/en/publications/ta/index.php and http://www.bea.aero/en/publications/studies/analyses.php

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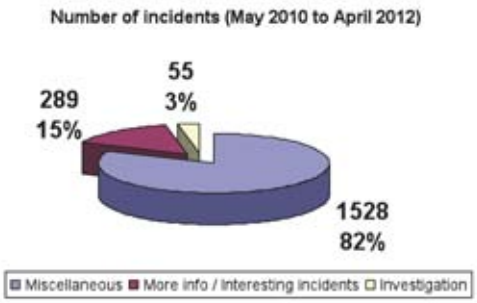
## Stats on the treatment

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## ❸ Feedback to operators

- ✓ Monthly feedback
  - ✓ To educate the operators on what to notify
  - ✓ To decrease the number of "miscellaneous" incidents
- ✓ Annual meeting
  - ✓ Feedback
  - ✓ Regulations
  - ✓ Major investigations and studies
  - ✓ Recommendations on incidents
  - ✓ Internal investigation vs BEA investigation

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## Special agreements with operators

✓ 7 airlines:

✓ French ANSP (DSNA): coming soon

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## Content of the Special Agreements

- ✓ List of events to notify to the BEA
- ✓ Notification process
- ✓ Data Preservation
  - ✓ FDR
  - ✓ CVR
  - ✓ Other
- ✓ Coordination between the operator's internal investigation and the BEA's one
- ✓ Release of information
- ✓ BEA/operator relation
  - ✓ BEA assistance to an internal investigation
  - ✓ Common safety studies
  - ✓ Annual reports

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## Conclusion

- ✓ The BEA has a dedicated unit for Incidents
- ✓ Objective: get the "right" amount of notifications
  - ✓ More notifications from more operators
  - ✓ And better quality
- ✓ Good cooperation with operators
- ✓ The detection of "interesting" incident:
  - ✓ Procedures and methodology are in place,
  - ✓ But still a challenge
  - ✓ Relies on the safety culture
  - ✓ The BEA is open to improve its procedures based on this workshop inputs

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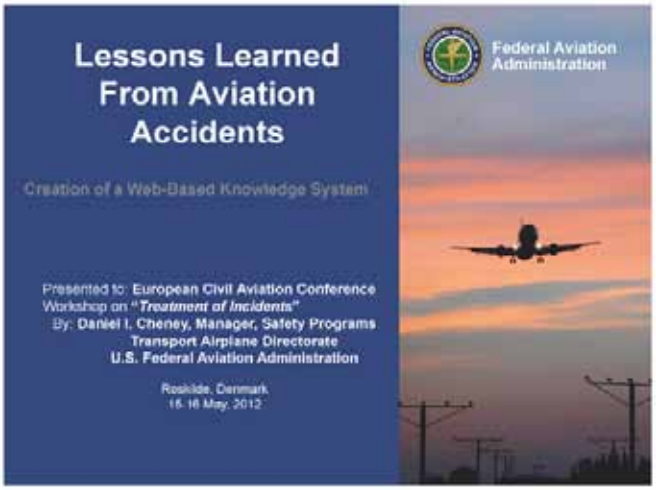
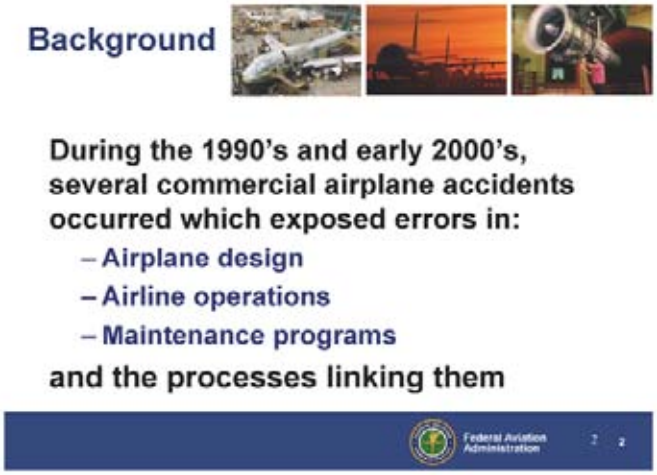
www.bea.aero

## LESSONS LEARNED FROM COMMERCIAL AVIATION ACCIDENTS: CREATION OF A WEB-BASED KNOWLEDGE SYSTEM

DANIEL CHENEY, SAFETY PROGRAMME MANAGER, FAA TRANSPORT AIRPLANE DIRECTORATE, USA




## TWA Flight 800

**747 crash off the coast of Long Island, NY**

- Center fuel tank exploded in flight
  - Flawed assumptions regarding fuel tank components

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## Swissair Flight 111

**MD-11 crash off the coast of Nova Scotia**

- Electrical arc resulted in cabin insulation material that burned aggressively
  - Flawed assumptions regarding burn characteristics

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## Alaska Flight 261

**MD-80 crash off the coast of California**

- Loss of control resulting from failure of horizontal stabilizer trim jackscrew
  - Flawed assumption regarding failure mode


Federal Aviation Administration

## American Eagle Flight 4184

**ATR 72 crash near Roselawn, Indiana**

- Ice contaminated wing surface and loss of airplane control
  - Flawed assumption regarding ice accumulation


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## Accident Awareness Lacking

- **The FAA identified lack of accident knowledge as a factor in these and other major accidents**
- **Lack of detailed understanding of major accidents is common**
  - misinformation, rumors, etc.

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## Costly lessons from these and many other major accidents were being lost by the passage of time

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**"Those who cannot remember the past are condemned to repeat it."**

George Santayana
Professor of Philosophy
Harvard University
The Life of Reason, Volume I
1905

**Nearly all large commercial aviation accidents are enormous human tragedies**

**A second tragedy is to not learn from them.**

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## Barriers to Accident Knowledge

- Fear of negative publicity
- Lengthy investigation/resolution
- "Not my job"
- "That's an old accident- not relevant today"
- IT tools only recently available

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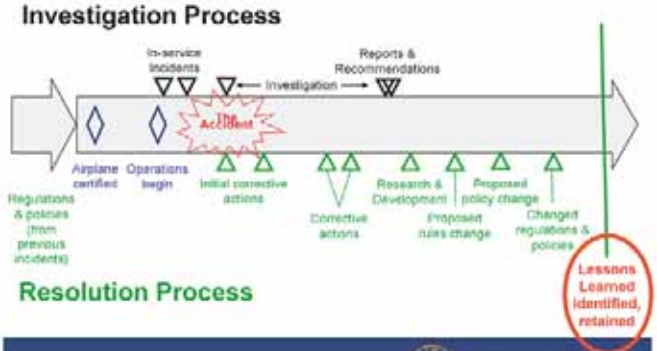
## Commercial Accident Life Cycle

**Investigation Process**




**Resolution Process**

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## FAA Initiative

- The FAA has now developed a web based ***"Lessons Learned from Transport Airplane Accidents"*** library
  - Includes the majority of key historical accidents
  - Life Cycle/Threat/Common Theme based
  - Initial release Fall of 2008; annual additions

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## Accident Lessons Related To:

- Unstabilized Approaches
- Incomplete Checklists
- Maintenance Errors
- Envelope Exceedances
- Flawed Design Assumptions
- Poor CRM
- Many others

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## The LL Library Is:

- Available public accident information
- Investigation AND resolution content
- Broadly applicable lessons

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## The LL Library is NOT:

- Re-investigation of any accident
- Assessment of *fault* or *blame*
- A collection of all accidents; only those with high lesson value

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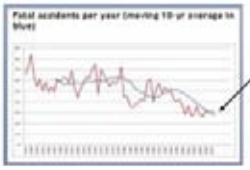
## Commercial Aviation Is Very Safe

- We are in the safest period in the history of global aviation
  - International safety initiatives paying off
- Not a single fatality within US for 2011
  - Nearly one billion passengers flown
- Improvements still needed




28 Accidents Worldwide (2011)


507 Fatalities Worldwide (2011)

Source: Aviation Safety Network-Worldwide data

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## Loss of control (LOC), controlled flight into terrain (CFIT), and runway mishaps remain major areas

**Fatalities by CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories**
**Fatal Accidents – Worldwide Commercial Jet Fleet – 2001 Through 2010**


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Loss of control remains major risk
-Improved training/equipment is key
-Intervention begins with knowledge
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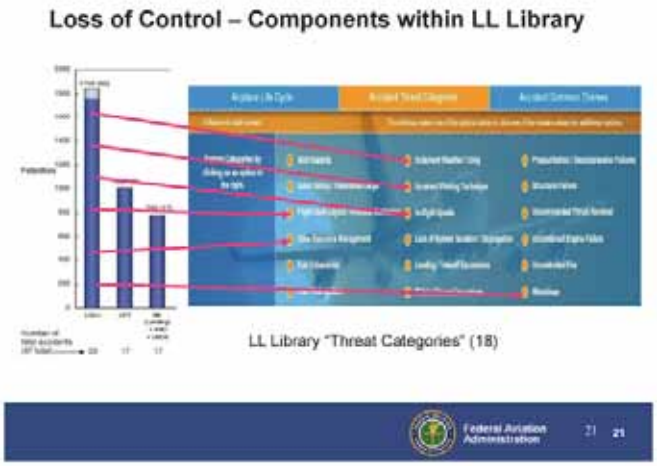
Loss of Control – Components within LL Library
LL Library "Threat Categories" (18)
Federal Aviation Administration


Loss of Control – Components within LL Library
LL Library "Threat Categories" (18)
Federal Aviation Administration

## Maintain/ Improve Safety

- ***Complacency*** **must be guarded against**
  - Can't assume safe future is a "given"
- ***"Intellectual turnover"*** **is a continual challenge**
  - Inexperience replacing experience is a reality

**Accident LL Library is one of the tools that can help guard against *complacency* and loss of knowledge through turnover**

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## Precursor Recognition

- **Lessons learned knowledge enhances accident precursor recognition**
  - Can facilitate targeted intervention- find/fix the "gaps"
  - Proactively remove hazards

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## Current Library Users

- **10,000+ Subscribers worldwide**
  - **Airplane Manufacturers**
  - **Engine Manufacturers**
  - **Airlines**
  - **Academia**
  - **Accident Investigators**
  - **Aviation Authorities**
  - **Training Organizations**

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## Purpose of Accident Library

- Identify and retain costly safety lessons
  - Available for today's aviation safety workforce
- Maintain and improve the safety of an already very safe commercial aviation system
  - Retain and reapply costly knowledge from generation to generation

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## Summary

- A web-based Accident Library is now available to enhance the safety of an already very safe commercial aviation system
  - Currently available at: http://accidents-ll.faa.gov/
  - 62 accident modules; more added each year

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## The Lessons Learned web site will now be demonstrated @ accidents-ll.faa.gov/

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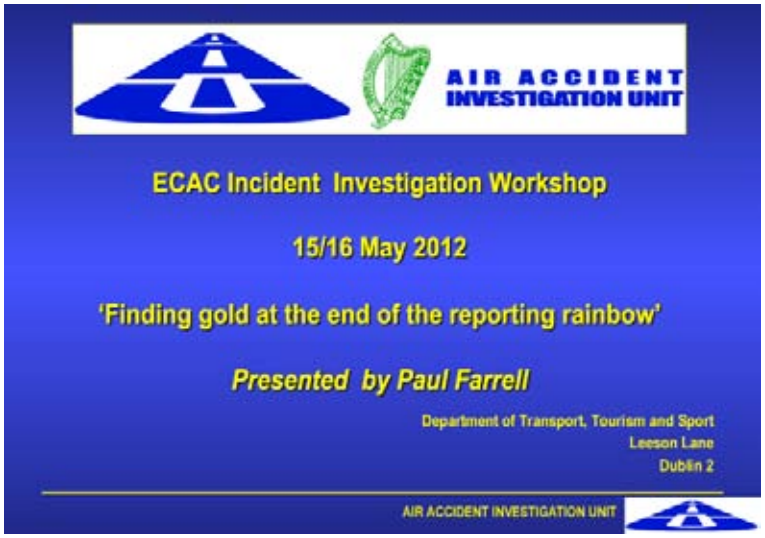
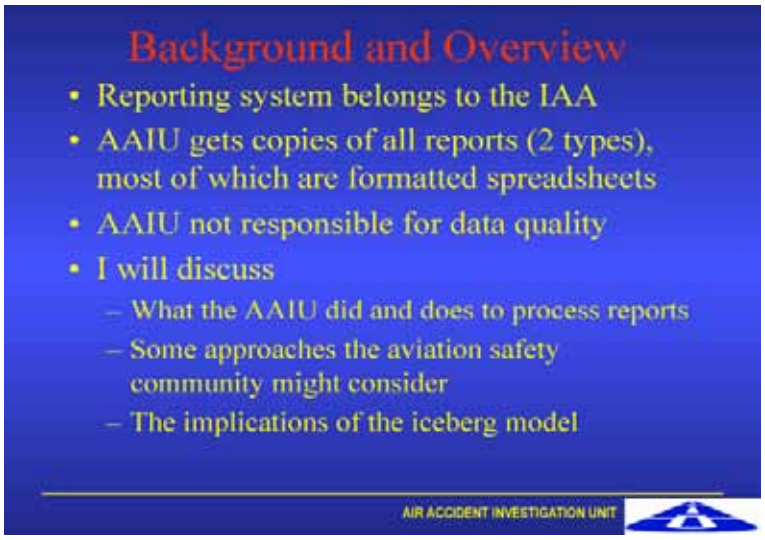
## FINDING GOLD AT THE END OF THE REPORTING RAINBOW

PAUL FARRELL, IRISH AIR ACCIDENT INVESTIGATION UNIT

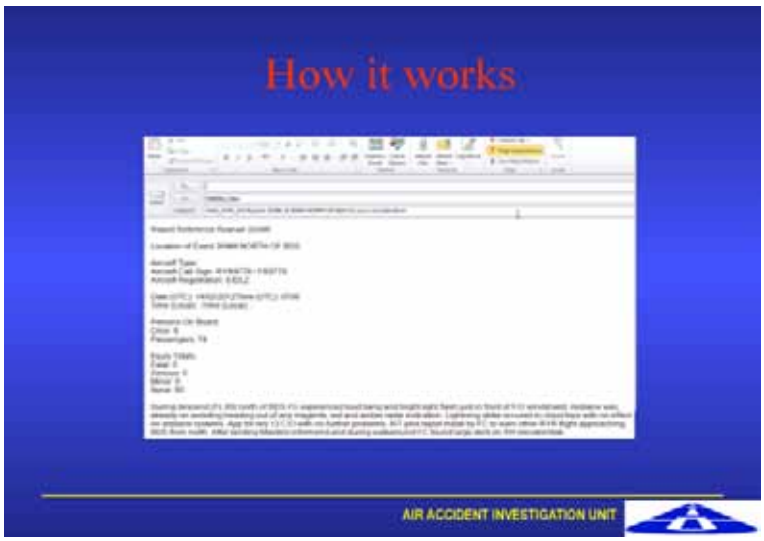




The Workload
SOTS Reports
Estimating 7,400+ for 2012!
2006
2007
2008
2009
2010
2011
AIR ACCIDENT INVESTIGATION UNIT


Mailbox
Database
Investigation
No further action required
Further action required
AIR ACCIDENT INVESTIGATION UNIT


How it works
AIR ACCIDENT INVESTIGATION UNIT

## Quick Query

AIR ACCIDENT INVESTIGATION UNIT

## Problems

- Data accuracy/consistency e.g. Location of event could be reporting point, airport (ICAO or IATA), runway, phase of flight (En-route)
- Ideally it should include State and FIR; without this determining state of occurrence is more difficult and analysing airspace hotspots is very difficult/impossible.
- How can effects of changed ATC procedures be monitored without this data?

AIR ACCIDENT INVESTIGATION UNIT

## Coding can obscure information

- Operators often classify events by outcomes e.g. Passenger Injury, Crew Injury
- Safety investigators are concerned with causes
- Causes which aren't classified may possibly be found in the occurrence description
- You only get the right answer if you ask the right question

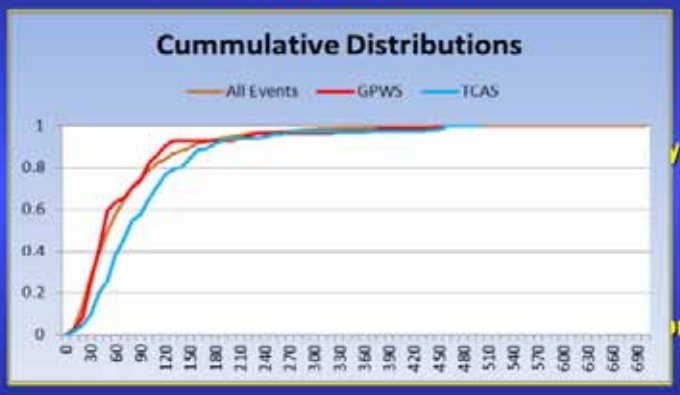
AIR ACCIDENT INVESTIGATION UNIT

## What really matters

- The real meat of the report is in the text description of the occurrence --- which doesn't always match the assigned coding(s)
- Can reports be profiled based on the text description of the occurrence?

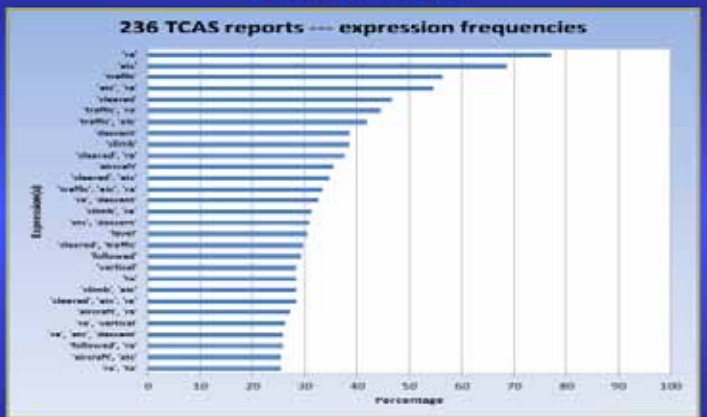
AIR ACCIDENT INVESTIGATION UNIT

## Word Counts




AIR ACCIDENT INVESTIGATION UNIT

## Correlations




AIR ACCIDENT INVESTIGATION UNIT

## What use is all of this?

- Looking in the text may provide indication of causal factors
- It may be possible to have a decision support system to identify reports meriting further attention
- Data-mining may be able to identify otherwise hidden trends
- Warning!!! It isn't easy and it will be subject to cultural and language influences, as well as corporate culture issues

AIR ACCIDENT INVESTIGATION UNIT

## Do we really believe in icebergs?

- When Accidents and Serious Incidents occur we should be able to find precursor incidents in the database. If not, why not? How do we fix it? If so, what was missed and why? How do we fix it?
- Should ICAO mandate Annex 13 examination of occurrence reporting systems for precursor events/ missed opportunities?
- Is enough being done to explore our report data to proactively identify trends which require attention to prevent accidents and serious incidents?
- If we say "I'm not surprised!", have we failed???

AIR ACCIDENT INVESTIGATION UNIT

## UK AAIB's Policy for Responding to Incidents

Keith Conradi, Chief Inspector, UK Air Accident Investigation Branch


SERIOUS INCIDENTS IN THE UK

| Date | Accidents GA | Accidents CAT | Serious Incidents |
|---|---|---|---|
| 2007 | 51 | 6 | 21 |
| 2008 | 39 | 11 | 18 |
| 2009 | 40 | 7 | 14 |
| 2010 | 25 | 5 | 14 |
| 2011 | 30 | 2 | 18 |
| Total | 185 | 31 | 85 |

## AAIB RESPONSE TO SERIOUS INCIDENTS

**AAIB Policy:**

Consistent
Best use of available resource
Underlying trends
Risk of not investigating (eg UKAB)

## AAIB RESPONSE TO SERIOUS INCIDENTS

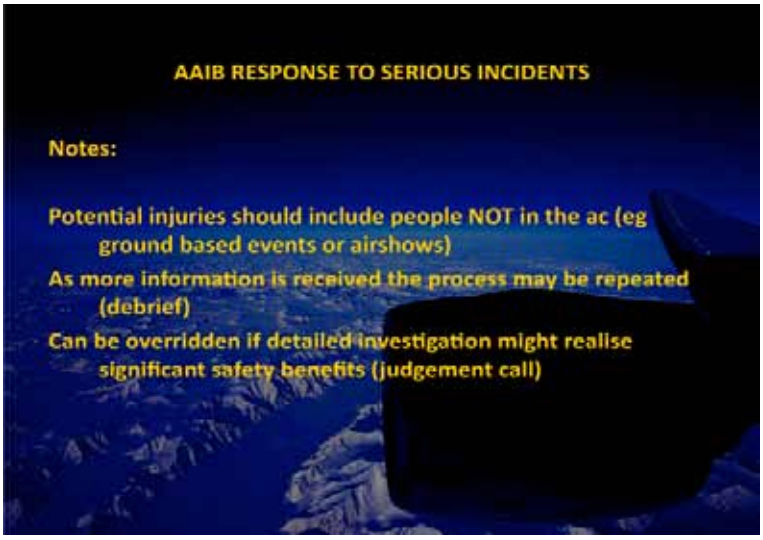
**Event Risk Classification**

2 Questions:

- What is the worst *credible* outcome that might have occurred had the event escalated?
- What was the effectiveness of the remaining barriers between what actually happened and the worst credible outcome?

## AAIB RESPONSE TO SERIOUS INCIDENTS

| Question 1<br>What is the worst credible outcome? | | Question 2<br>What was the effectiveness of the barriers remaining between the event and the worst credible outcome? | | | |
|---|---|---|---|---|---|
| | | High | Medium | Low | Not effective |
| Catastrophic | Loss of aircraft multiple (3+) fatalities | 50 | 102 | 502 | 2500 |
| Serious | 1 or 2 fatalities; multiple serious injuries; major damage to aircraft | 10 | 21 | 101 | 500 |
| Minor | Minor injuries; minor damage to aircraft | 2 | 4 | 20 | 100 |
| No further potential | No potential damage or injury could occur | 1 | | | |


AAIB RESPONSE TO SERIOUS INCIDENTS
Notes:
Potential injuries should include people NOT in the ac (eg ground based events or airshows)
As more information is received the process may be repeated (debrief)
Can be overridden if detailed investigation might realise significant safety benefits (judgement call)

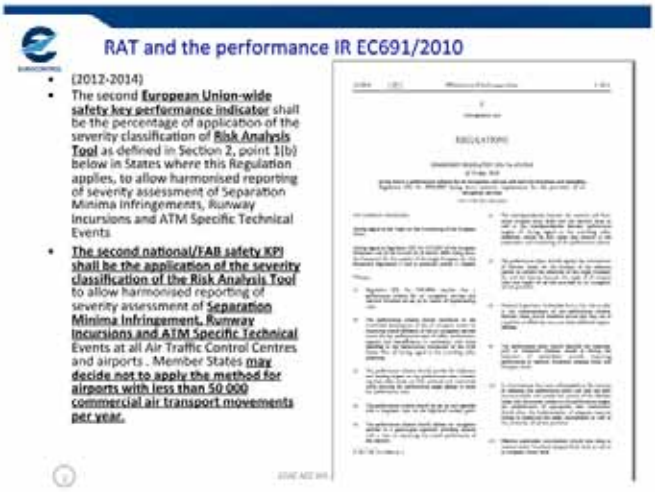

CONSIDERATIONS
ICAO guidelines
Late reporting
Performance takeoff problems

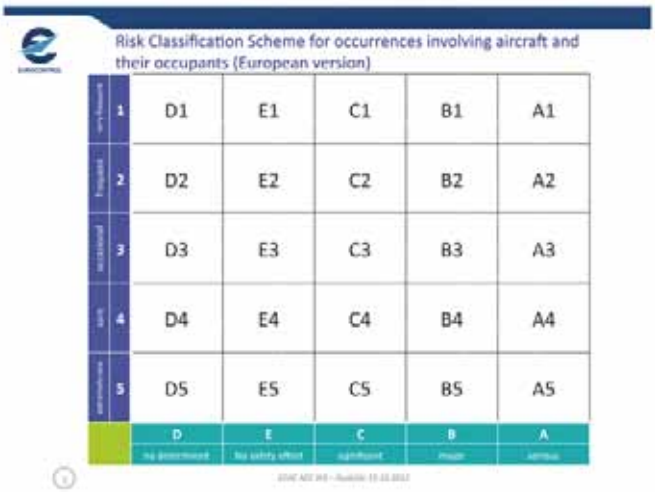

B737 G-THOF


A300 TF-ELK

## EUROCONTROL's 'RISK ANALYSIS TOOL': A SEVERITY AND RISK ASSESSMENT METHODOLOGY FOR REPORTED ATM INCIDENTS

*DRAGICA STANKOVIC, EUROCONTROL*

Risk Classification Scheme for occurrences covering the capability to deliver safe ATM services (European version)

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | D1 | E1 | C1 | B1 | A1 | AA1 |
| 2 | D2 | E2 | C2 | B2 | A2 | AA2 |
| 3 | D3 | E3 | C3 | B3 | A3 | AA3 |
| 4 | D4 | E4 | C4 | B4 | A4 | AA4 |
| 5 | D5 | E5 | C5 | B5 | A5 | AA5 |
| | D | E | C | B | A | AA |

## Why RAT/RAP/RAE ?

### Risk Analysis Tool/Process/Events

The RAT/RAP is a tool meant for assessing RAE:

- Service Providers – as part of their SMS *(The ATS Unit Manager perspective: the safety performance of his unit )*
- Regulators – as part of the Aviation-wide sector oversight *(Representing the airline passenger perspective: how safe is it to travel by air)*
- *Can be used by airlines too*

## Why Risk Analysis?

The Risk Analysis allows setting priorities:

## Risk Analysis Tool Aim (De-mystifying what is and what can do)

Ambition was to have a tool that is:

- Simple
- Easy to use
- Efficient/reliable (at least for 80/90% of cases)

Realism is that the tool:

- Will not provide the golden truth
- May not work well for complex incidents
- will still rely on experience and knowledge of experts

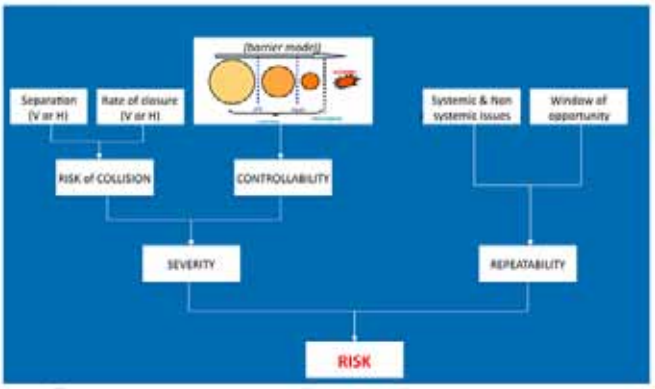
## Guidelines, SOPs available & EASA AMC

## Moving to a modern Web based application

## Moving to a modern Web based application


http://rate.corporate-hosting.eu/

## How does RAT work?




## Rules for organisation(s) SOP – The FAA Example

**Applicability**
The Risk Analysis Tool is to be applied to radar incidents involving two or more airborne aircraft with a Measure of Loss (MOL) of less than 66 percent. The tool contains separate spreadsheets for wake and non-wake events.

In order to prevent the introduction of inadvertent bias to Risk Analysis Tool values, data entry should be completed by a group of experts in possession of as much investigatory and factual information as possible.

**Risk Analysis Moderation Panel**
The Office of Quality Assurance will determine those events eligible for Risk Analysis, called Risk Analysis Events (RAEs), and will collect data for reliable analysis.

The panel will consist of three to five experts trained in the use of the tool. These experts will have diverse backgrounds from ATC, human factors, and/or flight operations.

## Rules for organisation(s) SOP – The FAA Example

**Panel Qualification and Currency**

There are multiple requirements for experts to participate on a Risk Analysis Moderation Panel, including experience, judgment, objectivity, and reliability. In addition, participants must have a clear understanding of the concept of risk as defined in this document and its application in the ATC environment.

**Nomination Process**

The Manager of Quality Assurance will nominate, in writing, candidates for panel participation. Nominations should include a brief summary of the characteristics and qualifications noted above and will be submitted to the Director of Quality Assurance, who will select appropriate candidates from the pool of nominees

**Member Training and Currency**

To ensure quality and standardization, panel members must be properly trained and qualified. Once qualified, individuals are responsible for maintaining their currency requirements as detailed in this section. Panel members must notify the chair if their currency lapses.

In order to receive initial qualification as a Risk Analysis Moderation Panel member, candidates must:

- Read and become thoroughly familiar with the most current SOP and other documentation
- Attend a one-day training session conducted by the chair or his/her designee
- Observe at least three RAE analyses

## What next ? Proper Risk Management

***Numbers for demo only (not real)***

Number of Separation Minima Infringements (Risk ATM GND) in RAT-Risk-Matrix

| Repeatability | | Severity: high | | | | low |
|---|---|---|---|---|---|---|
| | | A | B | C | E | D |
| | Σ-> | 4 | 15 | 83 | 124 | |
| high | 1 | 0 | 0 | 0 | 5 | Not relevant for GND, as there is always enough information available for investigation and assessment of risk |
| | 2 | 0 | 1 | 2 | 8 | |
| | 3 | 1 | 3 | 11 | 23 | |
| | 4 | 1 | 4 | 27 | 34 | |
| low | 5 | 2 | 7 | 43 | 84 | |

| SMI ATM GND total |
|---|
| 226 |
| 21 |
| 51 |
| 154 |

Risk to be monitored

## FAA Initial results - Issues Identified using RAT (2010)

- OJTI performance
- ATC recovery methods
- RNAV procedures and mitigation strategies
- Misapplication of Visual Separation
- Turns to Final

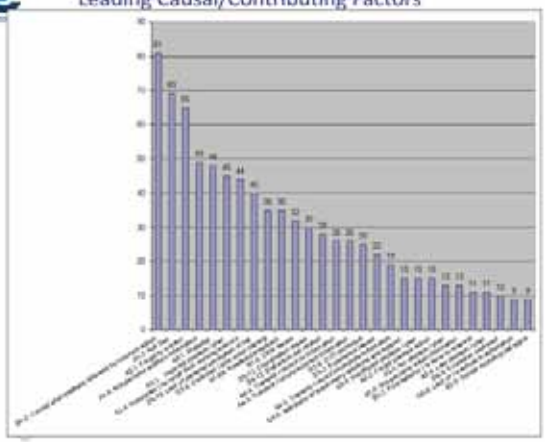
## FAA Initial results - Recommendations (2010)

- Review of OJTI selection and training methods
- Enhanced simulation training on recovery methods used as a result of OEs or PDS
- Strict adherence to local RNAV departure procedures, waivers, and mitigation requirements

## Top 5 FAA Hazard Risks derived with RAT as of today

1. Arrival Sequencing: Speed and Angle of Vectors
2. Arrival Sequencing: Turn ons at Same Altitude
3. Clearance Compliance: Altitude. e.g., level busts
4. Go Arounds
5. Coordination. e.g., lack of coordination or incorrect coordination.

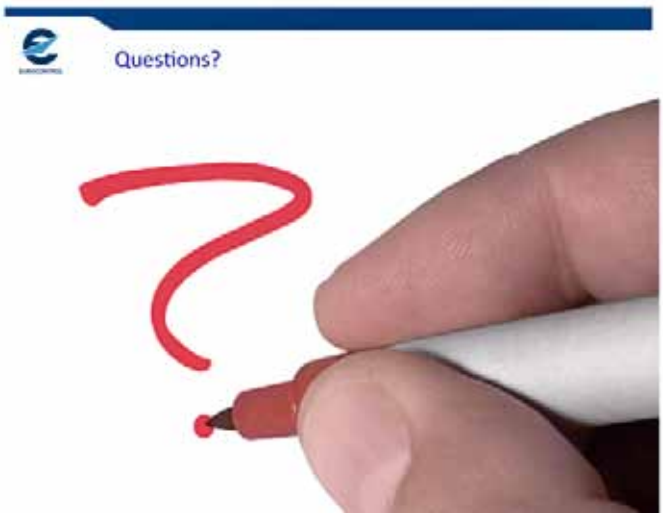
## Leading Causal/Contributing Factors



## What are the advantages of RAT?

RAT provides for:

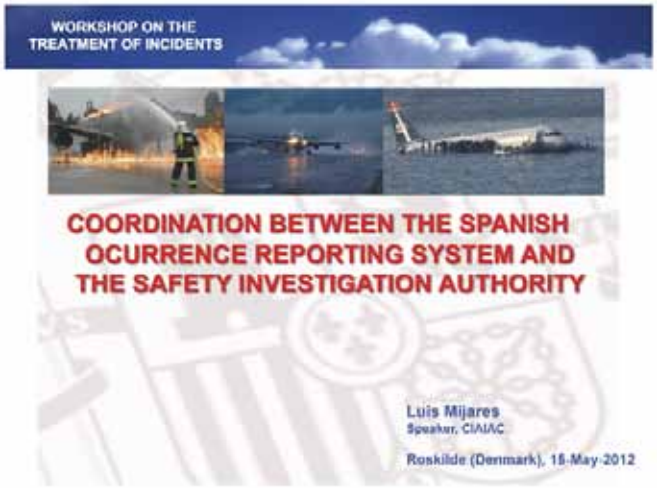
- A means to reduce subjectivity
- Harmonisation
- Transparency
- Easier communication/discussion
- Quick process
- Works as "push" to enhance investigation
- Provide hard facts in backing up Recommendation for improvement – see Recovery example


Questions?

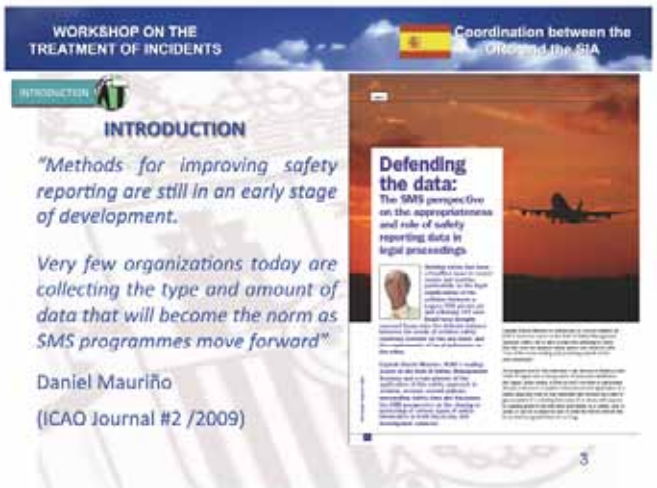

Demo
http://www.srv.nm.eurocontrol.int/rat/

## CO-ORDINATION BETWEEN THE SPANISH OCCURRENCE REPORTING SYSTEM AND THE SPANISH SAFETY INVESTIGATION AUTHORITY

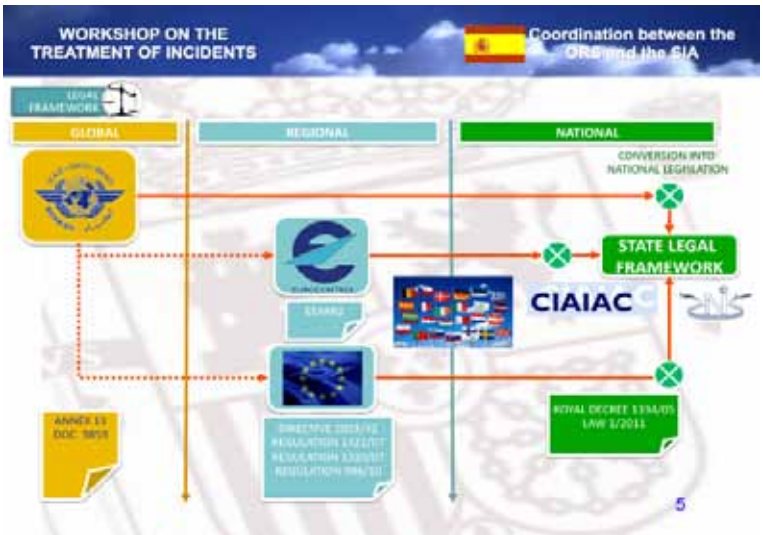
*LUIS MIJARES, COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL, SPAIN*





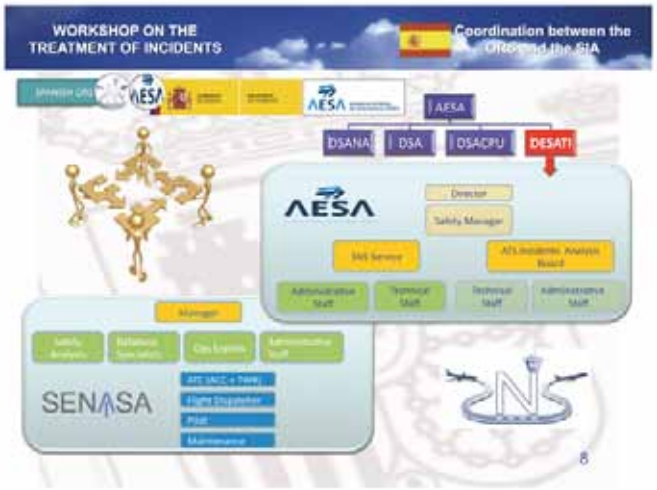



WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
INTRODUCTION
SAFETY OVERSIGHT SYSTEMS
TOOLS AIMED AT THE CAPTURE OF SAFETY INFORMATION (REPORTS)
CORE PROCESSES FOR THE OPERATION OF SMS/SSPs
PERFORMANCE INDICATORS
AUDITS
ACCIDENT/INCIDENT INVESTIGATIONS
SSP
OTHER SAFETY DATA
SAFETY SURVEYS
ORS REPORTS
4


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
LEGAL FRAMEWORK
GLOBAL
REGIONAL
NATIONAL
CONVERSION INTO NATIONAL LEGISLATION
STATE LEGAL FRAMEWORK
CIAIAC
ANNEX 13
DOC 9956
ROYAL DECREE 1334/05
LAW 1/2011
5


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
ENTITIES
CIAIAC
AESA
SAFETY INVESTIGATION AUTHORITY (SIA)
Reg (EC) 996/2010
• HIGH SEVERITY EVENTS (FEW)
• VERIFIED INFORMATION (MULTIPLE SOURCES)
• FORMAL INVESTIGATION PROCESS (ANNEX 13)
• INDEPENDENT FROM SAFETY OVERSIGHT AUTHORITIES
OCCURRENCE REPORTING SYSTEM (ORS)
ED 2003/42 <> RD 1334/2005
• MODERATE/LOW SEVERITY EVENTS (MANY)
• NON VERIFIED INFORMATION (REPORT)
• SAFETY SCREENING TECHNIQUE (NON STANDARD)
• PART OF SAFETY OVERSIGHT AUTHORITY
INVESTIGATION AUTHORITIES
REPORTING SYSTEMS


WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
CIAIAC
Board
President
Secretariat
Prevention and Studies
Investigation Area
Financial Department
Members (5)
Laboratory
Investigation Teams (3)
Investigator on duty (24/7)
7

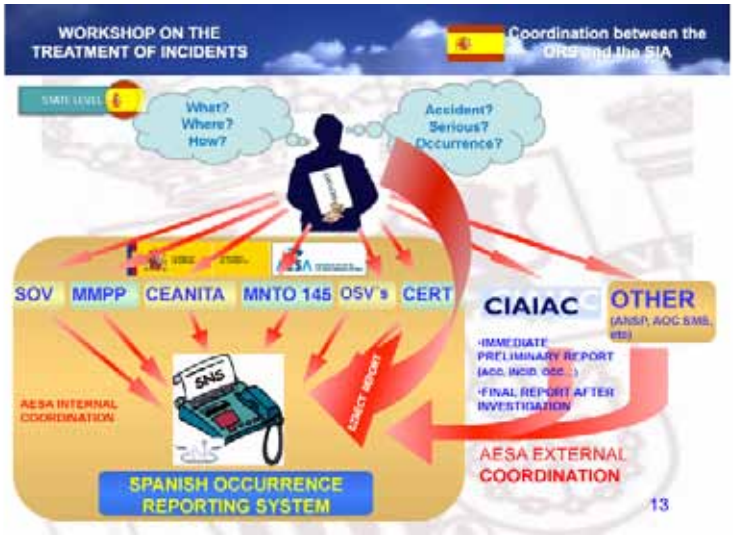

WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
AESA
DSANA
DSA
DSACPU
DESATI
AESA
Director
Safety Manager
SENASA
8


WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
AESA
MANDATORY AND VOLUNTARY OCCURRENCE REPORTING SYSTEM ESTABLISHED UNDER EU DIRECTIVE 42/2003
AIMED AT THE IMPROVEMENT OF SAFETY BY ENSURING THAT RELEVANT INFORMATION IS REPORTED, COLLECTED, ASSESSED, STORED AND DISSEMINATED
START OF OPERATIONS IN MARCH 2006
REPORTS MANAGEMENT OUT OF THE SAFETY OVERSIGHT AGENCY (AESA) AND PERFORMED BY EXTERNAL ORGANISATION (SENASA)
SAFETY INFORMATION LOAD INTO DATABASE (ECCAIRS)
INTEGRATED INTO AN EUROPEAN FRAMEWORK. NATIONAL DATABASE INFORMATION TRANSFERRED TO EU COMMON DATABASE
9


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORG and the SIA
CIAIAC
Reg. (EC) 996/2010
ACCIDENT: 'AN OCCURRENCE ASSOCIATED WITH THE OPERATION OF AN AIRCRAFT WHICH, ..., IN WHICH:
(i) A PERSON IS FATALLY OR SERIOUSLY INJURED ,...
(ii) THE AIRCRAFT SUSTAINS DAMAGE OR STRUCTURAL FAILURE WHICH ADVERSELY AFFECTS THE STRUCTURAL STRENGTH, PERFORMANCE OR FLIGHT CHARACTERISTICS OF THE AIRCRAFT, AND WOULD NORMALLY REQUIRE MAJOR REPAIR OR REPLACEMENT OF THE AFFECTED COMPONENT, EXCEPT FOR ENGINE FAILURE OR DAMAGE, WHEN THE DAMAGE IS LIMITED TO A SINGLE ENGINE, (INCLUDING ITS COWLINGS OR ACCESSORIES), TO PROPELLERS, WING TIPS, ANTENNAS, PROBES, VANES, TIRES, BRAKES, WHEELS, FAIRINGS, PANELS, LANDING GEAR DOORS, WINDSCREENS, THE AIRCRAFT SKIN (SUCH AS SMALL DENTS OR PUNCTURE HOLES) OR MINOR DAMAGES TO MAIN ROTOR BLADES, TAIL ROTOR BLADES, LANDING GEAR, AND THOSE RESULTING FROM HAIL OR BIRD STRIKE, (INCLUDING HOLES IN THE RADOME); OR THE AIRCRAFT IS MISSING OR IS COMPLETELY INACCESSIBLE;
SERIOUS INCIDENT: MEANS AN INCIDENT INVOLVING CIRCUMSTANCES INDICATING THAT THERE WAS A HIGH PROBABILITY OF AN ACCIDENT AND IS ASSOCIATED WITH THE OPERATION OF AN AIRCRAFT...
10


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORG and the SIA
AESA
EUROPEAN UNION'S DIRECTIVE 2003/42
SAFETY OCCURRENCE: AN OPERATIONAL INTERRUPTION, DEFECT, FAULT OR OTHER IRREGULAR CIRCUMSTANCE THAT HAS OR MAY HAVE INFLUENCED FLIGHT SAFETY AND THAT HAS NOT RESULTED IN AN ACCIDENT OR SERIOUS INCIDENT
SAFETY OCCURRENCE REPORTING SYSTEM: MECHANISM AIMED TO COLLECT, EVALUATE, PROCESS AND STORE REPORTED OCCURRENCES
SIZE
1 – 5
30 – 100
100 – 1000
1000 – 4000
Accidents
Serious Incidents
BREAD DEFINITION
Safety Occurrences
11

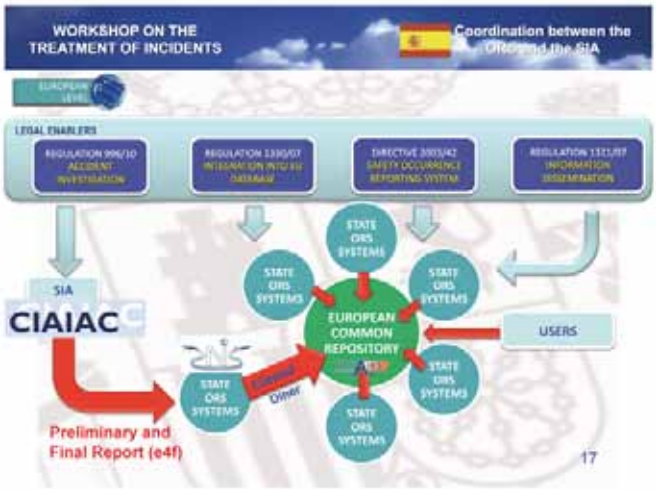

WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORG and the SIA
INDUSTRY
REGULATION
AESA
FLIGHT OPERATION
AIR TRAFFIC ATM
OCCURRENCE REPORTING
Directive 2003/42
RD 1334/2005
CIAIAC
12


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
What? Where? How?
Accident? Serious? Occurrence?
SOV
MMPP
CEANITA
MNTO 145
OSV's
CERT
CIAIAC
OTHER
(ANSP, AOC SME, etc)
·IMMEDIATE PRELIMINARY REPORT
·FINAL REPORT AFTER INVESTIGATION
AESA INTERNAL COORDINATION
AESA EXTERNAL COORDINATION
SPANISH OCCURRENCE REPORTING SYSTEM
13


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
1 REPORTS RECEPTION
2 DATA ENTRY
3 DATA CODING
4 EXPERT MEETING
5 QUALITY CHECKS
OF COURSE.... THE SOONER... THE BETTER!!
14


WORKSHOP ON THE TREATMENT OF INCIDENTS
Coordination between the ORS and the SIA
DECISION TAKING SCHEME FOR COMMUNICATION SNS -> CIAIAC
OCCURRENCE
YES
NO
CIAIAC
15
CREDIBLE: REALISTIC OR REASONABLE, IT MAY OCCUR ONCE FOR THIS COMBINATION OF CIRCUMSTANCES


WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
ACCIDENT (ANNEX 13 DEFINITION)
SEND TO
CIAIAC
16


WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
LEGAL ENABLERS
SIA
CIAIAC
STATE
ORS
SYSTEMS
EUROPEAN
COMMON
REPOSITORY
USERS
Preliminary and
Final Report (e4f)
17


WORKSHOP ON THE
TREATMENT OF INCIDENTS
Coordination between the
THANKS FOR YOUR
ATTENTION
18

## SINGAPORE'S APPROACH TO HANDLING INCIDENTS

BRYAN SIOW, AIR ACCIDENT INVESTIGATION BUREAU OF SINGAPORE



## Treatment of Incidents

AAIB

## Sources of information

Aerade Ops centre (Airport operator)

ATC/Tower (ATSP – Regulator)

Airline operator OCC/STN managers

Abnormal Operation Report Or Notifications (ATC)

Local Airlines' pilot Incident Reports (SIA, SIACGO, Silkair)

Local Airline Operator Notifications

Singapore Aviation Accident/ Incident Reporting System (State Aviation Safety Database)

Phone Calls

Duty Officer 24 hr

Emails & News

Investigators (Ops)

Verify & collect evidence Filter & evaluation before recommendation

Chief Inspector Of Accident

Filter & Evaluation of occurrence before recommendation

Classification

Investigating

Not investigating

Follow up with respective organisation's investigation and request for they reports. Any lesson learnt from their investigation maybe shared with industry after de-identification

Accident

Serious incident

Incident (with safety lessons)

AAIB

## Accident & Incidents investigated by AAIB

| Year | Accident | Serious incident | Incident |
|---|---|---|---|
| 2011 | 1 | 3 | 1 |
| 2010 | - | - | 2 |
| 2009 | - | 1 | 2 |
| 2008 | - | 1 | 1 |

AAIB


14 Jun 09
AAIB


28 Dec 10
AAIB


9 Jan 11
AAIB


Piper 28A
Seletar airport
28 Nov 07


Runway Excursion, Changi Airport
AAIB


27 Feb 12
AAIB


A380 pushback incident
Changi airport
10 Jan 08


Changi airport
2 Jun 07
Before
After


Seletar airport
21 Aug 07

## International Accident Investigation Forum (IAIF)

Singapore

Week of 22-26 April 2013

AAIB

## IAI Forum

- IAI Forum, arisen from the Chief Aircraft Accident Investigators Programme (CAAIP) 2007, aims to be primarily a gathering of senior government air accident investigation officials, although the attendance is not limited to these officials.
- The 1st IAI Forum was held on 21-23 Apr 10 and was attended by about 150 participants.
- Other agencies, airlines, manufacturers are welcome to participate.

AAIB

## 2nd IAI Forum
## Week of 22-26 Apr 13

- Keynote speaker – Director, ICAO ANB, Ms Nancy Graham
- Tentative Topics:
  - Developments in ICAO
  - Dealing with Media
  - Annex 13 and the Protection of Safety Information
  - Investigation Preparedness to Modern Aircraft
  - Family Assistance to Aviation Disaster

AAIB SINGAPORE

**Pang Min Li**
**AAIB Singapore**

pang_min_li@mot.gov.sg
(+65) 65413011

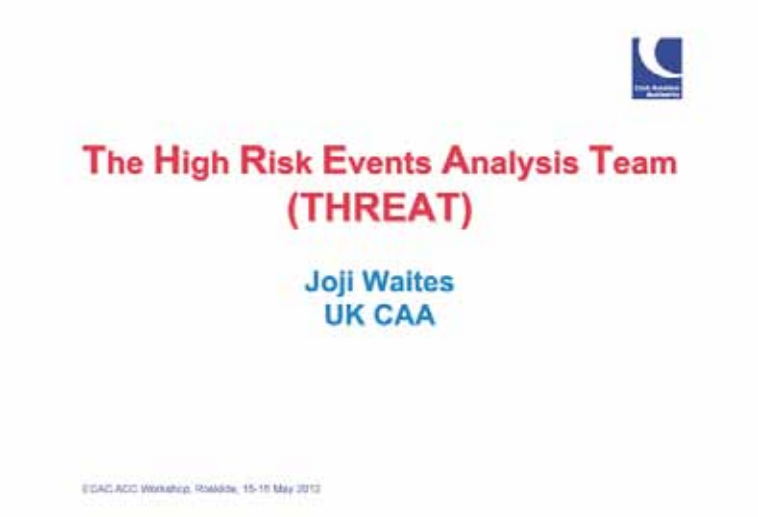
AAIB SINGAPORE

**Thank You**

AAIB SINGAPORE

## THE HIGH RISK EVENTS ANALYSIS TEAM (THREAT)

JOJI WAITES, CIVIL AVIATION AUTHORITY, UNITED KINGDOM





## CAA Safety Risk Analysis Process


ECAC ACC Workshop, Roskilde, 15-16 May 2012

## CAA Safety Risk Analysis Process


ECAC ACC Workshop, Roskilde, 15-16 May 2012

## THREAT Dataset

- Grade A or B MORs
- G-registered or UK operated (AOC):
  - Jet and turboprop aeroplanes > 5,700 kg
  - Turbine helicopters > 3,175 kg
- Passenger and cargo operations only
- Occurring worldwide since 1 Jan 2005
- Expanded scope: foreign aircraft in UK airspace

ECAC ACC Workshop, Roskilde, 15-16 May 2012

## THREAT Process

- Allocate causal and circumstantial factors
- Determine potential for catastrophic outcome and likelihood of such an outcome
- Allocate positive factors
- Allocate confidence
- Identify generic observations
- Propose mitigating actions

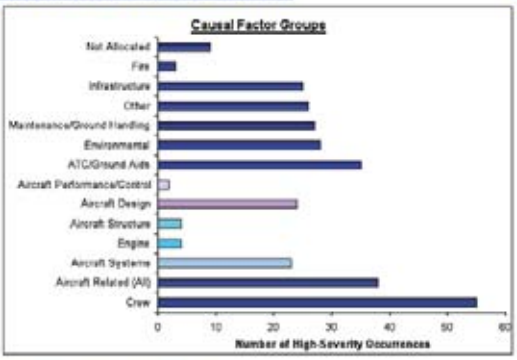
ECAC ACC Workshop, Roskilde, 15-16 May 2012

## Analysis Overview

- 169 high-severity occurrences in 2005-09
- 2 fatal accidents
- 17 other accidents, 52 serious incidents, 98 occurrences
- 4 grade A occurrences
- 35 occurrences involving aircraft damage
- 14 occurrences involving injuries

ECAC ACC Workshop, Roskilde, 15-16 May 2012

## Causal Factor Groups



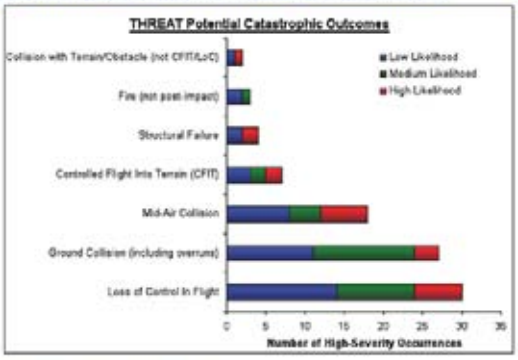

ECAC ACC Workshop, Roskilde, 15-16 May 2012

## Causal Factors

| Causal Factor Group | Top-Ten Causal Factors (not mutually exclusive) | |
|---|---|---|
| Crew | Failure in CRM (cross check/co-ordinate) | 30 |
| Crew | Omission of action/inappropriate action | 28 |
| Crew | Poor professional judgement/airmanship | 26 |
| Aircraft Design | Design shortcomings (including documentation that forms part of the approved design standard) | 24 |
| ATC/Ground Aids | Incorrect or inadequate instruction/advice | 23 |
| Other | Caused by other aircraft/vehicle | 23 |
| Maintenance/Ground Handling | Maintenance or repair error/oversight/inadequacy | 22 |
| Crew | Flight handling | 21 |
| Infrastructure | Incorrect, inadequate or misleading information to crew | 16 |
| ATC/Ground Aids | Failure to provide separation - air | 15 |

EDAC ACC Workshop, Roskilde, 15-16 May 2012

## Potential Catastrophic Outcomes

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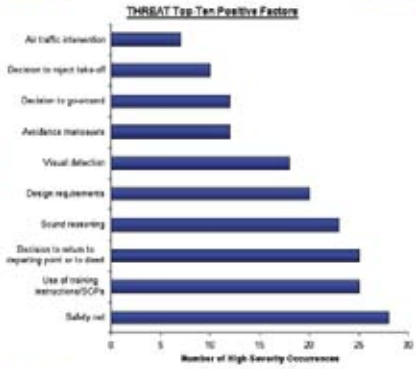
## Positive Factors

Some form of providence was present in 28 (or 17%) of all occurrences

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## Examples of THREAT Observations

- Lack of in-depth understanding by pilots of how aircraft operate beyond their interface with the technology
- Importance of pilots understanding the level of protection afforded by ATS provision in different types of airspace and knowing when heightened lookout is required
- Some operator's Operations Manuals do not reflect the Aircraft Flight Manual nor the manufacturer's recommended procedures

EGAC ACC Workshop, Roskilde, 15-16 May 2012

## Summary

- Systematic and thorough process
- Learning more from high-severity events
- Wide variety of events and causes
- Providence features strongly

EGAC ACC Workshop, Roskilde, 15-16 May 2012

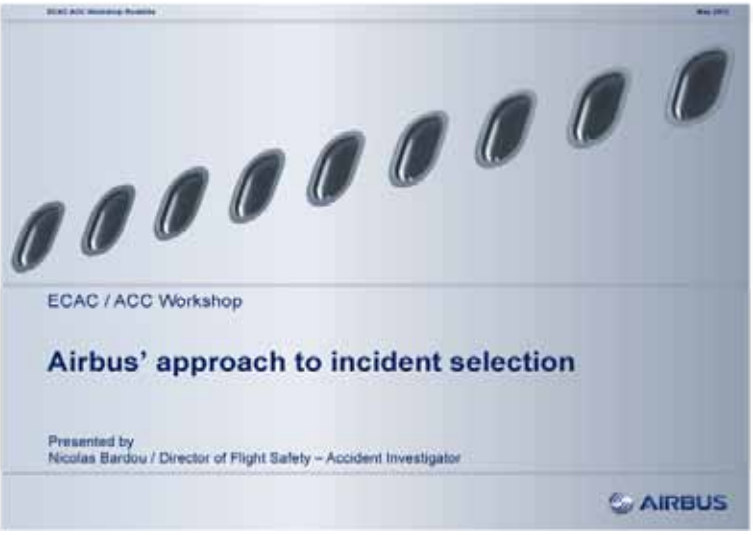
## Thanks For Your Attention
## Any Questions?

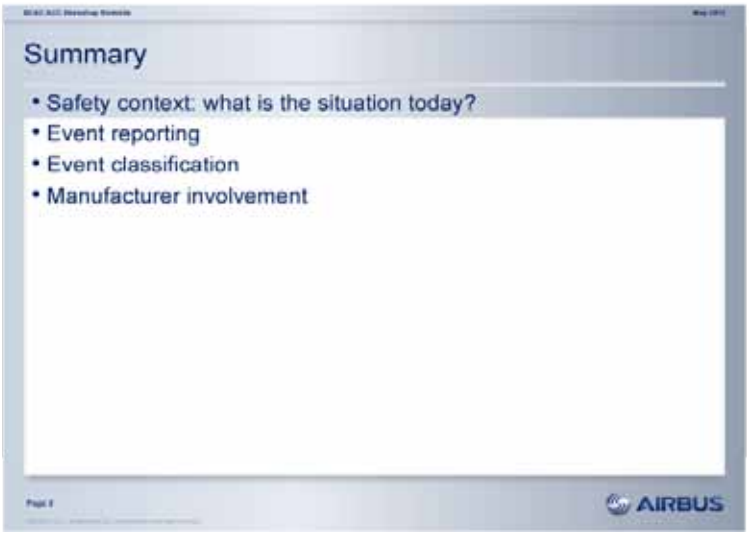
joji.waites@caa.co.uk

EGAC ACC Workshop, Roskilde, 15-16 May 2012

## AIRBUS' APPROACH TO INCIDENT SELECTION

NICOLAS BARDOU, AIRBUS

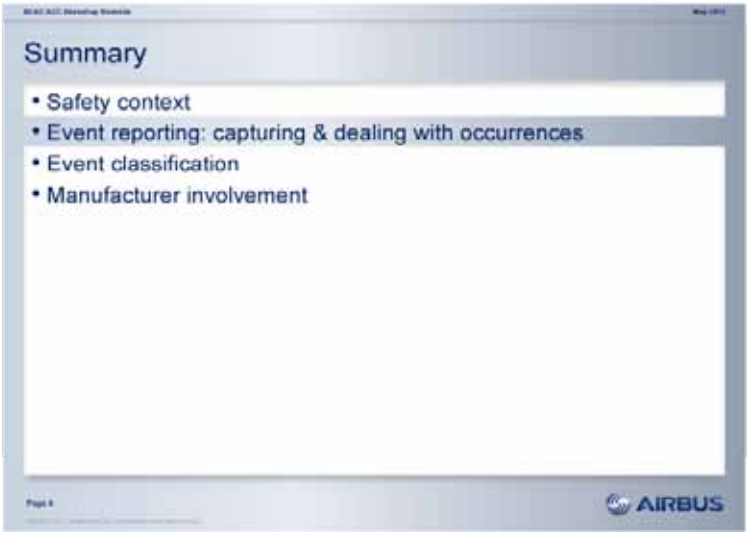


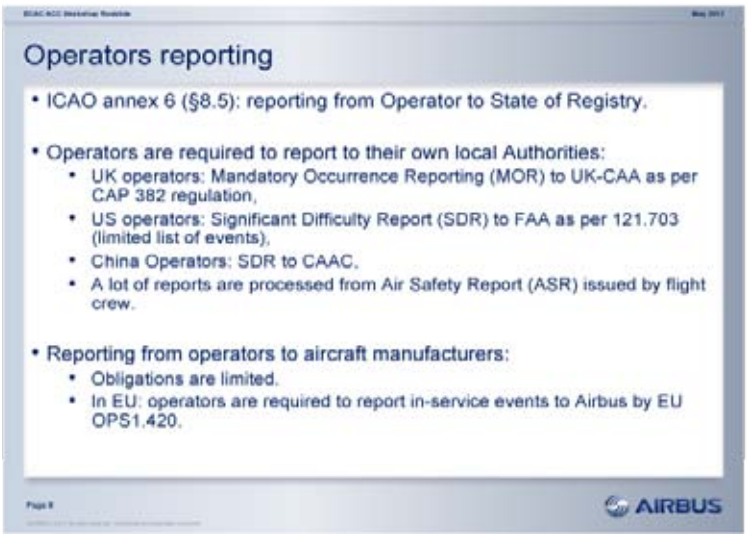


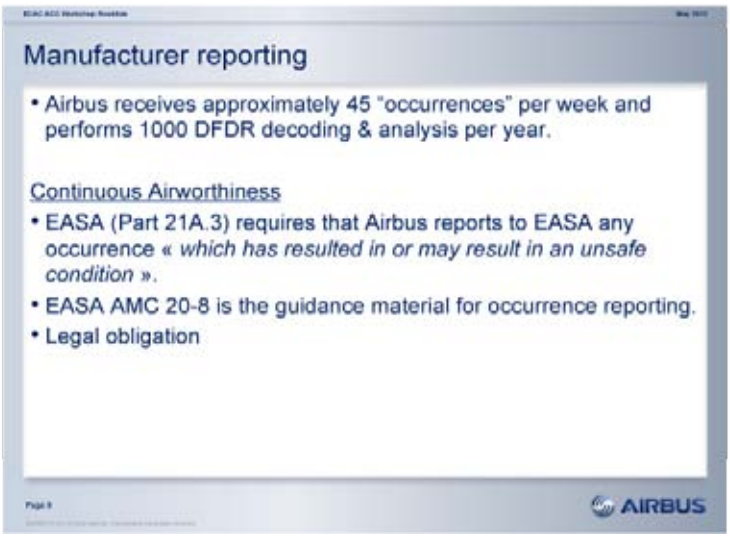
The Airbus Fleet - Over 11 500 orders
A380 Family 253
A340 Family 377
A350 Family 548
A330 Family 1200
A300/A310 Family 816
A320 Family 8400
Over 11500 aircraft sold to 338 customers
More than 7200 aircraft delivered
AIRBUS

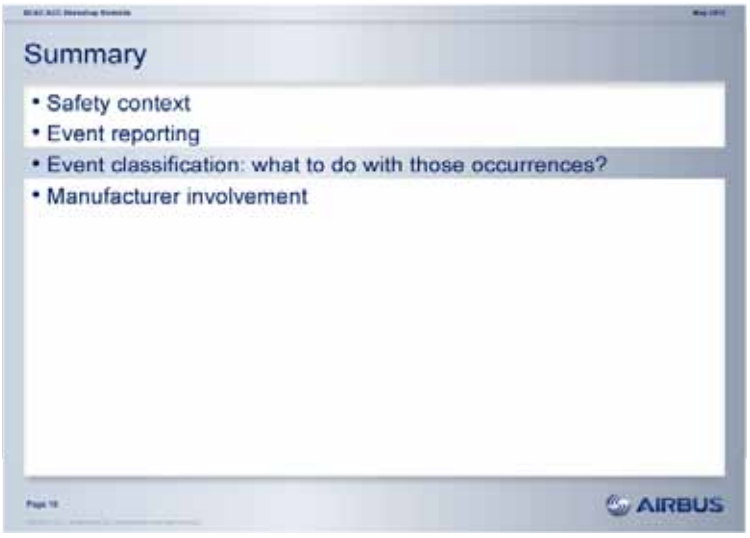

Airbus worldwide
372 Operators
6740 aircraft in Operations
An Airbus is Taking-off or landing every 2sec
AIRBUS


Summary
• Safety context
• Event reporting: capturing & dealing with occurrences
• Event classification
• Manufacturer involvement
AIRBUS

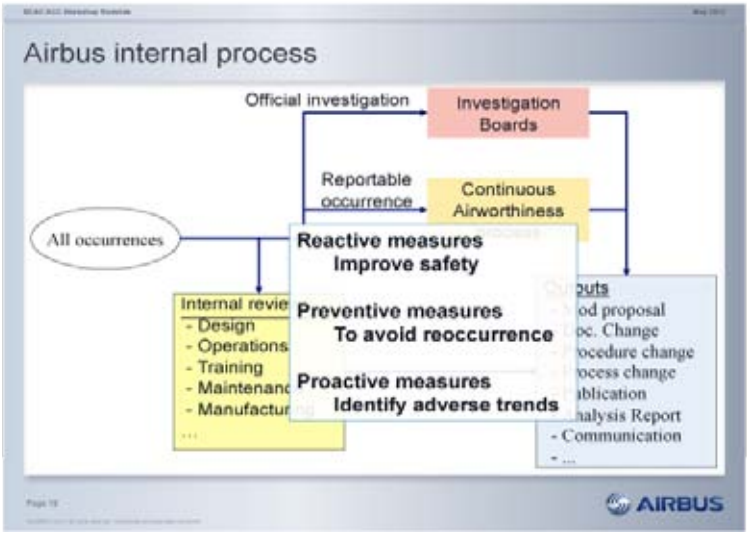

Events capturing
From all these flights how events are captured?
AIRBUS

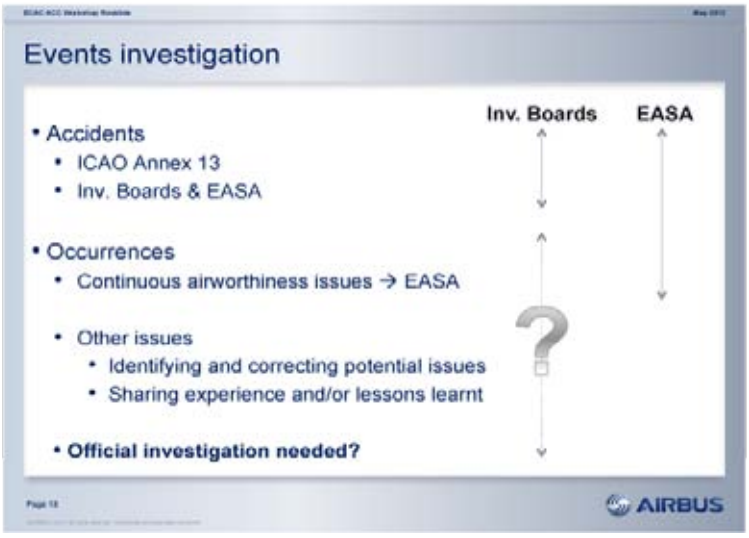

Operators reporting
• ICAO annex 6 (§8.5): reporting from Operator to State of Registry.
• Operators are required to report to their own local Authorities:
• UK operators: Mandatory Occurrence Reporting (MOR) to UK-CAA as per CAP 382 regulation,
• US operators: Significant Difficulty Report (SDR) to FAA as per 121.703 (limited list of events),
• China Operators: SDR to CAAC.
• A lot of reports are processed from Air Safety Report (ASR) issued by flight crew.
• Reporting from operators to aircraft manufacturers:
• Obligations are limited.
• In EU: operators are required to report in-service events to Airbus by EU OPS1.420.
AIRBUS

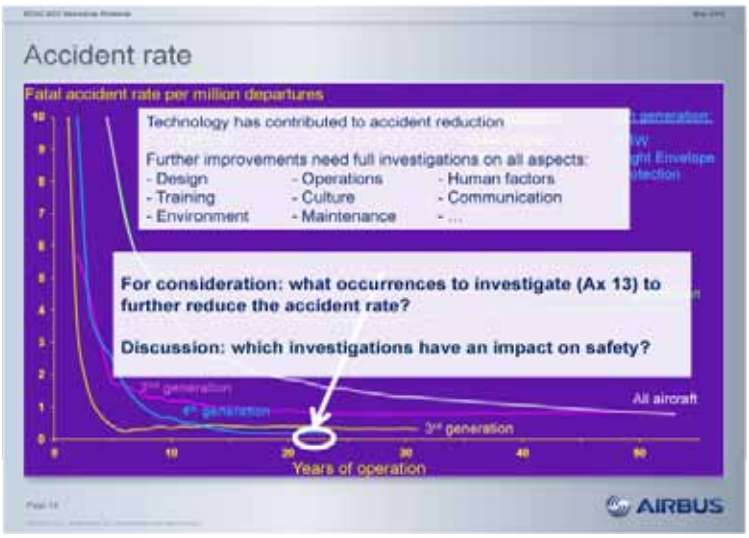

Manufacturer reporting
• Airbus receives approximately 45 "occurrences" per week and performs 1000 DFDR decoding & analysis per year.
Continuous Airworthiness
• EASA (Part 21A.3) requires that Airbus reports to EASA any occurrence « which has resulted in or may result in an unsafe condition ».
• EASA AMC 20-8 is the guidance material for occurrence reporting.
• Legal obligation
AIRBUS


Summary
• Safety context
• Event reporting
• Event classification: what to do with those occurrences?
• Manufacturer involvement
AIRBUS


Dealing with events reported
Airbus investigates all reported events.
Which ones will be by EASA or investigation boards?
(Annex 13)
AIRBUS


Airbus internal process
Official investigation
Investigation Boards
Reportable occurrence
Continuous Airworthiness
All occurrences
Reactive measures
Improve safety
Preventive measures
To avoid reoccurrence
Proactive measures
Identify adverse trends
- Design
- Operations
- Training
- Communication
AIRBUS


Events investigation
Inv. Boards
EASA
• Accidents
• ICAO Annex 13
• Inv. Boards & EASA
• Occurrences
• Continuous airworthiness issues → EASA
• Other issues
• Identifying and correcting potential issues
• Sharing experience and/or lessons learnt
• Official investigation needed?
AIRBUS


Accident rate
Fatal accident rate per million departures
Technology has contributed to accident reduction
Further improvements need full investigations on all aspects:
- Design
- Operations
- Human factors
- Training
- Culture
- Communication
- Environment
- Maintenance
- ...
For consideration: what occurrences to investigate (Ax 13) to further reduce the accident rate?
Discussion: which investigations have an impact on safety?
All aircraft
3rd generation
Years of operation
AIRBUS


Official investigations
• Many different working methods within the frame of annex 13
• Different classification levels / outcomes
• « For information only »
• « Class 1 / 2 / 3 / 4 »
• « Minor event » / « Serious incident » / « Severe incident »
• « Summary » / « Factual report » / « Full report »
• ...
• It would help the industry to share same definitions & harmonize working methods with a common focus
AIRBUS

## Summary

- Safety context
- Event reporting: capture
- Event classification
- Manufacturer involvement: what can we do?

## Involvement of manufacturer

Airbus supports major investigations by all possible means.

Allocated time & resources have to match event type and final objective.

Examples:

- Simulator session preparation for a major event replay:
  - 5 months * 2 persons
- Runway excursion performance computation:
  - 1500 hours

AIRBUS

## What do YOU expect?

What would help the industry:

1- Notify / Ensure same data is shared
2- Define the type of investigation
3- Define involvement / expectations
4- The "What" is understood (DFDR), more focus on the "Why"

**1 Investigation = clear safety objectives = efficient outcome**

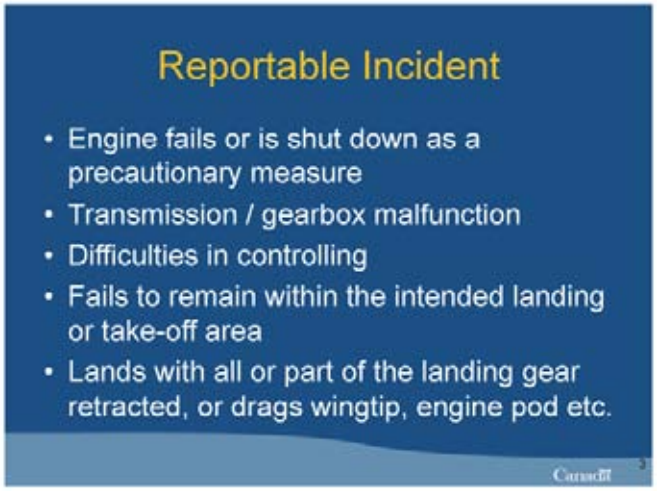
AIRBUS

AIRBUS

## INCIDENT HANDLING IN CANADA

BRAD VARDY, TRANSPORTATION SAFETY BOARD OF CANADA





## Reportable Incident

- Crewmember unable to perform
- Depressurization
- Fuel shortage – diversion or priority handling
- Incorrect or contaminated fuel
- Collision, ROC or LOS

## Reportable Incident

- Emergency declared, or requires priority handling or emergency response services standby
- Slung load released – unintentional, precautionary, emergency
- Dangerous goods release in or from aircraft

## Occurrence Classification

- 5-year average of 834 reported incidents
- TSB is not bound by legislation to investigate ***all*** occurrences
- Safety benefit
- TSB Occurrence Classification Policy
  - Resources
  - Obligations and commitments
  - Canadian interests
  - Public expectation
  - TSB experience

## Occurrence Classification

- Class 1 – Public Inquiry
- Class 2 – Significant potential to reduce risk
- Class 3 – Standard full investigation
- Class 4 – Safety study
- Class 5 – Data gathering

## Annex A to OCP
## Risk Assessment Criteria

- Probability of Adverse Consequences
  - History
  - How many?
  - Organizational, Management, Regulatory implications
  - Larger, systemic problems? Threat to public safety

## Annex A to OCP
## Risk Assessment Criteria

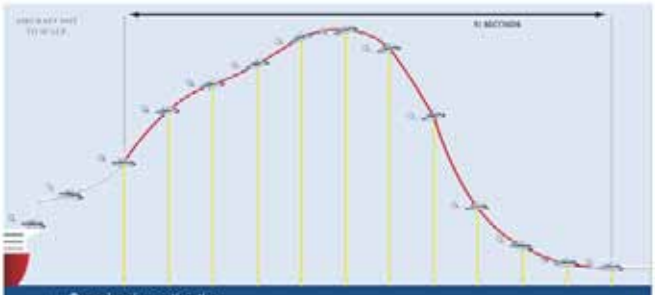
- Consequences of Occurrence
  - How many lives?
  - Property damage
  - Impact on carrier, industry, infrastructure, markets
  - Public, media, political interest / fallout

## Annex A to OCP
## Risk Assessment Criteria

- Safety Value
  - How well known is the issue?
  - New info on old problem?
  - Identified by TSB in past?
    - Board Concern?
    - TSB Watchlist?

## Investigating Incidents

- SMS
  - Mandatory for airline / commuter / AMO / airports / air navigation services
  - Pending for air taxi / aerial work operations
- TSB action varies



- Ongoing investigation
  - Transport-category helicopter – Departure from controlled flight
- Considerations
  - Environment, role of carrier, political interest and regional overtones, media and public interest, TSB experience
  - CVR – event overwritten (2.5 hour flight)

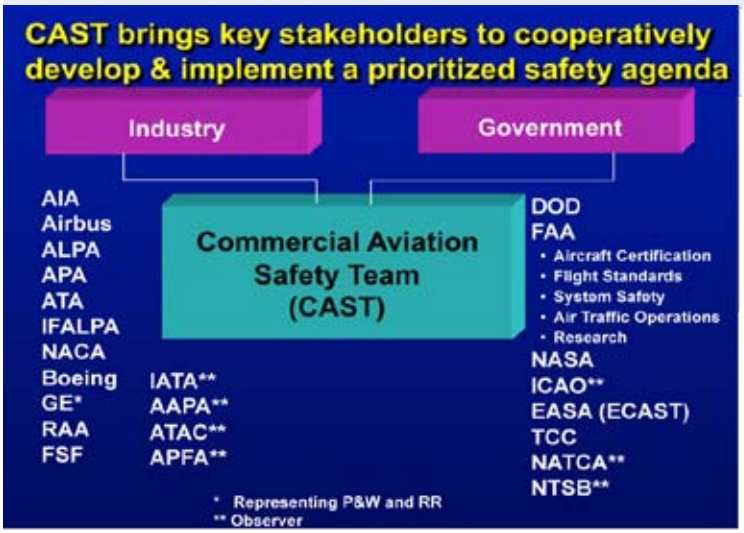

Investigating Incidents
• Air Canada B767-333 CYYZ – LSZH
Pitch Excursion, North Atlantic 30W
• Finding – CVR overwritten

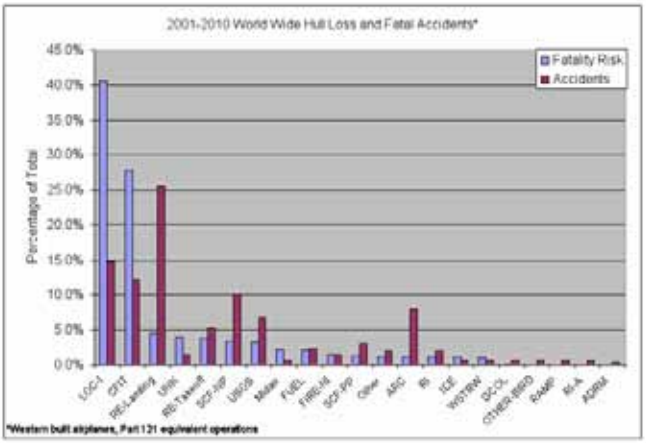

Canada

## SESSION 3: LOOKING FOR "WHAT WENT RIGHT"

### *REDUCING ACCIDENTS BY MONITORING SAFETY BARRIERS*

*JAY PARDEE, US FEDERAL AVIATION ADMINISTRATION*

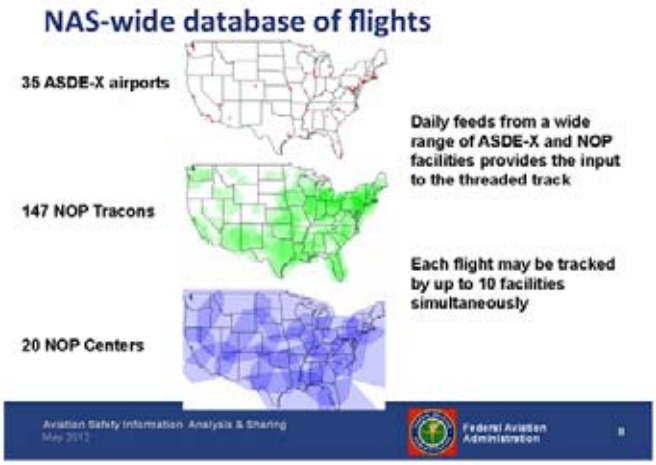




ASIAS Is a Key Component of
Continuous Improvement in Aviation Safety
Mitigations
Safety Analysis
asias
Information Sharing
Monitoring
Aviation Safety
asias
A collaborative government and industry initiative on data sharing and analysis to proactively discover safety concerns before accidents or incidents occur, leading to timely mitigation and prevention

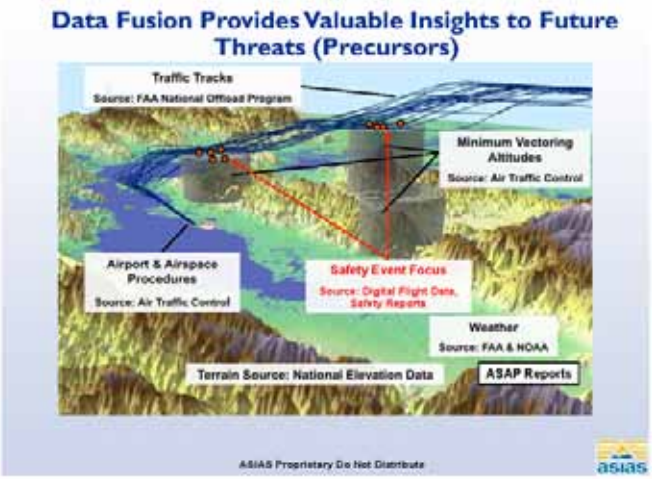

What is ASIAS…
A collaborative Government and Industry initiative on data sharing & analysis to proactively discover safety concerns before accidents or incidents occur, leading to timely mitigation and prevention.


ASIAS Members
44 Airlines
Air Wisconsin Airlines
Alaska Airlines
Aloha Air Cargo
American Airlines
American Eagle Airlines
Atlas Air
Cape Air
Chautauqua Airlines
CitationAir
Colgan Air
Comair
CommutAir
Compass Airlines
Delta Air Lines
Empire Airlines
*Evergreen International Airlines
ExpressJet
FedEx Express
Frontier Airlines
Gojet Airlines
Hawaiian Airlines
JetBlue Airways
Mesa Airlines
Mesaba Airlines
Miami Air International
North American Airlines
Omni Air International
Piedmont Airlines
Pinnacle Airlines
Polar Air Cargo
PSA Airlines
Republic Airlines
Shuttle America
SkyWest Airlines
Silver Airways
Southwest Airlines
Spirit Airlines
Sun Country Airlines
Trans States Airlines
United Airlines
United Parcel Service
US Airways
USA 3000 Airlines
World Airways
Government
FAA, NASA, Naval Air Force Atlantic, USAF Safety Center
Industry
AIA, ALPA, APA, A4A, Boeing, NATCA
As of 19 April 2012

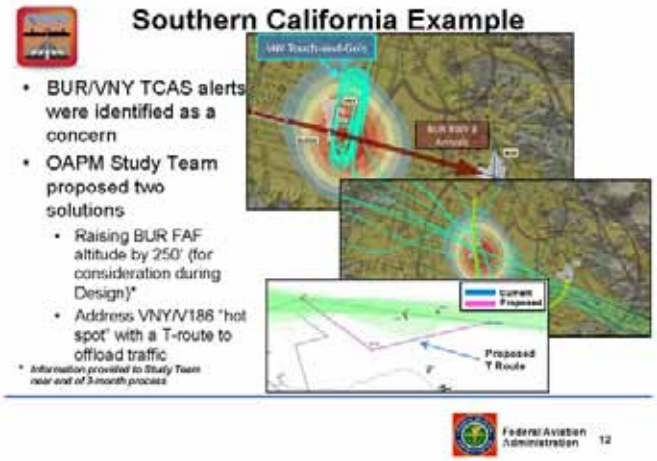

Data Sources Supporting ASIAS Studies
Proprietary Data
• ASAP
• FOQA
• ATSAP
• Manufacturers data
• Avionics data
Safety Data
• Aviation Safety Reporting System
• Runway Incursion
• Surface Incident
• Operational Error / Operational Deviation
• Pilot Deviation
• Vehicle or Pedestrian Deviation
• National Transportation Safety Board
• FAA Accident/Incident Data System
• FAA Service Difficulty Reports
ATC Information
• Traffic Management Reroutes and Delays
• Airport Configuration and Operations
• Sector and Route Structure
• Procedures
• Surveillance Data for En Route, Terminal and Airport
Other Information
• Bureau of Transportation Statistics
• Weather / Winds
ASIAS Proprietary Do Not Distribute


NAS-wide database of flights
35 ASDE-X airports
147 NOP Tracons
20 NOP Centers
Daily feeds from a wide range of ASDE-X and NOP facilities provides the input to the threaded track
Each flight may be tracked by up to 10 facilities simultaneously
Aviation Safety Information Analysis & Sharing
Federal Aviation Administration


Types of Proactive Safety Analyses
Directed Studies
Known Risk Monitoring
Safety Enhancement Assessment
Vulnerability Discovery
Benchmarking Operations
A Collaborative FAA-Industry ASIAS Executive Board (AEB) Provides Guidance and Oversight

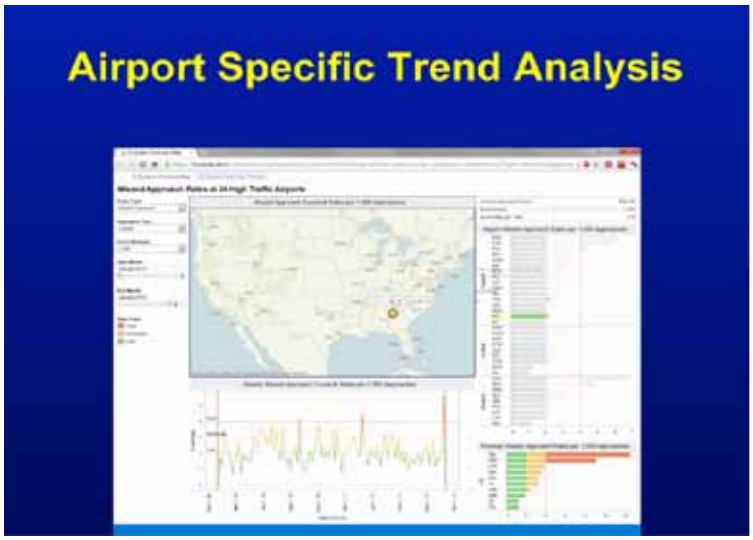

Data Fusion Provides Valuable Insights to Future Threats (Precursors)
Traffic Tracks
Source: FAA National Offload Program
Minimum Vectoring Altitudes
Source: Air Traffic Control
Airport & Airspace Procedures
Source: Air Traffic Control
Safety Event Focus
Source: Digital Flight Data, Safety Reports
Weather
Source: FAA & NOAA
Terrain Source: National Elevation Data
ASAP Reports
ASIAS Proprietary Do Not Distribute
asias

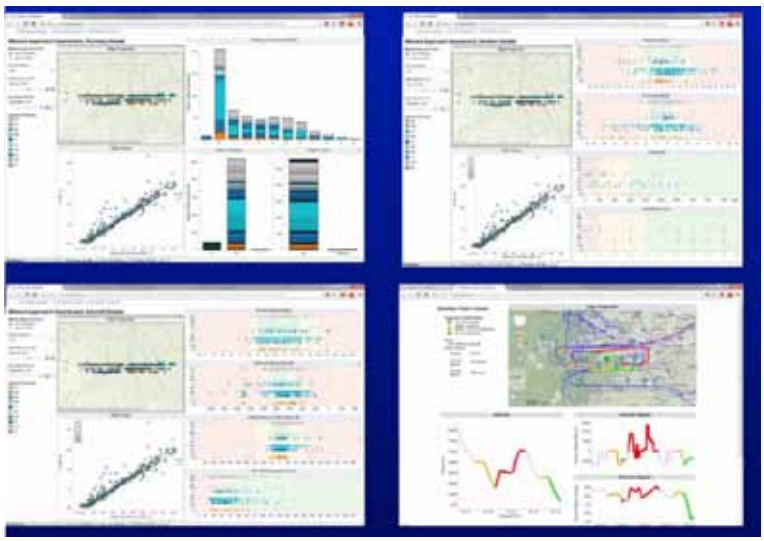

ASIAS Produces New Insights into Known and Emerging Risks
ASIAS aggregates data across multiple operators and analyzes it at the national level
ASIAS fuses data from various sources
ASIAS leverages available tools and builds new tools
Identifying TCAS Resolution Advisory Hotspots and Contributing Factors
asias


Southern California Example
• BUR/VNY TCAS alerts were identified as a concern
• OAPM Study Team proposed two solutions
• Raising BUR FAF altitude by 250' (for consideration during Design)*
• Address VNY/V186 'hot spot' with a T-route to offload traffic
* Information provided to Study Team near end of 3-month process
Current
Proposed
Proposed T Route
Federal Aviation Administration
12

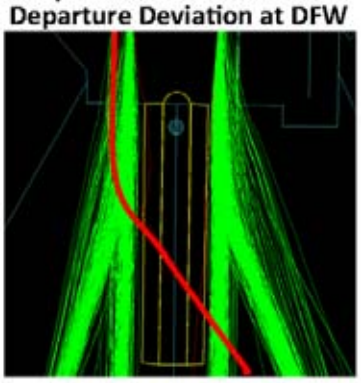
Unstable Approach Criteria - Severity Levels 1000 to 500 ft HAT and 500 to 50 ft HAT:

| Category | Criteria | Threshold |
|---|---|---|
| ILS | 1. Above Glideslope | > 1 dot high for 5 sec |
| | 2. Below Glideslope | > 1 dot low for 5 sec |
| | 3. Localizer Deviation | > 1 dot left/right for 5 sec |
| Airspeed | 4. High Speed | > (Vref + 20 kts) for 3 sec |
| | 5. Low Speed | < Vref for 3 sec |
| ROD | 6. High Descent Rate | > 1000 ft/min for 3 sec |
| Thrust | 7. Low Thrust Descent | N1 < 35% for 5 sec<br>N1 < 5th Percentile by Fleet Type |
| Configuration | 8. Late Flap Extension | Any flap movement > 2 degrees |
| | 9. Late Gear Extension | Any gear movement |
| | 10. Speed Brakes Deployed | Any deployment of speed brakes |
| Attitude | 11. Unstable Pitch | Abs( Pitch ) > 15 degrees for 3 sec<br>StDev( Pitch Rate ) > 1.25 |
| | 12. Unstable Roll | Roll > 40 degrees for 3 sec<br>StDev( Roll Rate ) > 3.5 |
| | 13. Unstable Yaw | StDev( Yaw Rate ) > 1.25 |
| GPWS | 14. GPWS Alert | Any GPWS Alert |



**Sample RNAV Off the Ground Departure Deviation at DFW**



16


## Positive Taxonomy

- Positive taxonomy was developed to help better identifying all the technical and human factors safety nets
- Positive taxonomy aids analyst:
  - Consider the human factor as a safety factor
  - Capture the functioning of effective system safety nets
  - Capture successful human interventions in databases

## Summary

- Monitoring penetration of Safety Barriers is an effective means to measure overall system safety
- Penetration of Safety Barriers should be considered as a precursor to accidents or serious incidents
- Safety Barriers operate in a "Positive" fashion to protect against the negative effects of mistakes/ problems/

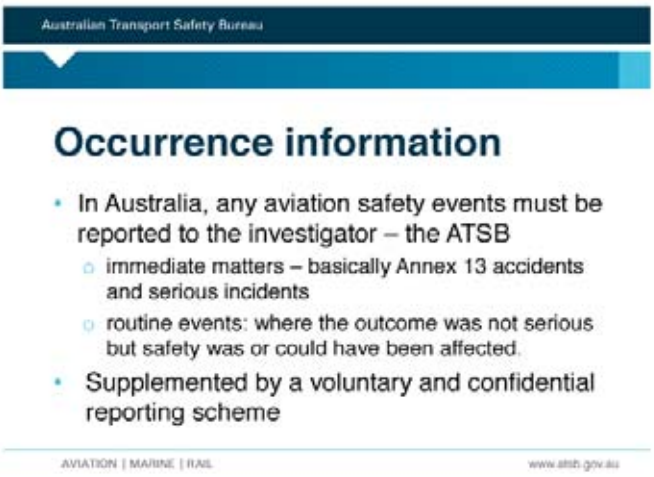
## Summary (Cont'd)

- Successful Safety improvements require 2 metrics
  - Must be able to measure the extent of implementation
  - Must be able to measure the effectiveness of precursor reduction
- Fusion of multiple data sources and enhanced analytical tools are becoming increasingly effective and allow a prognostic approach

## PREVENTATIVE INVESTIGATION: OCCURRENCE DATA AND 'WHAT WENT RIGHT'

MARTIN DOLAN, AUSTRALIAN TRANSPORTATION SAFETY BUREAU





Australian Transport Safety Bureau

## We hold a lot of information

- More than 15,000 notifications a year
- More than 8,000 occurrences
- Each tagged by type and causal factor
- The basis for regular safety trend analysis
- Full risk classification is the next step
- Already on-line: soon publicly searchable

AVIATION | MARINE | RAIL www.atsb.gov.au

Australian Transport Safety Bureau

## Occurrence (event) Risk Rating

- "*If this event had escalated into an accident, what would have been the most credible accident outcome?*"
- "*What was the effectiveness of the remaining barriers between this event and the most credible accident outcome?*"
- Rating = outcome x effectiveness

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Australian Transport Safety Bureau


AVIATION | MARINE | RAIL www.atsb.gov.au

Australian Transport Safety Bureau

## So what about investigations?

- Level 1: the catastrophic event
- Level 2: the major event
- Level 3: significant investigation
- Level 4: routine Annex 13 investigation
- Level 5: factual-only investigation

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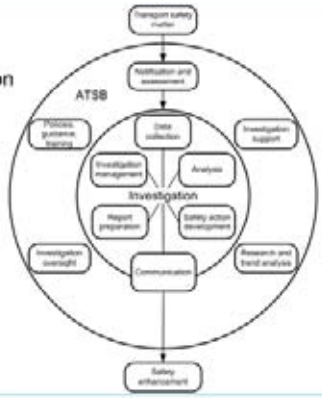
Australian Transport Safety Bureau

Investigation process

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## Analysis process


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Australian Transport Safety Bureau

## 'Level 5' – or short – investigations

- We undertake about 50 full investigations annually.
- We also complete about 100 'short' investigations, without formal analysis.
- These establish key facts for database entry and future trend analysis
- But we publish also them and generally add a 'safety message' about any obvious lesson

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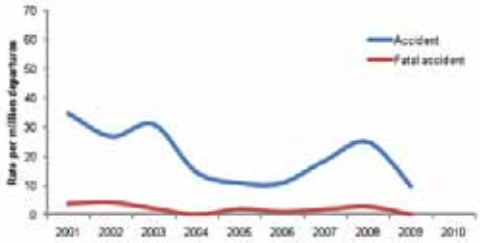
Australian Transport Safety Bureau

## Commercial air transport

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Australian Transport Safety Bureau

## Two potentially significant trends

- the execution of normal but infrequently used procedures, such as go-arounds
- breakdown of separation and problems in recovery from a compromised separation

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Australian Transport Safety Bureau

## And the response: for uncommon procedures

- We are giving greater weight in our decisions to investigate to relevant aircraft handling events
- We have initiated a cooperative project with operators to understand better the relevant aspects of training
- So far, we have not investigated an event of this sort that involves more than the results of individual actions
- And our basic message is that 'the system worked': errors were captured and resolved
- **Paradoxically, this is a problem**

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Australian Transport Safety Bureau

## And the response: for separation

- We are currently investigating (or have completed investigating) 15 breakdown of separation events
- In each case it seems so far that "the system worked" and we have not detected a critical systemic issue
- We will likely conclude, in each individual case, that the system is acceptably safe
- We have begun a safety issue investigation to see what, if anything, these single investigations have not revealed

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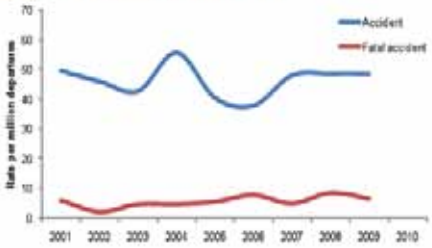
Australian Transport Safety Bureau

## General aviation

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Australian Transport Safety Bureau

## Avoidable accidents series

- Low-level flying
- Wire strikes involving known wires
- Managing partial power loss after take-off
- VFR into IMC
- Fuel management
- More to come

AVIATION | MARINE | RAIL www.atsb.gov.au

Australian Transport Safety Bureau

## Thank you

www.atsb.gov.au

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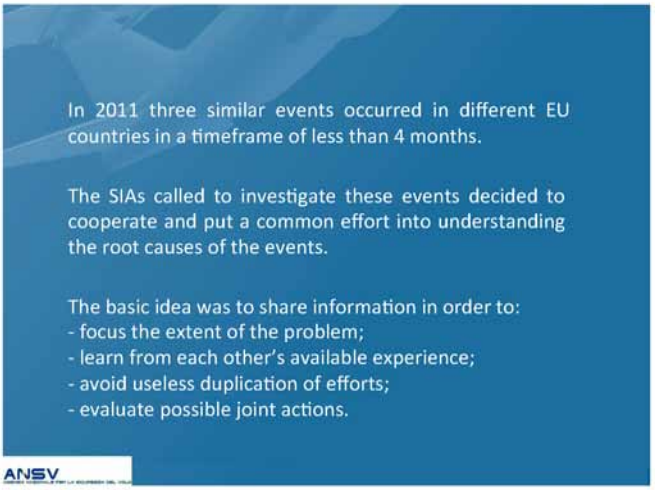
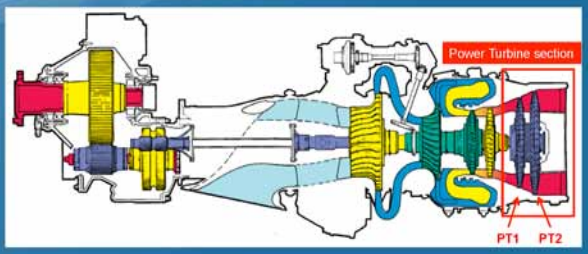
## THE EXPERIENCE OF DIFFERENT SIAS IN DEALING JOINTLY WITH SIMILAR SERIOUS INCIDENTS

MARIO COLAVITA, AGENZIA NAZIONALE PER LA SICUREZZA DEL VOLO, ITALY


All SIs were associated with an emergency return to the departure airport due to IFSD fire on PWC 127F engine.




ANSV

ANSV

EASA acted as initial point of contact between AIB-DK and ANSV-IT.

ANSV was present as AcRep to the investigation led by TSB-HU (engine disassembled at AVIO facilities in Pomigliano d'Arco, Naples).

ANSV

The 3 SIAs decided to hold a joint meeting (Rome, 7-9 Feb. 2012) in the presence of aircraft and engine manufacturers as well as the AcReps participating in the investigations and their technical advisors.

Invitations were extended to EASA and Transport Canada (both unable to attend).

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Main outcomes of the meeting

- All SIs due to the initial distress of a PT1 rotor blade causing subsequent damages and heavy unbalance of the whole PT assembly, further unbalance of the LP rotor, and final oil leakage due to breaking of No. 6 & 7 bearing compartment retaining bolts and distress of the radial transfer tubes.

  Fire was then originated by such a leakage in presence of hot parts.

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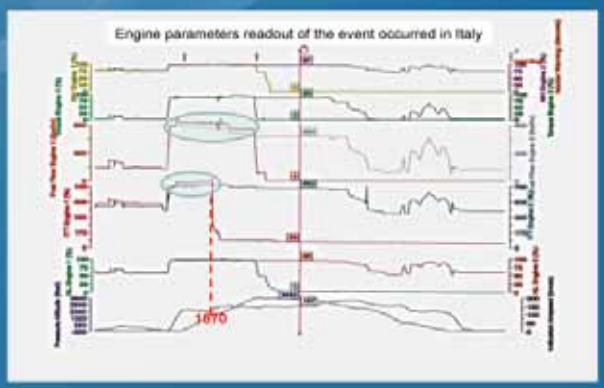
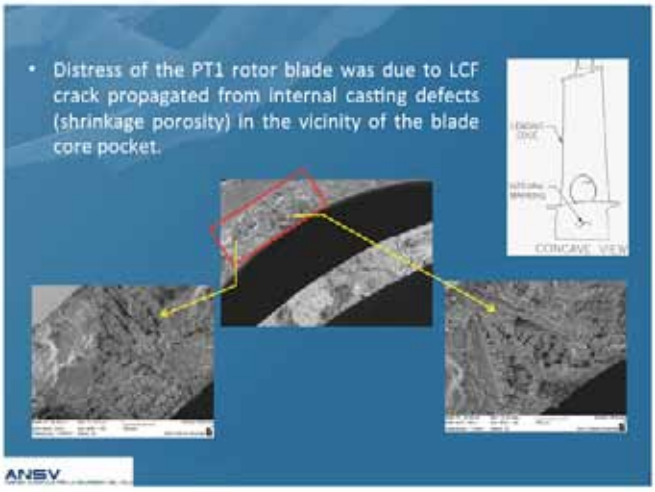
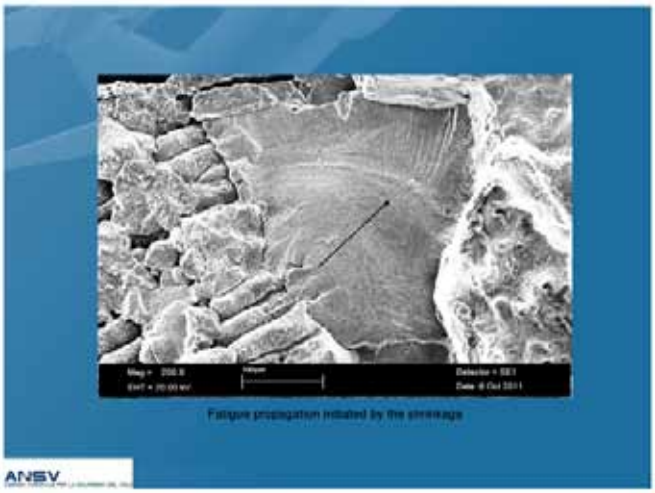
- All events occurred at initial climb.

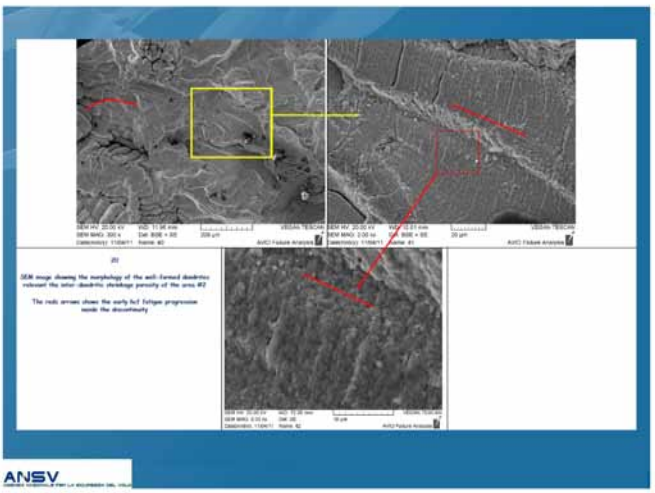



ANSV


• Distress of the PT1 rotor blade was due to LCF crack propagated from internal casting defects (shrinkage porosity) in the vicinity of the blade core pocket.
CONCAVE VIEW
ANSV


Total fatigue surface length 30mm or 25 mm of the convex airfoil chord
1
2
Total fatigue surface length 30mm or 23 mm of the concave airfoil chord
ANSV


Fatigue propagation initiated by the shrinkage
ANSV



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*Short-Term targets*

- To deal with the blades manufactured before 2008 (issue of SB21766) still in service.
  - → *Introduction of inspection plans to periodically check the blades in the pocket region*
  - → *Introduction of a replacement plan*
- Harmonization of the timeframe required among EU-MS to make effective an EASA approval modification in the AFM
  *Subject to a preliminary verification of the actual situation within EU and Canada*
- Introduction of a smoke evacuation procedure for ATR
  *with a reference addressing to it at the end of "in flight" and "at take off" engine fire or severe mechanical damage emergency procedures*

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*Mid-Term targets*

- Introduction of a CT check at a given sampling blade production interval, possibly on a temporary base, aimed to gain confidence in terms of actual POD of the RI improvements introduced in 2008.
- Review of the general policy related to the build up of the Emergency Procedures referred to the Type, by taking into consideration the criterion of minimising workload in cockpit and memory items.

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## Action Plan

Draft recommendations on the mentioned items to be prepared and circulated, firstly through the SIAs, and when refined to the parties involved for comments

ANSV

It took around 3 more months to reach an agreement on the actual format of the draft document.

Technical content:
It collects 5 SRs while summarizing the main technical aspects of the investigations.

Formal aspects:
Document signed by the heads of the 3 SIAs.
Cover letter sent to the addresses and copied to all parties involved in the investigations, signed by ANSV on behalf of the 3 SIAs clarifying "the full availability to host a dedicated meeting ... in case of comments on the technical content of the issues addressed in the document before final publication."

ANSV

*Acknowledgements to my colleagues from AIB-DK and TSB-HU for the very cooperative effort put in this joint activity*

ANSV

*Thank you for your attention!*

ANSV

## ECCAIRS 5

WIETSE POST, EC JOINT RESEARCH CENTRE

### ECCAIRS 5

*ECAC ACC Workshop on the Treatment of Incidents*

*15 and 16 May 2012 Roskilde Denmark*

*Wietse Post*
*European Commission (JRC)*

### Contents

*Political safety targets*
*ECCAIRS goals*
*What is ECCAIRS*
*ECCAIRS 5 tools*
*Positive factors*

### Safety targets from COM(2011) 144

- *Aviation: EU to become world's safest region*
- *Maritime: improve legislation and create a network to support maritime safety.*
- *Railways: enhance harmonisation of national safety measures*
- *Roads: halve casualties by 2020 (and ~0 in 2050)*

## ECCAIRS Mission

*Assist National and European transport entities in collecting, sharing and analysing their safety information in order to improve transport safety*

## ECCAIRS

*ECCAIRS is a set of software tools and support services made available by the European Commission to the involved transport communities in the European Union in the context of applicable EU legislation and in co-operation with international organisations.*

## ECCAIRS elements

*Co-operative Network*
- **Steering Committee**
- **Web portal**

*European Central Repository*
- **Based on ECCAIRS 5**

*Reporting System*
- **ECCAIRS 4**
- **ECCAIRS 5**

## Co-operative network

## European Central Repository

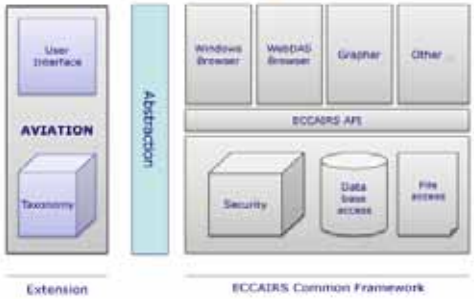
- *Occurrences (ECR)*
  - **Around 575.000 occurrences**
  - **Accessible by all EU/EFTA competent authorities plus EASA and Eurocontrol**
  - **Still subject to some access restrictions**
  - **Data Quality and Reporting discipline issues**
- *Safety Recommendations (SRIS)*
  - **Operation announced to ENCASIA in February 2012**
  - **Integration with ECR to be implemented soon**

## Reporting System

*ECCAIRS 4*
- **Established system**
- **World-wide usage**
- **Traditional approach**

*ECCAIRS 5*
- **Multimodal common platform**
- **Customisation of user interface and taxonomy**
- **Taxonomy improvements (ongoing)**

## Multimodal common platform




## ECCAIRS 5 for multimodal SIAs

*Reduced infrastructure costs*

- **Standardisation of systems and base software**
- **Less system administrators**

*Facilitates deployment*

- **Reduced user-training efforts**
- **Facilitates cross modal analysis methodologies**
- **More easy to generate a global transport view**

## Initial deployment ECCAIRS 5

*In maritime since Q1 2010 (central system)*

*In aviation available since Q2 2011*

- **Deployed in ECR and SRIS since Q4 2011**
- **Evaluations 1st customers Q3 and Q4 2011**
- **Deployments 1st customers Q1 2012**

*In rail operational since Q3 2011 (central system)*

## Opportunities for customisation

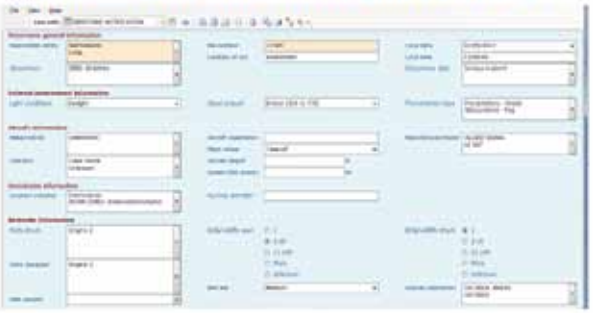
*Taxonomy*

- **Allocated custom attributes**
- **Translations**
- **Distributed web maintenance of value lists (operators, regions, etc.)**

*User Interface*

- **Custom views**
- **Custom reports**
- **Custom analysis reports with queries and AWB**

## Example of a new view (birdstrike)



## Taxonomy: factors

- *What happened, how and why (classic approach)*
  - **Events with descriptive and explanatory factors**
- *What might have happened (risk oriented)*
  - **Potential factors**
- *What happened to avoid a worse outcome (new)*
  - **Positive factors**

## Positive factors

## Positive factors (status)

*No data collected yet*

- **ECCAIRS 5 is not being widely deployed yet**

*How to stimulate reporting of positive factors*

- **Increase ECCAIRS 5 usage**
- **Awareness could be an issue: training & education**
- **Mandatory customised views could also help**

## Thank you

**HTTP://eccairsportal.jrc.ec.europa.eu**

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