CD-ROM Enclosed

IATA

Safety Report 2001

Issued March 2002

International Air Transport Association

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Montreal — Geneva

Safety Report 2001
Ref. No: 9049-02
ISBN 92-9171-779-7

Montreal — Geneva

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FOREWORD

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Director
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Safety (together with Security) is the number one corporate objective of IATA. A key component of the IATA Safety Strategy 2000+ and the IATA Safety Management System is the monitoring of airline operations. IATA uses the Safety Report to report on airline operations and enhance safety awareness and accident prevention. This year the Safety Report will confront a period in aviation safety that has been unlike any other.

What is the NEW Safety Report 2001?

This new Safety Report, which combines Jet and Turboprop accident statistics, ***has inherited the best features of its predecessors,*** the IATA Jet and Turboprop Reports, by retaining most of the safety metrics, but some of the ***terminology is updated*** and some of the consensus based definitions applied by the industry in accident and incident taxonomy are used. The ambitious technique used by IATA to analyse, early in the New Year, the accidents (and increasingly the incidents) of the previous year has been retained. Furthermore, the scope of the Safety Report has increased and is now more of a ***"State of the Nation" on Safety,*** providing information on the developing IATA Safety Management System as well as other important industry safety initiatives.

This NEW Safety Report was developed ***in support of Safety Strategy 2000+, and with our customers in mind,*** providing them not only with areas of concern and high risk, combined with recommendations to the industry, but also providing our customers with direction to safety management information and available tools. In 2001 there was a 21% increase in the number of accidents during the approach and landing phase for Western Built Jets. Improving Safety is a co-ordinated effort and as such IATA Safety has called on ***our Safety Alliance Partner, Flight Safety Foundation,*** in order to include the Approach and Landing Accident Reduction (ALAR) Tool Kit CD-ROM as part of the Safety Report 2001 package.

Here are some of the changes:

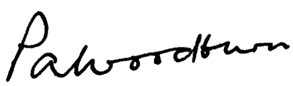
- Colour Printed Report
- There is now a CD-ROM targeted at Airline Safety Managers included in a pocket at the end of the report. The information on the CD-ROM is not exhaustive, but it does serve as an indication of some of the valuable tools for accident prevention which have come to IATA Safety's attention during 2001.
- The new IATA Directory of Airline Safety Representatives is included as part of the Safety Report package.

Acknowledgements

IATA wishes to thank the Operations Committee, Safety Committee and its Classification Working Group and Human Factors Working Group for their contributions in the development of this report. In particular, IATA gratefully acknowledges the support of KLM City Hopper for hosting this year's Classification Working Group Meeting. It is with the dedicated efforts of the IATA Safety Team that this report is put together.

With this report we have developed a valuable tool in order to prevent accidents and incidents. We hope that you will find it useful.

Guenther Matschnigg
Senior Vice-President
Operations and Infrastructure



Paul Woodburn
Director
Safety

EXECUTIVE SUMMARY

OVERVIEW 2001

Safety and Security are the number one corporate objectives for IATA. The IATA Safety Report explains how IATA is implementing Safety Strategy 2000+ and how this is developing to better serve the Industry.

The tragic events of 11 September, 2001 have left indelible images in all of our minds. Their impact upon the aviation industry, related industries, the world economy and society as a whole is such that some of the consequences must be mentioned in this IATA Safety Report. These events though were predetermined acts of violence. They were not “accidents” and should be kept separate from the accidents addressed in this report.

This new Safety Report, which combines Jet and Turboprop accident statistics, has inherited the best features of its predecessors, the IATA Jet and Turboprop Reports. It therefore retains most of the former safety metrics but updates some of the terminology and exploits some of the industry consensus based definitions in accident and incident taxonomy. For example, the term “Hull Loss” rather than “Total Loss” has been adopted and the excellent work by the ATA on Phase of Flight definitions has been introduced.

The ambitious technique used by IATA to analyse, early in the New Year, the accidents of the previous year has been retained, for this process is seen as a key component of the IATA Safety Management System (SMS). The Safety Report aims to enhance safety awareness and accident prevention. Its broader view of the 2001 safety and security scene will be evident against the backdrop of a year in aviation safety that has changed the world. Invariably, however, it is amongst the detail that the gems of accident prevention are to be found and this report makes no apology for delving into that detail. After presenting the accident statistics for 2001, it will classify and analyse the data and offer recommendations on accident prevention.

The challenging task of classifying the accidents was performed by the IATA Safety Committee’s Classification Working Group (CWG), which assembled in Amsterdam from 21 to 24 January 2002. The session was hosted impeccably by KLM City Hopper and was very well supported by the airlines with 17 Airline and Manufacturers Safety Executives in attendance.

The CWG’s accident review of **2001 revealed a total of 83 operational accidents involving Jet and Turboprop Western Built aircraft, which is similar to the 84 accidents experienced in the year 2000.**

Continuing the comparison of Operational Accidents involving Western-Built aircraft, with last years figures shown in [ ], there were 20 [22] Jet Hull Loss (HL) accidents and 36 [28] accidents in which the aircraft was Substantially Damaged (SD). Of the Turboprop accidents, 16 [20] were HLs and 11 [14] aircraft incurred SD.

Meanwhile, the **Operational Loss Rates per million sectors for Western Built Jets reduced from 1.1 per million sectors to 1.0 per million with a corresponding reduction from 0.59 in 2000 to 0.54 per million flying hours in 2001. Viewed over 1992 to 2001 period of the Safety Report statistics, 2001 is therefore a better year for accident prevention than any other year in that period.**

During 2001 the **Operational Loss Rates for Turboprops expressed in terms of Hull Losses per 1000 aircraft years also reduced from 3.8 to 3.0,** which represents an improvement in accident prevention over the 1992 to 2001 decade.

The overall safety gains made by the aviation industry in 2001 cannot be divorced from the events that took place on 11 September 2001, which claimed the lives of so many people aboard the aircraft involved and many more on the ground. These events of course were no accident and at such a time accident statistics seem to be irrelevant. Yet behind this horrific event there is a safety performance from which the industry can take some satisfaction. Measured in terms of the IATA Safety Report metrics, which are deemed to be the most authoritative and relevant, 2001 did represent an improvement in aviation safety in terms of the Western Built Jet and Turboprop HL and SD loss rates. Indeed, **the reduction in the number of fatal accidents (Operational HLs and SD, Jet and Turboprop) and the associated halving of the number of people who lost their lives** are statistics in which the industry can take some comfort.

When viewing this modest improvement in the accident statistics, it is important to understand that the industry already has a good safety record and low rate of accidents. The task of reducing this rate still further is mainly concerned with the reduction of inherent risk in the system. Such risk management demands great effort and enterprise. As indicated by the bold statistics presented below, **whilst 2001 had a better than average safety performance, there is still room for further improvement, most markedly in the area of Approach and Landing — particularly undershoot — accidents and in regard to accidents in which Western Jet fleets experienced SD.** The recommendations made in this report will therefore address those areas of greatest risk.

One of the strong messages to come out of 2001 is that the highly developed principles of safety management are equally pertinent to operational security. IATA's position is that the most effective way to improve operational security is to prevent terrorism. Beyond this fundamental, however, IATA has helped to develop practical ways in which the safety community can assist with security. This report will therefore highlight where the IATA Operations and Infrastructure division has contributed to the enhancement of operational safety and security. Similarly IATA has been monitoring how these changes might impact on safety. It concludes by urging caution that the vital new security imperatives do not detract from the essential safety processes that are bringing the accident rates down to their lowest ever levels.

CONCLUSIONS 2001

*(This part of the Executive Summary refers to **Western Built Jets** unless otherwise stated).*

ACCIDENT SUMMARY

- **83 Operational Accidents** (HL+SD involving Jet and Turboprop) — **similar to the year 2000.**
- **Jet Hull Loss rate down from 1.1 to 1.0 per million sectors, a marginal improvement** in terms of the decade as a whole.
- Number of **Jet Fatal accidents down from 9 to 8** and the number of fatalities, excluding deliberate acts of violence, almost halved compared with 2000.
- **Turboprop Hull Loss rate down from 3.8 to 3.0 per 1000 aircraft years,** a small improvement in terms of the decade as a whole.
- Number of **Turboprop Fatal accidents dropped markedly from 12 to 7,** again with the number of fatalities almost halved compared with 2000.
- Number of **Jet SD accidents increased by 6.**
- Viewed over 1992 to 2001 period of the Safety Report statistics, 2001 is marginally a better year for accident prevention than any other year in that period.
- **Therefore, although 2001 was a better than average safety performance there is still room for further improvement, most markedly in the area of Approach and Landing — particularly undershoot accidents — and in regard to accidents in which Western Jet fleets experienced SD.**
- In terms of direct costs (excluding lost revenue, etc) the cost of HLs for both Jet and Turboprop dropped from US$539M in 2000 to US$275M in 2001, excluding deliberate acts of violence. To include the latter, a further US$4500M should be added for the HL figure alone!

CLASSIFICATION AND ANALYSIS SUMMARY

(Year 2000 figures are entered in [ ] where known)

Controlled Flight Into Terrain (CFIT)

- In terms of CFIT accidents there were 2 [3]Jet and 3[4] Turboprop CFIT HLs and a further 3 Eastern Built Turboprop CFIT Accidents. ***Therefore an improvement in CFIT Jet and Turboprop.***

Approach and Landing Accidents (ALA)

- ALA Accidents dominated the accident statistics with ***6 (5HL, 1 SD) undershoots.***
- ***61%*** (16HL, 18SD) of the 56 operational accidents occurred during the ALA phases of flight. 96% of the 24 skill failure accidents occur during ALA phases of flight. ***In the 2001 there were 34 accidents in ALA compared with 28 in 2000. Therefore a 21% increase in ALA Jet Accidents.***
- Of the 56 operational accidents, 25% (7HL,7SD) involved cargo operations. ***5 of the 6 accidents where the aircraft landed short of the runway involved cargo aircraft.***
- There were 10 [11] runway excursions and 7 accidents which resulted in a hard landing.
- There were ***18 Jet and 4 Turboprop accidents which indicate that if a "timely" go around had been carried out, they may not have occurred.***

Situational Awareness

- ***Poor Situational Awareness continued to feature strongly*** amongst the Western-Built Jet fleet, contributing to 5 [7] accidents as well as 5 accidents the Western-built Turboprop fleet.

Loss of Control

- Of the Western Built Jet Fleet there was ***only 1 [4] Loss of Control accidents and 1 [4] Turboprop.*** Amongst the Eastern-built fleet there were 2 Loss of Control Accidents involving Jet as well as 2 involving Turboprop.

Human Factors

- The analysis of Human Factors in the western built Jet accidents indicates ***pilot proficiency/skill failure as dominant.*** Skill failures are seen to have contributed to 24 of the 56 (43%) operational accidents in 2001. Most (88%, 21 of the 24) skill failure classifications are identified with landing accidents, and 10 of these were combined with adverse weather.

Weather/Night

- ***25 Western-built Jet and Turboprop accidents were adverse weather related.*** Of the 56 jet accidents, 16 are known to have occurred in darkness.

Ground Damage

- There was ***5 Jet accidents which involved Ground Damage,*** a continuing concern.

Tail Strikes

- There were ***5 Jet and 1 Turboprop tail strike accidents*** with many more reported as incidents amongst particular categories of aircraft showing the majority of incidents in the landing phase of flight.

Fuel Management

- There were ***2 Jet and 2 Turboprop events related to Fuel Management*** with many more identified amongst incident reports.

ISSUES 2001

The Safety Report expands on the following issues identified by the CWG as being areas of safety concern:

- Variation in Regional Hull Loss Rates
- Sharp increase in Approach and Landing accidents comapred with the year 2000
- Landing Skills and need for “Timely” Go-around decision
- Flight Crew Technical Knowledge and System Understanding
- System Design Ambiguity
- Pilot Recency and Fatigue
- Impact on Safety of Flight of Environmental Pressures at Airports
- Commercial Pressure on Pilots
- Decision Making and Leadership
- Language Proficiency and Use of Other Than English in ATC
- PAN/Mayday Procedures
- Airfield Facilities and Marking
- Instrument Landing System Integrity
- Wind Shear Warning
- Safety Incident Reporting Culture
- Ground Servicing
- CEO’s Role for Safety Accountability
- Runway Incursions
- Tail Strikes
- Fuel Management
- Safety and Security

RECOMMENDATIONS

Recommendations provided in previous IATA Safety Reports must often be reiterated, especially since much of the readership may be new to the airline industry. Additionally, experienced airline managers, flight and ground personnel will often benefit from revisiting the recommendations made in this and previous IATA Safety Reports. It is therefore recommended that reference is made to the Supporting Documents Section of enclosed CD-ROM.

For the year 2001 it is recommended that:

1. *In view of the clear message coming from this year’s safety report that the Approach and Landing Phases of flight present the highest risk — particularly in relation to undershoot accidents — airlines are urged to incorporate the Flight Safety Foundation ALAR Tool Kit in their training programmes.*
2. *Both Airbus and Boeing are expected to distribute training videos in 2002 covering various aspects of landing technique. Operators should obtain and incorporate this training material to improve crew proficiency.*
3. *Airlines optimise their FDM systems to focus more closely on undershoot tendency, low level go-arounds and landing long. Animator analysis tools should be used to assist with timely counselling of flight crew.*
4. *Through its Flight Simulator WG IATA establish a means of sharing airline FDR data with the simulator manufacturers to allow development of more realistic environmental models for landing phase training.*
5. *IATA design the STEADES services web site, planned for March 2003, to include a collection of de-identified animated flight data readouts of accidents and serious incidents for flying training purposes.*
6. *In their recurrent training sessions, airlines focus on the Go-around decision at a low height, assisted by the pilot survey included on the CD-ROM enclosed with this report.*
7. *Operators adopt a retribution free Go-around policy.*

8. *Aircraft manufacturers conduct research to assess whether current technical/systems training of flight crews is matched appropriately to the level of understanding required by crews for effective systems management during Non-normal procedures.*
9. *In the particular area of fuel management procedures aircraft Manufacturers should ensure that checklists enable flight crews to confirm whether their aircraft is leaking fuel.*
10. *IATA Human Factors Working Group (HFWG) examine the examples of "design traps" cited in the Safety Report, e.g. mis-setting of stabiliser trim, and make recommendations to the Manufacturers.*
11. *IATA SAC forms a task force, with ICAO and IATA Management participation to investigate the impact on safety of environmental pressures on flight path and runway choices and develop recommendations.*
12. *Airlines ensure that training in judgement, decision making and leadership commence at the earliest possible point in flying training and be continuously developed. Scenarios such as bounce recovery, tailstrike, low level go-arounds and windshear/crosswind situations should be included.*
13. *Pressure to achieve superior proficiency in English Use by Air Traffic Control personnel and flight crew at International Airports be maintained by IATA and the Industry.*
14. *As part of the drive towards ICAO standard phraseology, the benefits of two levels of priority, PAN and Mayday, should be reinforced by ICAO.*
15. *IATA work with ICAO to achieve timely and appropriate NOTAMS of Airport Work in Progress, supported by other forms of effective airfield communications, movement monitoring and observance of Standards for ground markings.*
16. *System Manufacturers, ATC authorities and ICAO together should enhance procedures for communicating the testing and maintenance of Instrument Landing Systems. Aircraft characteristics and crew procedures should also be reviewed by the Manufacturers.*
17. *Local knowledge of wind shear and other operationally orientated information about destination airports be shared through IATA SWAP or STEADES.*
18. *IATA maintain emphasis on the promotion of just, non-punitive, air and ground safety reporting and investigation systems, with deeper involvement of the aircraft manufacturers and wider circulation of de-identified investigation reports. IATA encourages the use of corporate-wide Non-Punitive Incident reporting policies and investigation techniques such as Maintenance Error Decision Aid (MEDA), the Procedural Event Analysis Tool (PEAT) and other error detection and prevention tools.*
19. *Airlines review and comment on the IATA paper included on the Safety Report 2001 CD-ROM concerning "A CEO's Responsibility For Safety."*
20. *Airlines incorporate Runway Incursion Training into flight crew qualification, approved training, and other pilot training programmes. This training should focus on enhancing the ability of flight crew to recognise and avoid situations contributing to runway incursions.*
21. *IATA seek to improve the reporting of runway incursion incidents by ensuring that the STEADES programme implementation maintains a particular focus on this area to support the data-driven approach being adopted by EUROCONTROL, CAST and the FAA.*
22. *Airlines note and support IATA's initiative to set comprehensive and harmonised aviation security standards through the Global Aviation Security Action Group (GASAG).*

CHAPTER 1 — INTRODUCTION

1.1 GENERAL

Safety is the number one corporate objective of IATA. This IATA Safety Report reports on the progress being made with the implementation of the Safety Strategy 2000+ and how the IATA safety management system is developing to respond to the needs of the member airlines. A key component of this system is the monitoring of airline operations. This is why IATA Safety needs to be a data-driven organisation, exploiting its unique position as a trusted keeper of safety data; a role according to ICAO that no other organisation can play. The Safety Report is therefore an exposition of the methods used by IATA to gather safety data and the message it is sending to the aviation community. It is about enhancing safety awareness and accident prevention.

This year the Report will confront a period in aviation safety that has seen great change. The IATA Safety Department itself has experienced considerable internal change and it is also appropriate to report on what is surely a period of growth in safety resources and initiatives, the like of which IATA has not seen. The report will therefore set out to describe the developments in IATA Safety simply to help its customers — the airline safety people — understand how best to work with its safety management system. Having presented this backdrop, the report will address the detail of the accidents and incidents of the year 2001. No apology is given for delving into that detail because it is there that the lessons of accident prevention are to be found. After presenting the accident statistics for 2001, the report will classify and analyse the data and offer recommendations on accident prevention.

1.2 THE NEW SAFETY REPORT

1.2.1 NEW FORMAT

The ambitious technique used by IATA to analyse, early in the New Year, the accidents (and increasingly the incidents) of the previous year has been retained. This process is seen as a key component of the IATA Safety Management System.

The most noticeable change with this new Safety Report is the move towards presenting not only areas of concern and high risk, combined with recommendations to the industry, but it also now provides direction to safety management information and tools.
There is now a CD-ROM included in the report which is divided into the following sections:

- **Safety Report,** containing the Report and PowerPoint slide support package;
- **Supporting Documents,** containing additional material supporting discussions in the report;
- **Safety Toolkit,** containing useful and practical material for use at airlines;
- **CEO Brief,** containing executive summary and PowerPoint presentation;
- **Web links;** containing links to websites and documents available on the Web that IATA Safety recognises as helpful to airlines.

Although the additional information that is found on the CD-ROM is not exhaustive, it does serve as an indication of some of the valuable tools for accident prevention which have come to IATA Safety's attention during 2001. All of these components form the new Safety Report.

1.2.2 NEW TERMINOLOGY

This new Safety Report, which combines Jet and Turboprop accident statistics, has inherited the best features of its predecessor, the IATA Jet and Turboprop Report. It therefore retains most of the safety metrics but updates some of the terminology and uses some of the consensus based development of definitions performed by the industry in accident and incident taxonomy. For example the term "Hull Loss" rather than "Total Loss" has been adopted and the admirable work by the ATA on Phase of Flight definitions has been introduced. These changes will be discussed later in this section.

1.3 CLASSIFICATION WORKING GROUP (CWG)

The challenging task of classifying the accidents was performed by the IATA Safety Committee's Classification Working Group (CWG), which assembled in Amsterdam from 21 to 24 January 2002. **Appendix A** describes the role of the CWG in more detail. The session was hosted impeccably by KLM City Hopper and was very well supported by the airlines, with 17 Airline and Manufacturers Safety Executives participating as follows:

Captain Tom Croke	Aer Lingus	Chairman
Captain Doug Stott	Qantas	Vice-Chairman
Captain Deborah Lawrie	KLM	CWG Host
Captain Saad Al-Sheri	Saudi Arabian Airlines	
Captain Thomas Baberg	Lufthansa	
Captain Jurg Schmid	Crossair	
Captain Carlos Nunes	Air Portugal	
Captain Louis Theriault	Air Canada	
Captain Bertrand Courville	Air France	
Mr. Alan Rohl	British Airways	
Mr. Jean Daney	Airbus	
Mr. David Carbaugh	Boeing	
Mr. Jim Donnelly	Bombardier	
Mr. Nuno Aghdassi	Embraer	
Mr. Paul Hayes	Air Claims	
Ms. Jill Sladen	IATA Facilitator/Co-Editor	
Wing Commander David Mawdsley	IATA Facilitator/Co-Editor	

1.4 REPORT AUTHORITY

The Safety Report is sponsored by the IATA Safety Department, approved by the IATA Safety Committee (SAC) and authorised for distribution by the Operations Committee (OPC).

1.5 PURPOSE OF THE SAFETY REPORT

The purpose of the Safety Report is fully described in **Appendix B.** Its primary purpose is to assist with maintaining safety vigilance by identifying the areas of greatest risk apparent from the experience of aircraft accidents. It aims to offer practical advice to airlines in accident prevention against the backdrop of accidents that have occurred in 2001. The report is taking an increasing interest in air safety incidents, seeing them as useful pointers for accident prevention. It presents data and trends, analyses and recommends preventative measures.

1.6 SAFETY STRATEGY 2000+

IATA has long been a leader in the development and establishment of industry Best Practices. Safety Strategy 2000+ is promoting IATA standards on industry operational practices and aircraft equipment which improve safety.

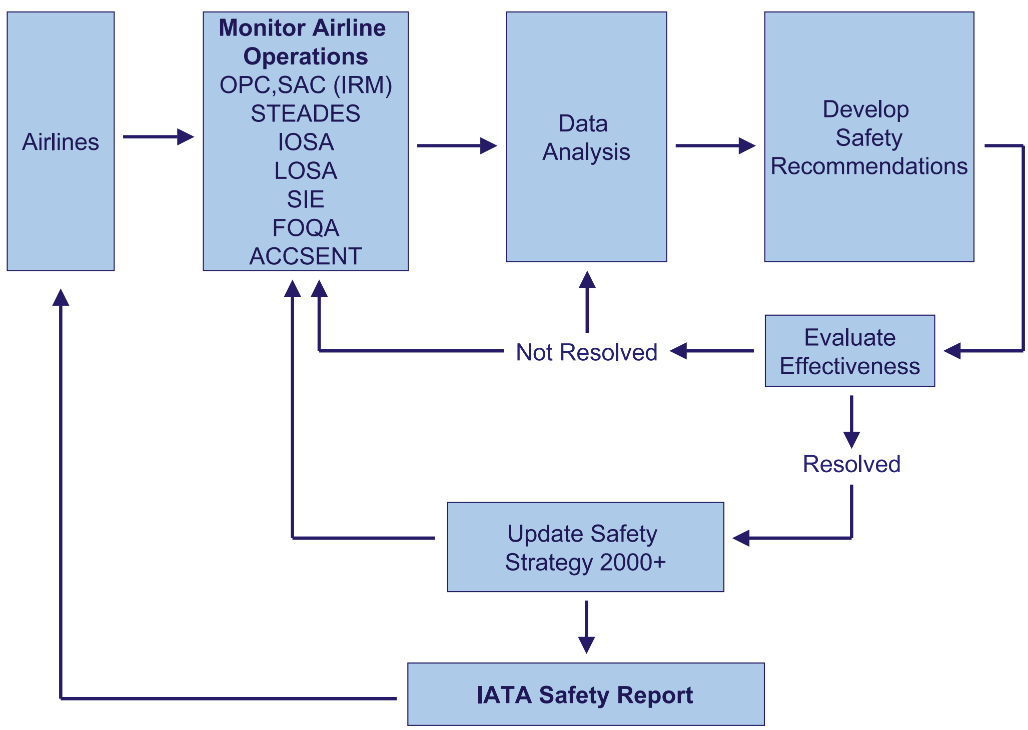
Safety Strategy 2000+ calls for consolidation and integration of safety efforts at IATA with other industry organisations for greater effect, including regional airline associations, aircraft manufacturers and the Flight Safety Foundation. It concentrates on Controlled-Flight-Into-Terrain (CFIT), Approach-and-Landing and Loss-of-Control accidents, which represent the greatest threat, while maintaining awareness of other hazards through the integration and evaluation of safety data from various sources. This data-driven approach is apparent in the STEADES (Safety Trend Evaluation, Analysis and Data Exchange System) project launched by IATA on 9 October 2001. **Refer to the Supporting Documents Section of the CD-ROM enclosed for a PowerPoint presentation of Safety Strategy 2000+.**

Under Safety Strategy 2000+ regional safety priorities are being established and best means for regional safety initiatives determined and implemented. Proper evaluation of the impact of safety initiatives, in conjunction with constant monitoring of the industry safety performance, will be key in ensuring the strategy is effective and delivers the desired goal of a continuous improvement in safety. These strategies have led IATA to form its own safety management system.

In view of the significant developments which have taken place in IATA's safety management system during 2001, this Safety Report will show how it is being developed to respond to Safety Strategy 2000+. An update will therefore be provided in subsequent paragraphs of the various components in the safety management system shown in Figure 1.A. The diagram shows where the Safety Report fits into the IATA safety management system.

Figure 1.A

IATA Safety Management System



1.7 SAFETY MANAGEMENT SYSTEMS

A Safety Management System (SMS) applies a business-like approach to safety. It is a systematic, explicit and comprehensive process for managing safety risks. As with all management systems, a SMS provides for goal setting, planning, and measuring performance. A SMS is woven into the fabric of an organisation. It becomes part of the corporate culture, the way people do their jobs. The IATA SMS is based on these precepts.

JAR-OPS states that “an operator shall establish an accident prevention and flight safety programme, which may be integrated with the Quality system, including programmes to achieve and maintain risk awareness by persons involved in operations”. This statement is based on the ICAO recommended practice (Annex 6 Pt 1) for operators to have such a programme in place. ICAO Doc 9422 (Accident Prevention Manual) gives appropriate guidance material and describes a SMS. IATA Safety is not only striving to align with these precepts but would also like promote them amongst its member airlines. **Airlines are advised to review the excellent material prepared by the Regulatory Authorities on Safety Management Systems such as UKCAA CAP 712 and Transport Canada TP 13739 and adopt these processes in their management of safety and risk. (Refer to Web Links and Supporting Documents on the enclosed CD-ROM).**

In doing so, airline safety departments will be able to interface more effectively with the safety organisations beyond their airline — not least IATA — and thus join forces with a large, business-like enterprise in the cause of accident prevention.

1.8 GLOBAL AVIATION INFORMATION NETWORK

To enhance its own SMS, IATA Safety is working closely with the Global Aviation Information Network (GAIN). GAIN is an industry and government initiative to promote and facilitate the voluntary collection and sharing of safety information, by and among users in the international aviation community, to improve safety. GAIN was first proposed by the Federal Aviation Administration in 1996, but has now evolved into an international industry-wide endeavour that involves the participation of professionals from airlines, employee groups, manufacturers, major equipment suppliers and vendors, and other aviation organisations. The GAIN organisation consists of an industry-led Steering Group, of which IATA Safety is a member, three working groups, a Program Office and a Government Support Team.

GAIN is already making a particularly valuable contribution to the development of IATA STEADES. This coincides with the welcome reduction of legal impediments to collecting and sharing of flight safety related information announced by the FAA in 2001. Given these developments, IATA is ideally placed to act as the honest broker of airline safety data. Moreover, ICAO is already seeing IATA as having a specific unique role as a trusted keeper of data, a role that no other organisation can play”. (Dan Maurino, Flight Safety and Human Factors, ICAO). GAIN is also seeing IATA as being in a unique position to help improve aviation safety worldwide through enhanced safety information collection and sharing.

IATA Safety would like to draw attention to two products arising recently from the GAIN initiative which are seen as contributing greatly to safety management. The first of these is the **Operator’s Flight Safety Handbook (Issue 1, June 2000 which is published in CD ROM format.** The other is a **Guide to Methods and Tools for Airline Flight Safety Analysis (Issue 1 December 2001). (Refer to Web Links on the enclosed CD ROM).** Again these documents will help Airline Safety Departments develop the processes for not only developing their own SMS but those which are necessary to improving aviation safety world-wide through enhanced safety information and sharing, not least with IATA. **Airlines are advised to obtain both of these documents to assist with enhancing their SMS and to enable them to participate more fully in global safety information exchange. (Refer to Web Links on the enclosed CD ROM).**

1.9 IATA SAFETY GOVERNANCE

1.9.1 OPERATIONS COMMITTEE AND THE SAFETY COMMITTEE

The IATA SMS is governed by the Operations Committee (OPC) and the Safety Committee (SAC). The OPC was created to advise the IATA Board of Governors, and the Director General, on all matters that relate to the improvement of safety, security, and efficiency of civil air transport. The SAC reports to the OPC to assist in all matters that relate to the optimisation of airline safety. In this way the OPC and SAC airline representatives help to formulate IATA's safety strategies and trigger the initiatives based on their experiences and their perception of the threats to safety.

1.9.2 INCIDENT REVIEW MEETING (IRM)

Part of the SAC is the Incident Review Meeting (IRM) which is particularly valuable in providing a unique opportunity for Safety Executives to share in confidential session the experience of accidents and incidents which their airlines may have suffered. Apart from being a safety information exchange, the IRM is also an important part of IATA's information collecting process. It assists IATA Safety to remain sensitive to the safety concerns of its member airlines and complements the work of the CWG. Additionally the SAC deploys the CWG in the role described at **Appendix A.** These forums have been the traditional "input" to the IATA safety system for many years. However, IATA's new safety initiatives are already beginning to contribute to the information gathering process of IATA's SMS. It is therefore pertinent to report on the implementation of these initiatives arising from Safety Strategy 2000+.

1.10 DEVELOPMENTS IN THE IATA SMS

1.10.1 STEADES

The Safety Trend Evaluation, Analysis and Data Exchange System (STEADES) project is one of the most important safety initiatives of IATA's Safety Strategy 2000+ and is already forming an essential part of the SMS. STEADES is collecting data from incident reports provided by pilots and support personnel of airlines in a de-identified format to ensure confidentiality. Data is forwarded to IATA for trend analysisvia the safety departments of the airlines participating in STEADES. The STEADES database already comprises some 200,000 records and about 25 airlines are subscribing data. Within the next four years, it is anticipated that approximately 250 airlines will be participating in the scheme. The corresponding amount of data will cover approximately 95% of all international commercial air traffic, and a very substantial amount of domestic traffic. Some trend analysis has already been carried out but the methodology is still being developed and is expected to mature by mid 2002, when trends and findings will be shared globally amongst the participants. STEADES will be by far the biggest and only global safety database. IATA has formed a STEADES Steering Group which includes the safety executives from 10 airlines and operators to support and direct this project and help with its propagation throughout the IATA community and the industry at large. Distribution of reports will be by electronic means, initially by CD, but ultimately developed to an interactive web site. **Refer to Supporting Documents on the enclosed CD-ROM for a PowerPoint presentation of the status of the STEADES programme.**

Additionally, IATA Safety has developed an Accident Database called ACCSENT, initially for supporting the work of the CWG which will be developed further to form part of the STEADES service. The Safety Department has also recently procured the Airclaims CASE database to assist with the analysis work involved with the production of the Safety Report. In this way IATA Safety is moving towards its aim of becoming "data-driven" to better serve its customer airlines.

1.10.2 FLIGHT DATA MONITORING

Flight Data Monitoring (FDM), as it is often referred to in Europe, or Flight Operations Quality Assurance (FOQA) as it is termed in the USA, is seen as a major component of IATA SMS. The potential of this technology to assist with IATA's oversight of airline operations is immense and IATA Safety has already conducted a feasibility study to assess the contribution that FDM could make to the STEADES programme.

Figure 1.B

Why Flight Data Monitoring?

Photograph by Samuel Lo

The FDM programmes, which are now in use by many airlines, analyse the recorded flight data and check for Events. Events are occasions in which the aircraft have been flown outside set limits and so, by their very nature, they describe failures in skill or in procedures. Understandably, airlines are reluctant to share this data, because of fears of litigation or reports in the media. It is unlikely therefore that IATA will persuade airlines to share such data, at least in the near future, but more probable is the sharing of more generalised Flight Data Recorder (FDR) based information, provided that it is de-identified. This form of data sharing is referred to in the European Safety Community as "Maxval" or "Snapshot". The outcome of this feasibility study will soon be presented to the SAC and OPC. However, this research has already confirmed that given the co-operation and trust long enjoyed by its members in the safety arena, IATA's unique position as a trusted keeper of safety data could be used here. The most important advantage of such a system for airlines is that they could be given access to the IATA file, summing all de-identified data for all aircraft types, and would be able to compare their aircraft handling with that of participating airlines. For its part, IATA would have access to all de-identified data and would be able to analyse many aspects of flying and flight safety for inclusion in STEADES and also in this Safety Report.

1.10.3 SAFETY OVERSIGHT

Most of the systems described so far in this Safety Report are based on "incidents". Some sort of event has to occur and be reported to the SMS before the system reacts. They are largely reactive systems which, if applied in a good safety reporting culture, will nevertheless make a proactive contribution to accident prevention. To move more into the proactive arena, however, the SMS should also include quality and safety auditing to appropriate standards. Safety and Quality auditing is applied from the top of the aviation system with the ICAO Universal Safety Oversight Audit Programme, which became operational in 1996. During the first two years of operation, the programme detected numerous deficiencies in the establishment of effective safety oversight programmes in Contracting states. This critical need for increased attention to global aviation safety led to the full establishment of an ICAO universal safety oversight audit programme comprising regular, mandatory, systemic and harmonised safety audits. **ICAO's Safety Oversight Audit Manual First Edition — 2000** provides a complete exposition of the system with its standards and checklists.

1.10.4 LINE OPERATIONAL SAFETY AUDIT (LOSA)

Reflecting its specific interest in human factors, ICAO has supported and promoted research in the application of Line Operational Safety Audits (LOSA), a system which also was jointly developed by Continental Airlines, the University of Texas, and ICAO. It is a non-jeopardy process for observing normal line operations. LOSA employs "auditors" in the cockpit who observe how flight crew deal with day-to-day issues. It shows how events unravel, how the flight crew deal with threats, and how they manage errors. **Refer to the Web Links on the enclosed CD ROM for information on LOSA and Threat and Error Management.**

The sort of information captured by LOSA is unlikely to be forthcoming by other means. At airline level, LOSA represents the last piece of a cocktail of data made up of FDM, Air Safety Reporting, (and the findings of the ensuing investigation) and quality assurance programmes. The same is true at the IATA level. Here LOSA would complement STEADES and any FDM programmes established by IATA, thus adding to the input to the SMS. IATA Safety is therefore co-ordinating with the University of Texas, to appraise the existing LOSA database, discuss technical issues involved in LOSA data management, and assess the extent and timing of IATA's co-operation.

1.10.5 OPERATIONAL QUALITY STANDARDS (OQS)

IATA has begun to carry out some safety auditing as part of its own Operational Quality Standards (OQS) review programme. IATA Operations conducts OQS reviews of airlines applying for membership. These reviews provide an insight to some of the safety issues affecting emerging airlines, often in less developed parts of the world. This is therefore a useful de-identified source of information for IATA Safety. In future reports IATA expects to communicate some of the safety concerns identified by the OQS programme.

For example, during 2001, the areas impacting on safety highlighted by the OQS reviews identified a lack of a safety culture and structure, sometimes under-resourced, inappropriately staffed with incumbents lacking dedicated training. Moreover, OQS has shown that there is a widespread lack of knowledge of the benefits to be gained from a management supported, pro-active Safety drive encompassing all departments of an airline. It is also apparent that very little use is being made of the many affordable and effective tools and activities that are available.

Such messages conveyed to an emerging airline at a formative stage are considered to be particularly valuable. In this way IATA has begun to take a much more proactive approach to the safety oversight of its member airlines and as such is improving the perspective of its SMS, but this activity is only focussed on a very small percentage of the airline population.

1.10.6 IATA OPERATIONAL SAFETY AUDIT

Looking to the airline industry at large, it is apparent that there is an ever-increasing proliferation of inspections, reviews and audits which often overlap, both in intent and content. Over 70,000 audits are performed annually at an estimated cost to the industry of USD 3.6 billion. Behind this sizeable expenditure resides the problem of wide variability in both operating and audit standards and their application. The opportunity to standardise, harmonise, and rationalise the audit process is being taken by IATA in the form of the IATA Operational Safety Audit (IOSA). **Refer to Supporting Documents on the enclosed CD ROM for a PowerPoint presentation of the status of the IOSA programme.**

The purpose of IOSA is to formulate and implement an internationally recognised evaluation system by which the competence and reliability of an airline to deliver a safe operation and manage attendant risks may be assessed. IOSA spans the whole airline SMS, including Senior Management accountability, Safety and Quality Oversight, Flight Operations, Cabin Safety, Flight Dispatch, Ground Operations, Cargo, Dangerous Goods, Engineering/Maintenance and Security.

The events of 11 September have made the implementation of IOSA more difficult but good progress is being made. It is apparent that the Industry need for IOSA is now greater than it has ever been, especially in terms of the recognition of security as a critical element of flight safety. The project is fast gaining industry recognition having already been endorsed by the FAA. IOSA complements the ICAO Safety Oversight Audit programme as shown at Figure 1.C. Whereas IOSA with its safety and quality standards and check lists takes a bottom up approach working from the airlines, the ICAO oversight programme works from the top down.

Figure 1.C

ICAO Oversight/IOSA Relationship

Figure 1.C shows how IOSA closes the loop between the regulatory oversight (ICAO) top down approach and the operational oversight (IATA) bottom up approach. With this closed loop in sight, IOSA will model ICAO's Standards and Recommended Practices.

IOSA is recognised as the largest safety initiative ever undertaken by IATA for the collective benefit of its Members. IATA intends to seek international recognition and accreditation of the proposed audits and offer a related suite of products and services around IOSA. To the extent possible, the IOSA audit will be conducted consistent with quality audit principles. One important benefit will be the insight the IOSA audits will provide for IATA Safety, and the feedback it will get from its customers — the airlines — from the audit reports. In this way, IOSA will serve as a vital, and very proactive part, of the cocktail of safety feedback IATA needs for its SMS to thrive.

1.10.7 SAFETY INFORMATION EXCHANGE AND SWAP

The IATA SMS is not only about data feedback but it has also to do with exchanging the ensuing information, appropriately identified, with member airlines. For many years the members of the IATA Safety Committee (SAC) have shared safety information regarding operational safety issues via the SAC Info Exchange Scheme. IATA facilitated this exchange of questions and answers initially by teletype and then by email. This exchange of information is continuing to evolve. At SAC/12 the committee agreed to move this information exchange activity to the web in the form of a discussion group called SWAP (Safety with Answers Provided). This was initially set up as a test site with access limited to the Members of SAC in order to assess functionality of using this type of vehicle for exchanging information. It has proved to be user friendly, and it is identified that airlines benefit from this free and voluntary exchange of information. In fact, the benefits of SWAP are twofold. Firstly, Safety Departments of airlines have the opportunity to ask operational, airside or cabin safety questions. They will receive responses from a diverse group of airlines, which is IATA membership pool. Secondly, SWAP provides IATA and the SAC with yet another means for monitoring airline operations and insight into the areas of concern and high risk, which is an important element of the SMS system. Therefore at SAC/13 the committee strongly supported the extension of SWAP to all IATA Members and to the rest of the aviation industry. As a result, the new SWAP site will begin construction. In its new form it will encompass operational, cabin and airside safety issues. The link to the SWAP site can be found on the enclosed CD-ROM. Ultimately, SWAP will be integrated with the STEADES interactive web-site to form part of the overall IATA SMS.

1.11 MONITORING AIRLINE OPERATIONS

This section of the report has described the primary components of the IATA SMS. Having explained the role of the OPC, SAC and the CWG, the section has shown how safety data systems and information exchange systems are increasingly contributing to IATA's SMS and how these are being developed to assist with more effective monitoring of airline operations. This is not a big-brother function, rather it reflects a customer-driven, more business-like approach to safety which is being taken by IATA.

Against this backdrop, subsequent sections of the report will address the accidents of the year 2001 and search for ways in which IATA, its airlines, and others with the same ideals can prevent accidents. It will show how the safety report can play its part within the IATA SMS and maintain IATA's focus where it best serves its customers.

The safety metrics to be used by IATA SMS are fully described at **Appendix C.** Some of these have been updated and are therefore reviewed here to complete the backdrop to the subsequent accident classification and analysis presented in the Safety Report.

In this electronic age, the ease with which data is exchanged is unprecedented and arising from this is the need to standardise definitions. There are a number of industry initiatives and working groups attempting to do this for the benefit of the Industry as a whole. IATA Safety has become aware of a number of these initiatives and considered them. This new Safety Report aims to align with these definitions and metrics. As a result there are three main areas that have been updated: the term Hull Loss is used, the Phase of Flight definitions and occurrence category definitions.

Hull Loss versus Total Loss There is an industry debate regarding Hull Loss, Total Loss and Aircraft destroyed and their relation to measuring safety. While it is true that at present the terms Hull Loss and total loss are influenced by economics, the definition of Total Loss is also dependent on the terms of insurance contracts, for this reason and also to align with the industry this new Safety Report now incorporates Hull Losses. Perhaps in the future there will be a move to present statistics of aircraft destroyed **(Refer to Supporting Documents on the enclosed CD-ROM).** The definitions for Hull Loss and Total Loss are found below.

Hull loss: An accident in which the aircraft is substantially damaged and as a result is deemed to be beyond economical repair.

Total Loss: refers to accidents in which the aircraft has been destroyed or damaged according to the following definitions:

(a) **Western-built aircraft.** A Total Loss is defined as an aircraft which has been destroyed or otherwise damaged beyond economical repair (as generally determined by the insurance contract). It should be noted that on rare occasions an aircraft may actually be repaired after having been a total loss, however, they are still counted as having been total losses.

(b) **Eastern-built aircraft.** Accidents to the Eastern-built aircraft have been classified as “total hull losses”, a term used in the former Soviet Union to denote an accident where the aircraft was either destroyed or otherwise never repaired. This is not the same as the definition used for Western-built aircraft.

Phase of Flight These phase of flight definitions were, and continue to be, developed by the Air Transport Association Flight Operations Working Group. The phase of flight definitions used in the Safety Report are based on the Flight Operations Information Data Interchange — Phase of Flight Specification, ATA iSpec2200 (ATA POF Spec). Rather than presenting a statistic that indicates how many events happened on the ground, statistics are now presented in terms of what actions the crew were undertaking (refer to Appendix C for definitions). An obvious benefit of these phases is that they are based on crew actions, and therefore create a strong relationship between the information and task at hand helping to integrate human factors throughout the statistics, rather than dealing with human factors as a separate issue.

Occurrence Categories

Mentioned throughout the report are statistics relating to areas of concern that the CWG are monitoring such as undershoots, loss of control, runway excursions and incursions etc. Where applicable the CWG is using these terms in conjunction with the definitions developed by CAST ICAO Common Taxonomy team. **(Refer to Supporting Documents on the enclosed CD-ROM).**

1.12 IATA REGIONS

The currently assigned IATA regions are set out at **Appendix D.**

1.13 CONVENTIONS

Unless otherwise specified, figures shown in square brackets [ ] relate to 2000 data.

1.14 ACCIDENT REVIEW 2001

The Safety Report provides an overview of all accidents that occurred in 2001 in simple format with the accident narratives set out at **Appendix E.** The graphs and illustrations should prove helpful for general use by airline management, crewmembers, training organisations and safety staff. **(Refer to Safety Report on enclosed CD-ROM for additional graphs in the Slide Support Package.)**

CHAPTER 2 — JET SYNOPSIS

2.1 STATISTICS FOR WESTERN BUILT JETS

2.1.1 DATA FOR 2001

Unless otherwise indicated, figures provided in square brackets [ ] relate to data for the previous year.

Fleet-Hours-Sectors

World Fleet (end of year): 15,580 [14,723]

Hours Flown: 37.0 million [37.5 million]

Sectors (landings): 20.0 million [19.9 million]

Accidents

All Hull Losses:	24 [22]	Operational Hull Losses (HL):	20 [20]
All Substantial Damage:	37 [30]	Operational Substantial Damage (SD):	36 [30]
Total accidents:	**61* [52]**	**Total Operational Accidents:**	**56 [50]**

**These figures exclude ground events where there was no intention of flight, but do include acts of violence.*

The following table lists the operational Hull Losses (HL) and Substantial Damage (SD) accidents by aircraft group/type (Refer to Appendix C for definitions).

Figure 2.1.A

GROUP 1				GROUP 2				GROUP 3				GROUP 4			
TYPE	HL	SD	TOT	TYPE	HL	SD	TOT	TYPE	HL	SD	TOT	TYPE	HL	SD	TOT
Passenger				**Passenger**				**Passenger**				**Passenger**			
B707	1		1	B737(JT8)	2	1	3	A300	1		1	A300-600	1	3	4
B727	2	1	3	F28		1	1	L1011		1	1	A319		1	1
				DC9		1	1	MD80	1	2	3	A320	1	2	3
												A321		2	2
												A330		1	1
												B737 CFM	1	3	4
												B737 N		1	1
												B747-400		2	2
												B767		1	1
												B777		1	1
												B146/RJ	1	1	2
												E145		1	1
												F100	1	2	3
												MD11		1	1
Total	**3**	**1**	**4**	**Total**	**2**	**3**	**5**	**Total**	**2**	**3**	**5**	**Total**	**5**	**22**	**27**
All-Cargo				**All-Cargo**				**All-Cargo**				**All-Cargo**			
B707	2	1	3	B737 (JT8)		1	1	DC10		1	1				
B727	3	1	4	B747	1	2	3								
Caravelle	1		1												
DC8	1	1	2												
Total	**7**	**3**	**10**	**Total**	**1**	**3**	**4**	**Total**	**0**	**1**	**1**	**Total**	**0**	**0**	**0**
TOTAL	**10**	**4**	**14**		**3**	**6**	**9**		**2**	**4**	**6**		**5**	**22**	**27**

Operational Loss Rates

Hull losses per million sectors: 1.00 [1.10]

Hull losses per million hours: 0.54 [0.59]

Passengers Carried-Fatal Accidents-Fatalities & Fatality Rate

Passengers carried (million):	1,810 [1,926]
Estimated change since the previous year:	6.0 % decrease [7.1% increase]
Fatal accidents:	8* [9]
Fatalities:	
Passengers:	380 [729]
Crew:	21* [53]
Total:	**401* [782]**

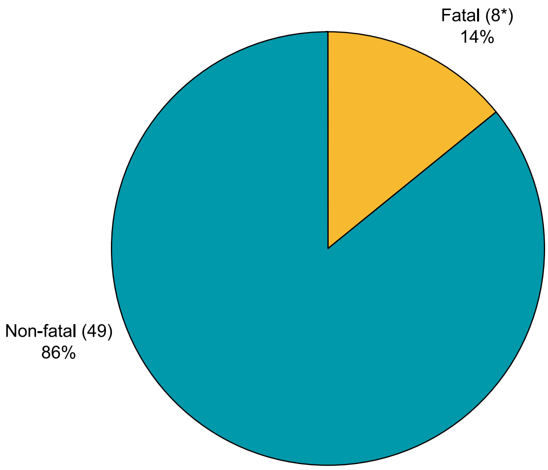
**Note Fatal and Fatalities include 1 crew member killed falling from an aircraft while attempting to open the door, there was no damage to the aircraft.*

Fatality rate: 0.21 [0.38] passenger-fatalities per million passengers or the equivalent of one passenger-fatality per 4.8 [2.6] million passengers carried.

Of the 56 operational accidents (20 HL and 36 SD), 7 (13%) resulted in passenger and/or crew fatalities.

Figure 2.1.B

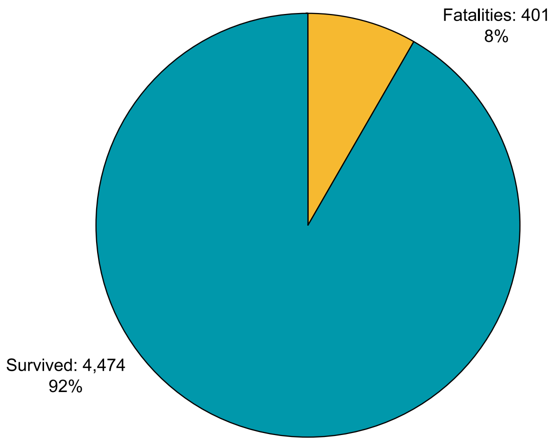
Fatal Accidents vs Operational Accidents



There were 4,874 [5,538] individuals aboard the 56 [50] aircraft involved in operational accidents. Of these, 400 [782] suffered fatal injuries as a consequence while 4,474 [4,760] survived. The following diagram illustrates this relationship.

Figure 2.1.C

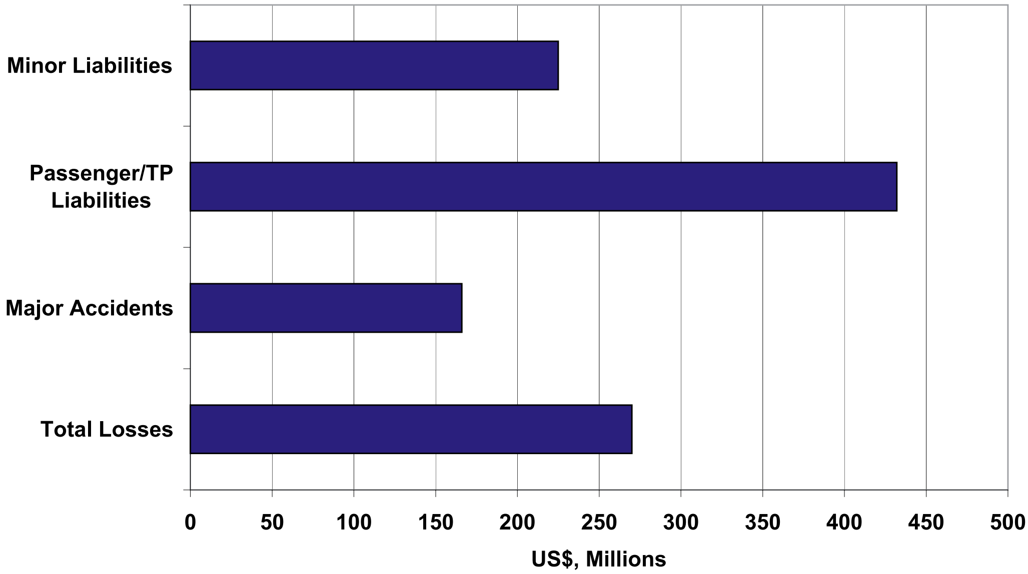
Operational Accidents (56)



Estimated Cost

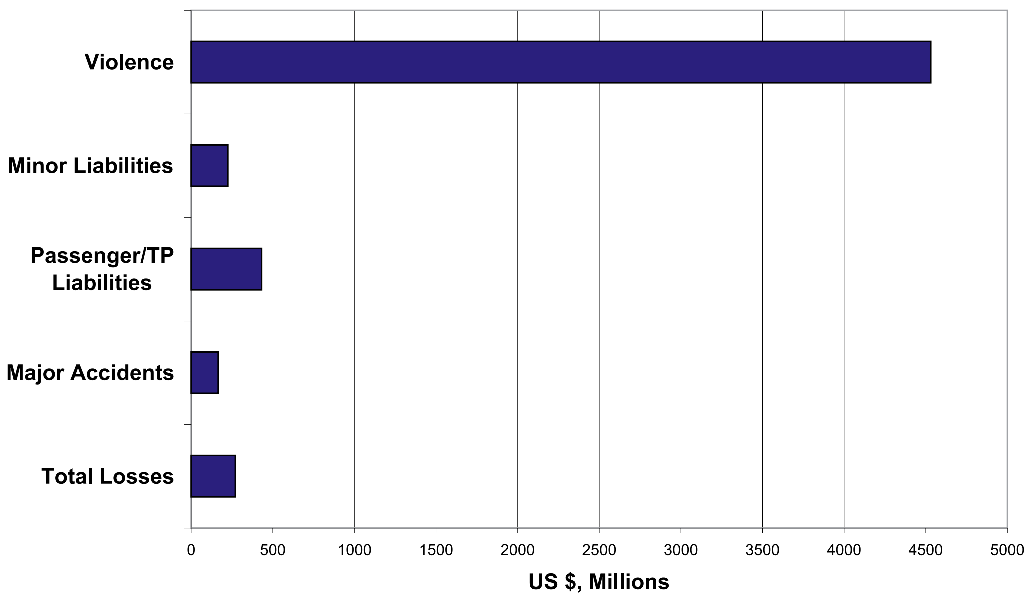
The direct cost (excluding lost revenue etc.) of the operational Hull Loss (HL) accidents is estimated at $228 [$496] million. These costs for all accidents are illustrated in the following diagram.

Figure 2.1.D
Costs (All Accidents)
Excl. Deliberate Acts of Violence



Of course 2001 has been without precedent in terms of acts of violence. The graph below indicates the cost of these acts of violence.

Figure 2.1.E
Costs (All Accidents)
Incl. Deliberate Acts of Violence



Registry-State of Operator-State of Occurrence

The following table lists the operational Hull Loss accidents which occurred in 2001. Refer to Appendix D for IATA Regions.

Hull Losses: **20 [20]**

Figure 2.1.F

Date 2001	Aircraft Registration	State of Operator	IATA Region	State of Occurrence	IATA Region
1/5/01	S9-BAI	Angola	AF	Angola	AF
1/9/01	CP-2323	Bolivia	SA	Argentina	SA
1/31/01	HK-3932X	Colombia	SA	Colombia	SA
2/7/01	EC-HKJ	Spain	EU	Spain	EU
3/3/01	HS-TDC	Thailand	FE	Thailand	FE
3/7/01	PT-MST	Brazil	SA	Brazil	SA
3/11/01	N701NE	USA	NA	Micronesia	FE
3/23/01	SU-BMV	Egypt	NE	Liberia	AF
4/4/01	N791AL	USA	NA	Colombia	SA
5/10/01	D2-FCK	Angola	AF	Angola	AF
5/22/01	C-GNWI	Canada	NA	Canada	NA
5/23/01	N1419D	USA	NA	USA	NA
8/1/01	7O-ACW	Yemen	NE	Eritrea	AF
9/7/01	TN-AGO	United Kingdom	EU	Congo	AF
9/16/01	PP-CJN	Brazil	SA	Brazil	SA
10/8/01	SE-DMA	Scandinavia	EU	Italy	EU
10/17/01	AP-BCJ	Pakistan	FE	UAE	NE
11/12/01	N14053	USA	NA	USA	NA
11/24/01	HB-IXM	Switzerland	EU	Switzerland	EU
11/27/01	9G-MKI	Ghana	AF	Nigeria	AF

The following table lists the operational Substantial Damage accidents which occurred in 2001.

Substantial Damage: 36 [30]

Figure 2.1.G

Date 2001	Aircraft Registration	State of Operator	IATA Region	State of Occurrence	IATA Region
1/3/01	XA-TKR	Mexico	SA	Mexico	SA
1/14/01	F-GCBE	France	EU	USA	NA
1/15/01	9M-MPH	Malaysia	FE	United Kingdom	EU
2/25/01	HL7592	Korea	FE	Korea	FE
3/6/01	N375FE	USA	NA	USA	NA
3/15/01	OO-CTR	Belgium	EU	Dominican Republic	SA
3/17/01	N357NW	USA	NA	USA	NA
3/22/01	TS-IMM	Tunisia	AF	Tunisia	AF
4/4/01	C-GDCC	Canada	NA	Canada	NA
4/18/01	G-VOLH	United Kingdom	EU	Portugal	EU
4/21/01	N728FV	Mexico	SA	USA	NA
4/26/01	N8076U	USA	NA	USA	NA
5/10/01	EC-FXI	Spain	EU	United Kingdom	EU
5/13/01	TU-TAG	Ivory Coast	AF	South Africa	AF
5/17/01	HS-TAX	Thailand	FE	Thailand	FE
5/17/01	HS-TAZ	Thailand	FE	Thailand	FE
6/2/01	D-ABTH	Germany	EU	USA	NA
6/10/01	B-3040	China	FE	China	FE
6/27/01	ZS-OOS	South Africa	AF	Belgium	EU
7/6/01	C-FTNA	Canada	NA	France	EU
7/17/01	HC-BMD/ FAE220	Ecuador	SA	Ecuador	SA
7/19/01	PP-BSE	Brazil	SA	Brazil	SA
7/21/01	LN-RMT	Scandinavia	EU	Finland	EU
8/4/01	C-FRYG	Canada	NA	Cuba	SA
8/19/01	D-AHIA	Germany	EU	Turkey	EU
8/24/01	C-GITS	Canada	NA	Portugal	EU
8/25/01	D-AKNH	Germany	EU	Germany	EU
9/5/01	G-VIIK	United Kingdom	EU	USA	NA
9/5/01	TC-THB	Turkey	EU	Turkey	EU
9/6/01	YV-43C	Venezuala	SA	Trinidad	SA
9/15/01	PT-MRN	Brazil	SA	Brazil	SA
11/1/01	5Y-KQD	Kenya	AF	Kenya	AF
11/3/01	S9-BOE	Sao Tome	AF	Angola	AF
11/16/01	F-OHMP	Lebanon	NE	Egypt	NE
11/20/01	B-16101	Taiwan	FE	Taiwan	FE
12/17/01	PT-SSI	Brazil	SA	Brazil	SA

Cargo vs. Passenger Operations

Figure 2.1.H

HL and SD accidents, and loss-rates for Cargo and passenger operations for Western Built Jets

	Fleet End of 2001	HL	HL per 1000 Aircraft	SD	Total	Operational Accidents per 1000 Aircraft
Cargo	1,726	8*	4.64	7	15	8.69
Passenger	13,854	12	0.87	29*	41	2.96
Total	**15,580**	**20**	**1.28**	**36**	**56**	**3.59**

*Includes one ferry flight.

Accident Summaries

Descriptions of jet airliner operational Hull Loss and Substantial Damage accidents, and certain other losses, are presented in Appendix E.

2.1.2 DATA FOR LAST 10 YEAR PERIOD (1992-2001)

Introduction

To obtain a more complete picture of current operations, a 10-year period is considered sufficiently long to indicate significant trends and short enough to eliminate the influence of superseded practices and procedures.

Hours-Sectors

In this period, some 1,163 airlines are recorded as having operated commercial jet aircraft and having performed the following:

Hours Flown: 308.7 million

Sectors: 169.8 million

Operational Hull Losses

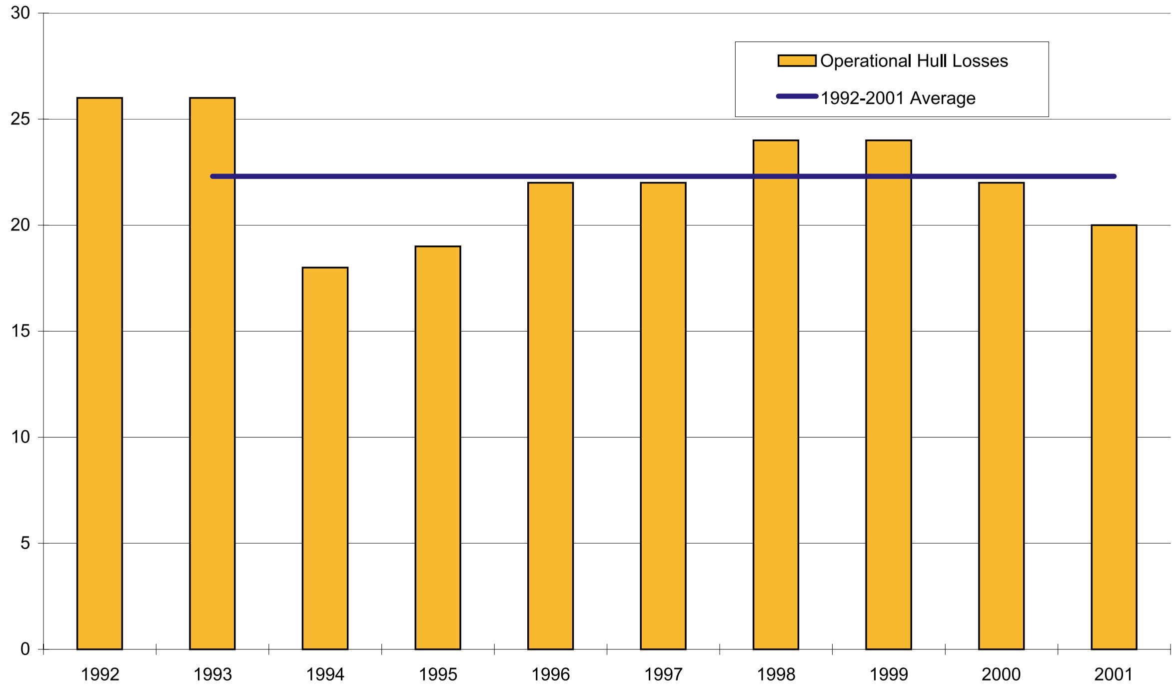
Operational Hull Losses: 223

Average over the period: 22.3

Average over last 5 years: 22.4

Figure 2.1.I depicts the operational Hull Losses (HL) and the 5 and 10 year averages for the 1992-2001 period.

Figure 2.1.I
Operational Hull Losses (1992-2001)

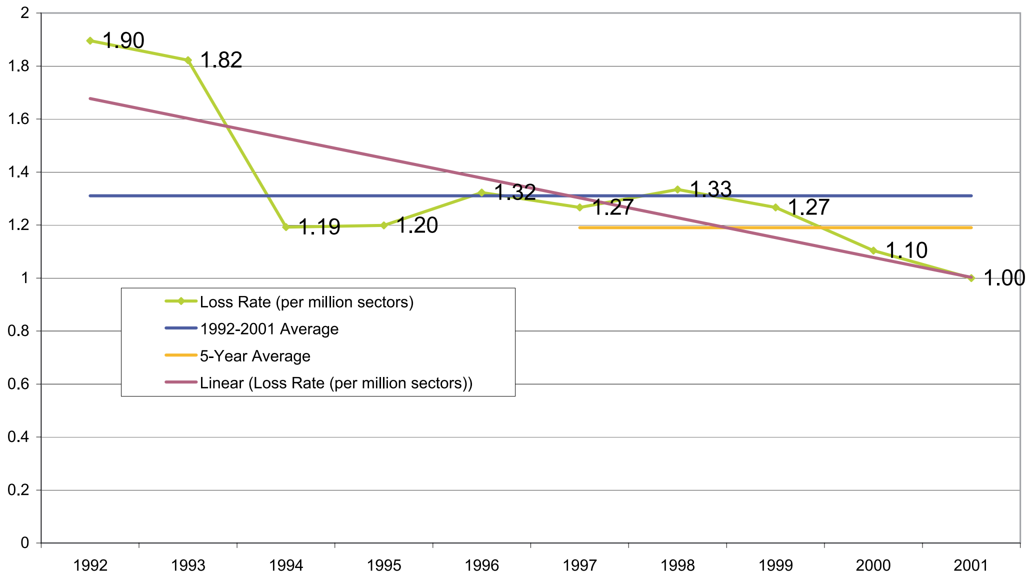


Loss Rates

The following graph shows the Loss Rate (Hull Losses per million sectors), together with the 5 and 10 year annual averages, and a trendline (3 year moving average).

Figure 2.1.J

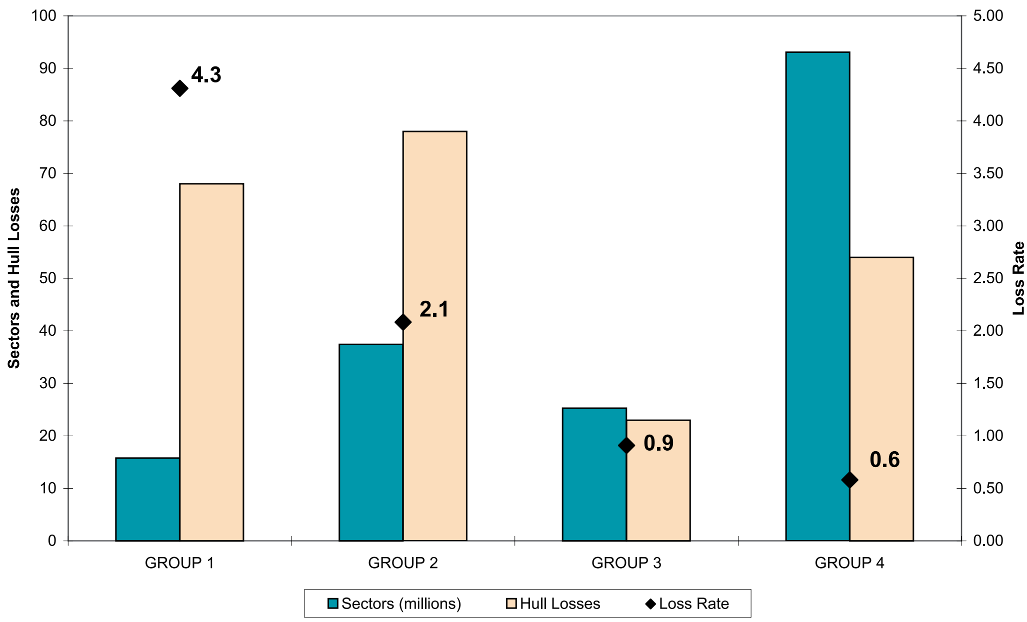
Loss Rate (1992-2001)



The following graph shows Sectors, Hull Loss, and Loss Rate by Aircraft Group for the 1992-2001 period. (Refer to Appendix C for definitions.)

Figure 2.1.K

Sectors-Hull Losses-Loss Rate (1992-2001)



Passengers Carried-Fatal Accidents-Fatalities & Fatality Rate

Passengers Carried:	16,382 million
Fatal Accidents:	99
Fatalities:	Passenger: 6,221
Crew:	540
Total Fatalities:	**6,761**
Fatality Rate:	0.21 passenger-fatalities per million passengers carried

Figure 2.1.L
Fatal Accidents and Passenger Fatalities (1992-2001)

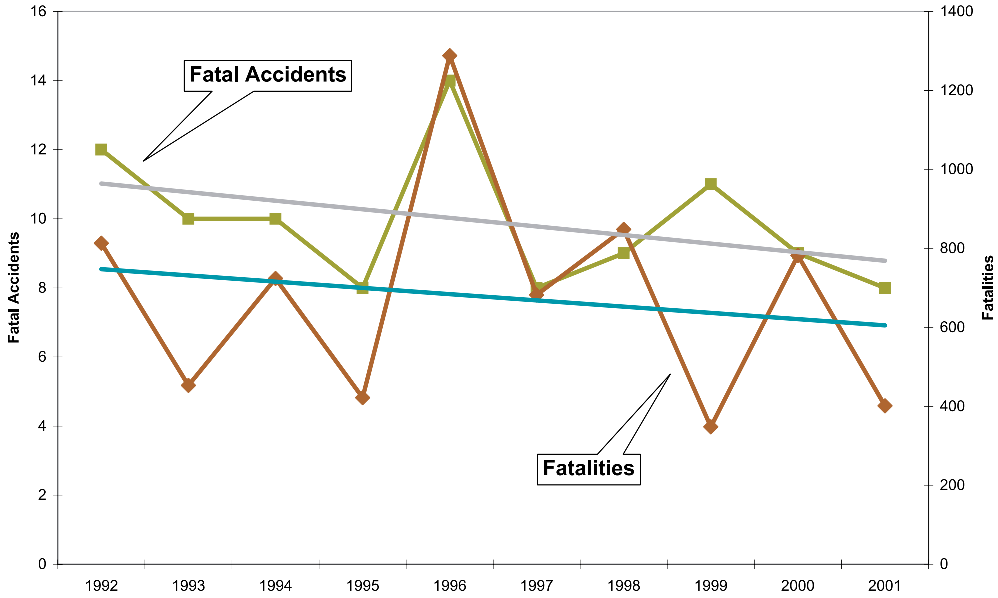
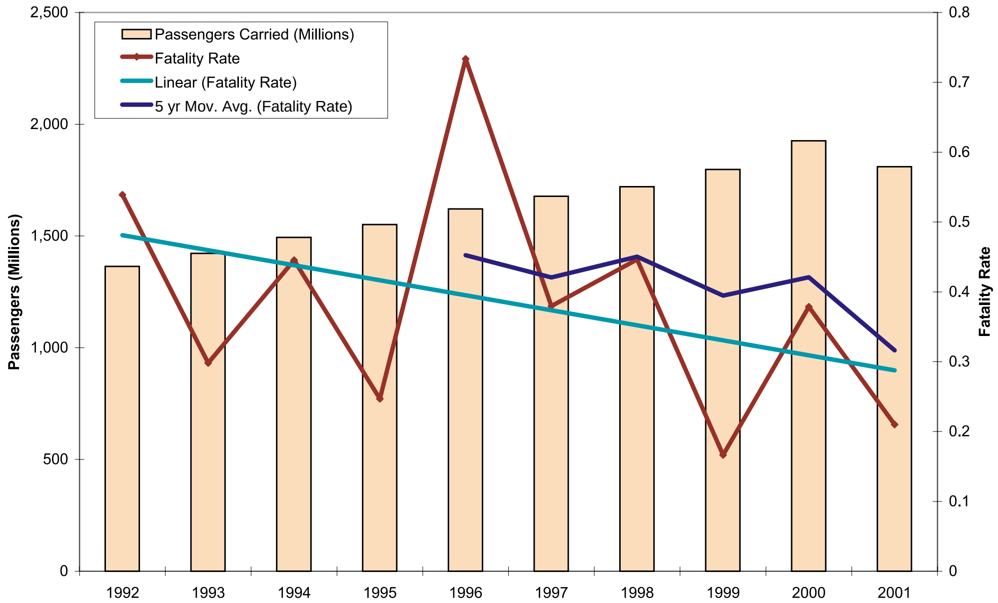


Figure 2.1.M
Passengers Carried & Fatality Rate (1992-2001)



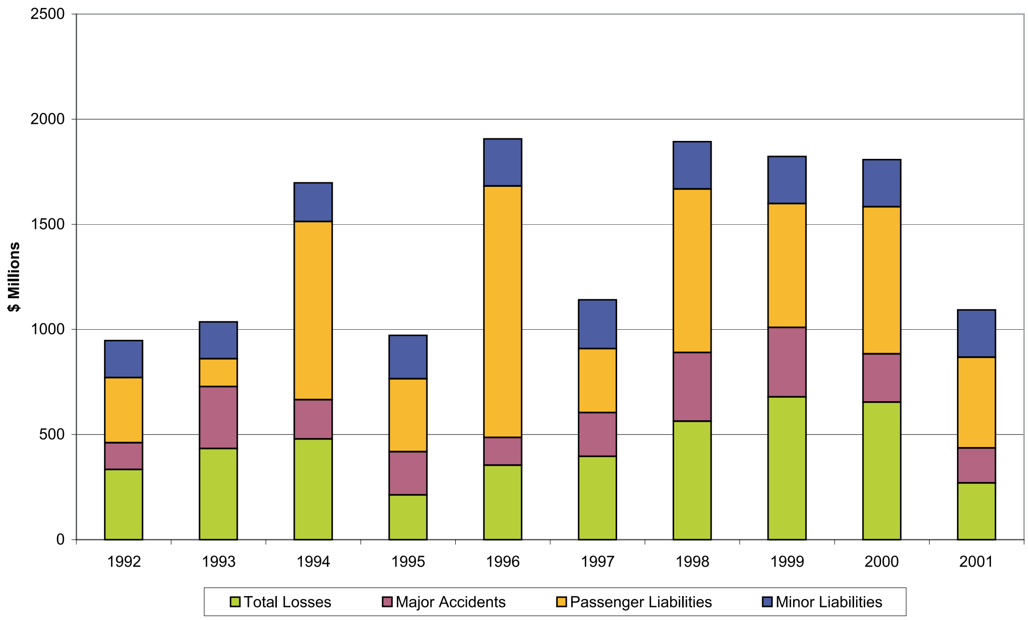
Estimated Cost

The figure shows the estimated cost for all losses involving Western-built jet airliners, excluding acts of violence.

Figure 2.1.N

Accident Costs (1992-2001)

(Excluding Deliberate Acts of Violence)

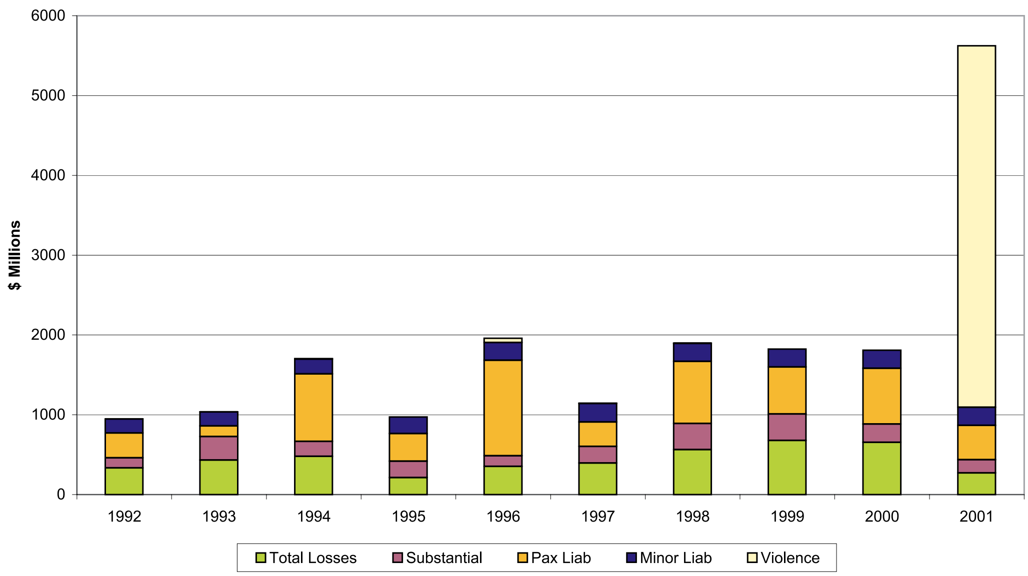


The figure shows the estimated cost for all losses involving Western-built jet airliners, including acts of violence.

Figure 2.1.O

Accident Costs (1992-2001)

(Including Deliberate Acts of Violence)



2.1.3 HISTORICAL RECORD

Hours-Sectors-Fleet

Since 1958, jet transport aircraft have flown some 671 million hours and 412 million sectors.

The figure shows the number of hours, sectors and fleet size since 1958. The number of hours per sector was fairly stable until 1984, but has been increasing at a much greater rate since. The most likely causes are:

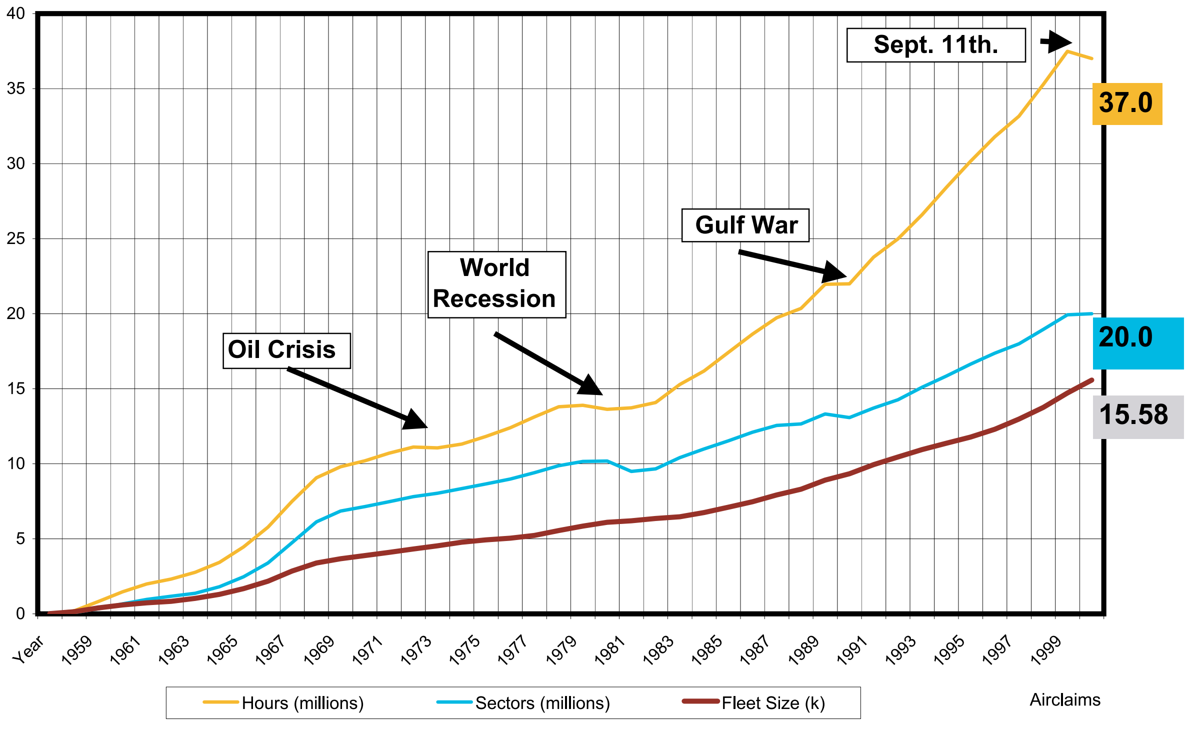
- The transfer of a large amount of short-haul traffic from jet operators to commuter operators in turboprops albeit now reverting from turboprop back to commuter jets;
- Introduction of ETOPS; and
- Introduction of long-range aircraft (A340, B747-400, etc.).

The plotted line for hours flown shows four points where the steady growth is discontinuous:

- 1974, first crude oil crisis;
- 1981, world economic recession;
- 1991, Gulf War and over-capacity and
- 2001, terrorist attack on the U.S.

Figure 2.1.P

Hours – Sectors – Fleet



Hull Losses since 1958

Airline	
Operational	689
Test & Training	40
Violence (flight)	51
Violence (ground)	40
Non-operational (ground)	44
Non-Airline/Unknown	24
Total Hull Losses	**888**

The following figure shows the operational Hull Losses since 1958, a trendline (linear), the average over the period 1958-2001 and the last 20-, 10- and 5-year annual averages. These values are:

- For the period (1958-2001):16
- Last 20 years (1982-2001):19.9
- Last 10 years (1992-2001):22.3
- Last 5 years (1995-2001): 22.4

Figure 2.1.Q

Operational Hull Losses (1958-2001)

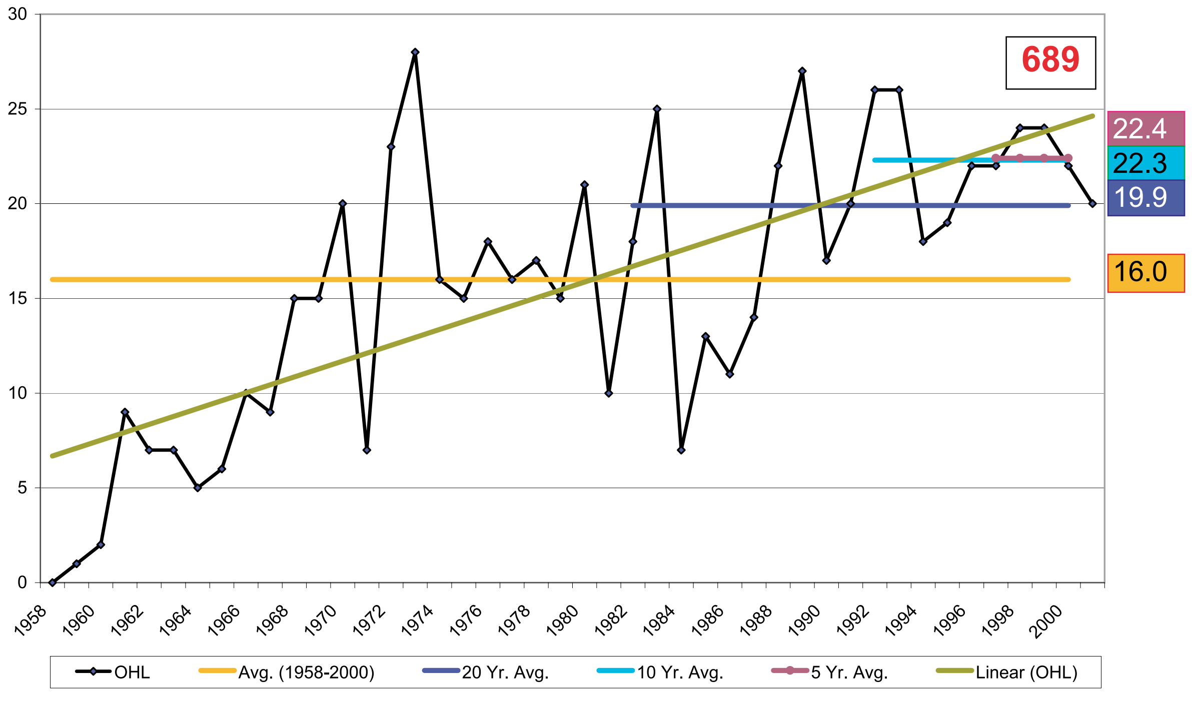
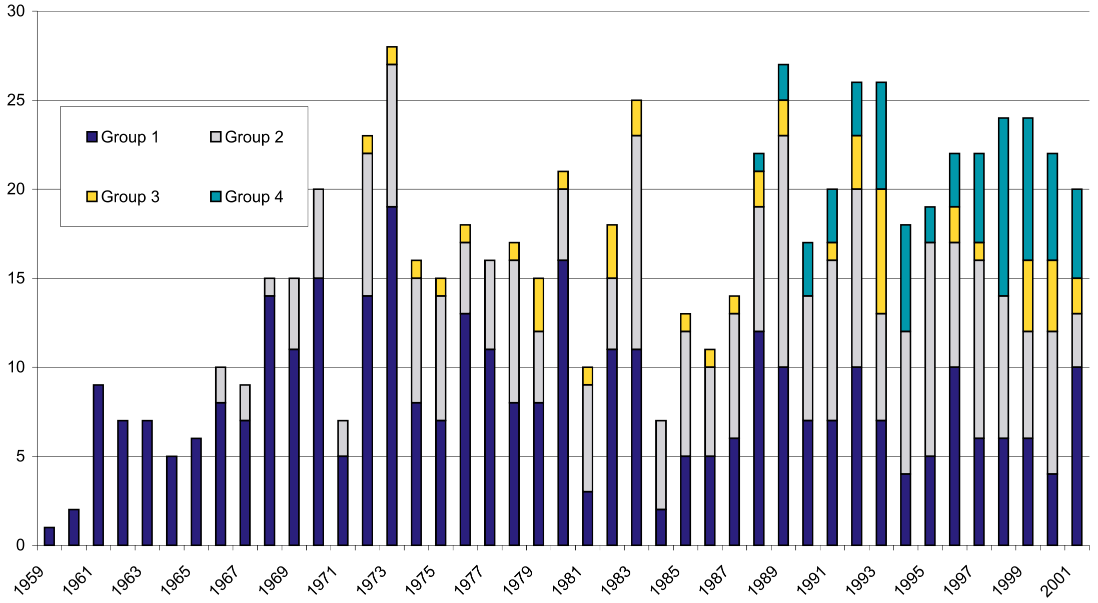


Figure 2.1.R

Operational Hull Losses by Aircraft Group*



*Refer to Appendix C for definitions of aircraft groups.

Loss Rate

Figure 2.1.S

Hull Losses per Million Sectors

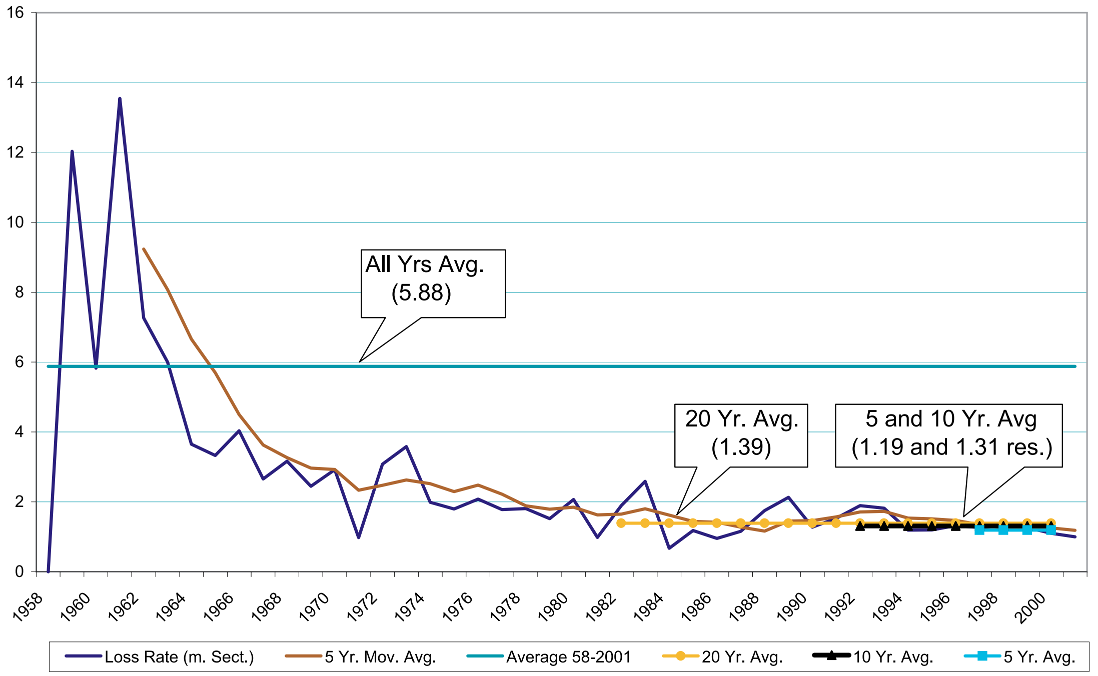
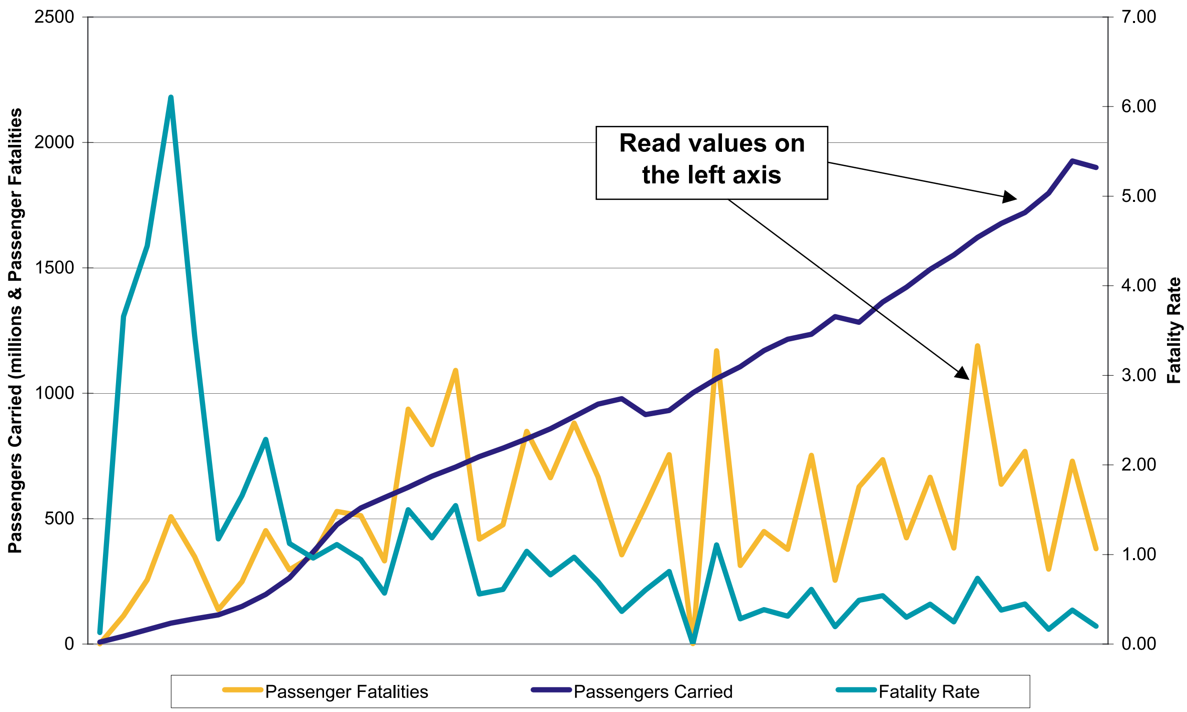


Figure 2.1.T

Passengers Carried-Fatalities & Fatality Rate



2.2 ACCIDENT CLASSIFICATION — WESTERN-BUILT JETS

2.2.1 INTRODUCTION

This Safety Report includes a subjective assessment of the most apparent contributory factors leading to accidents. The advantage of this practice is that it facilitates early identification of emerging problems. The disadvantages are that occasionally some accidents cannot be assessed at all because of insufficient data, and that no update of these initial assessments is made. However, experience has shown that these early assessments are invariably born out by the eventual publication of the accident reports.

2.2.2 EVENTS

The more significant events identified in 2001 that resulted in an operational Hull Loss (HL) or Substantial Damage (SD) accident were as follows:

- There were 6 (5HL, 1SD) accidents where the aircraft landed short of the runway;
- In 17 accidents (5HL, 12 SD), weather was a contributory factor;
- There were 10 (2HL, 8SD) runway excursions;
- There were 7 (3HL, 4SD) accidents which resulted in a hard landing;
- There were 2 Controlled Flight into Terrain (CFIT) accidents;
- There were 5 events which involved ground damage to the aircraft;
- There was one loss of control accident;
- There were 7 (3HL, 4SD) accidents involved undercarriage failure;
- There were 5 (3HL, 2SD) accidents involving loss of situational awareness; 1 ended in a CFIT and 1 in an undershoot, 1 in a hard landing;
- There were 2 events related to fuel management and
- There were 5 tailstrikes.

2.2.3 PHASE OF FLIGHT

The following table illustrates the distribution, in relation to the phase of flight, of operational:

- Hull Loss (HL) accidents;
- Substantial Damage (SD) accidents;
- Fatal Accidents and
- Fatalities (crew and passenger).

Figure 2.2.A

Phase of Flight	HL	SD	Total	Fatal Accidents	Fatalities
GDS		1	1		
PRF	1		1	1	1
ESD		3	3		
TXO	1		1		
TOF	1	4	5	1	110
RTO		1	1		
ICL					
ECL	1	3	4	1	260
CRZ		2	2	1	1
DST		1	1		
APR	2		2	2	25
GOA					
LND	14	18	32	1	3
TXI		2	2		
PSF		1	1		
Total	**20**	**36**	**56**	**7**	**400**

Refer to Appendix C for definitions.

Figure 2.2.B

Operational Accidents by Phase of Flight

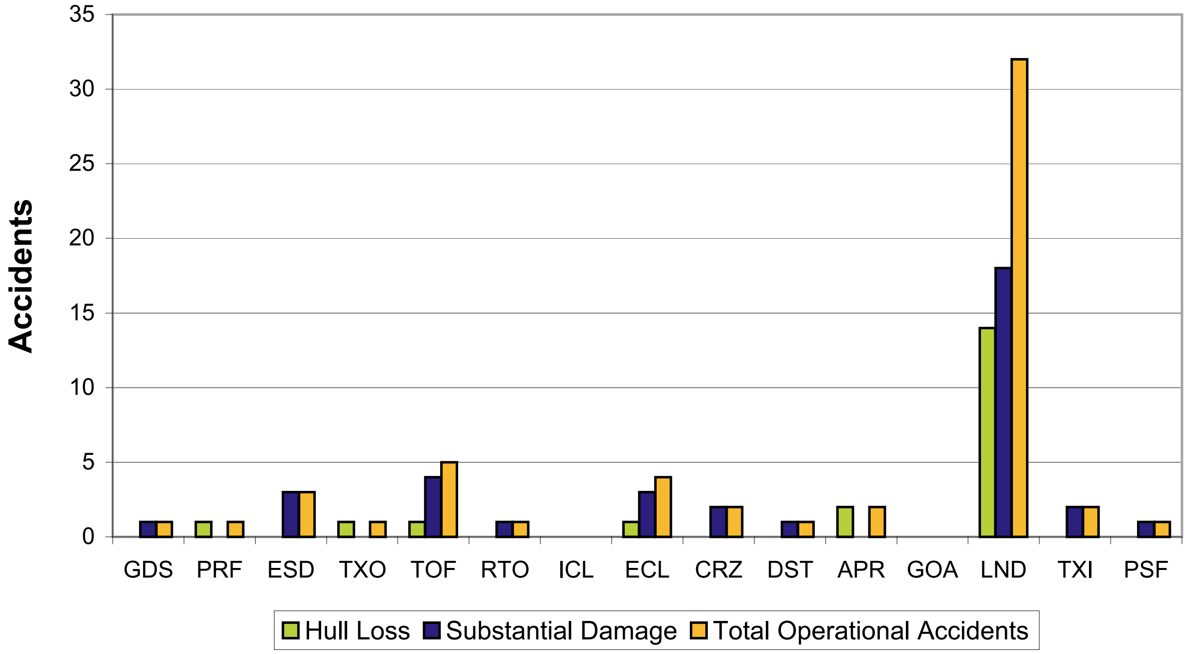
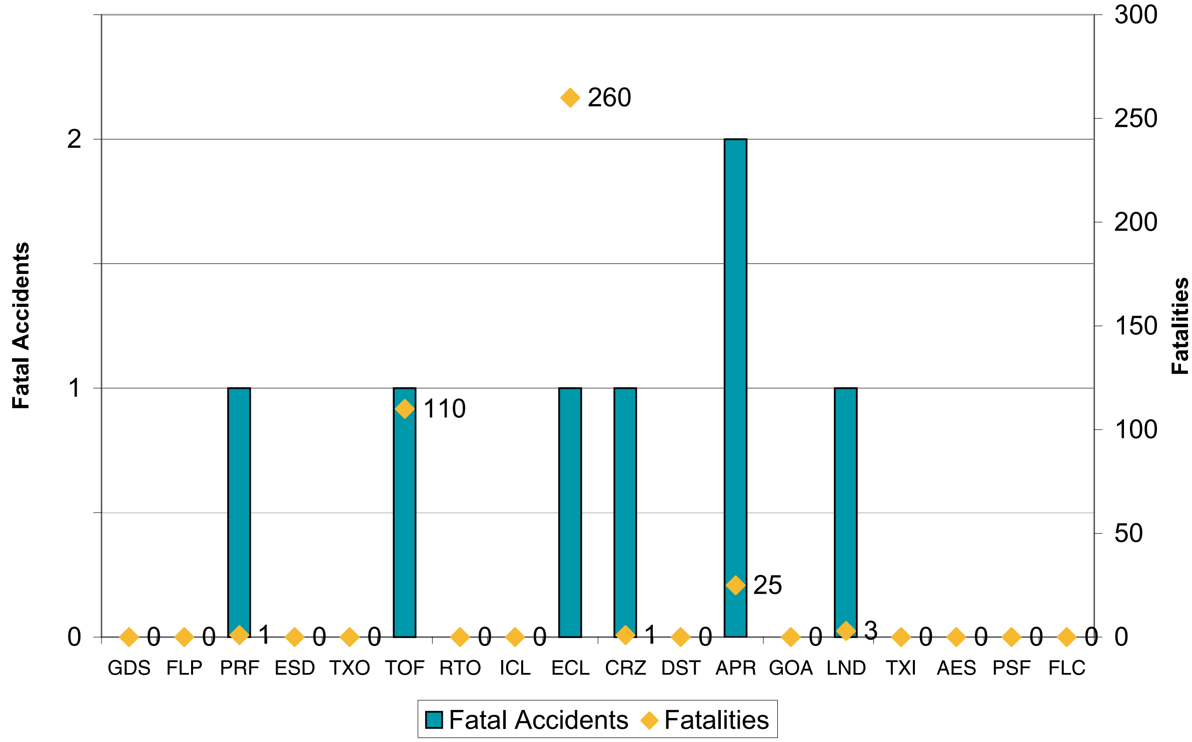


Figure 2.2.C
Fatal Accidents and Fatalities



FLP	Flight Planning
PRF	Pre-flight
ESD	Engine Start / Depart
TXO	Taxi-out
TOF	Take-off
RTO	Rejected Take-off
ICL	Initial Climb
ECL	En Route Climb
CRZ	Cruise
DST	Descent
APR	Approach
GOA	Go-around
LND	Landing
TXI	Taxi-in
AES	Arrival / Engine Shutdown
PSF	Post-flight
FLC	Flight Close
GDS	Ground Servicing

2.2.4 IATA CONTRIBUTORY FACTOR CODING

There was sufficient information to classify all 56 operational accidents (20 HL and 36 SD). This resulted in 149 classifications, grouped as indicated below. (Refer to Appendix C for definitions).

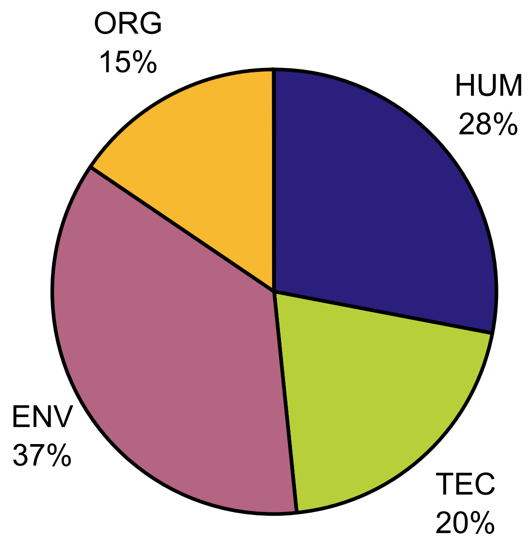
Figure 2.2.D

			HUM		TEC		ENV		ORG	
Human	**HUM**	42	H1	8	T1	4	E1	17	O1	11
Technical	**TEC**	30	H2	10	T2	0	E2	4	O2	2
Environmental	**ENV**	54	H3	24	T3	8	E3	3	O3	0
Organisational	**ORG**	23	H4	0	T4	1	E4	2	O4	1
Incomplete	**I**	0			T5	2	E5	10	O5	8
					T6	0	E6	6	O6	1
					T7	8	E7	2	O7	0
					T8	0	E8	1	O8	0
					T9	6	E9	1		
					T10	0	E10	0		
					T11	1	E11	8		
					T12	0				
	Total	**149**		**42**		**30**		**54**		**23**

The relationship between contributory factor codes is illustrated in the diagram below:

Figure 2.2.E

IATA Contributory Factors

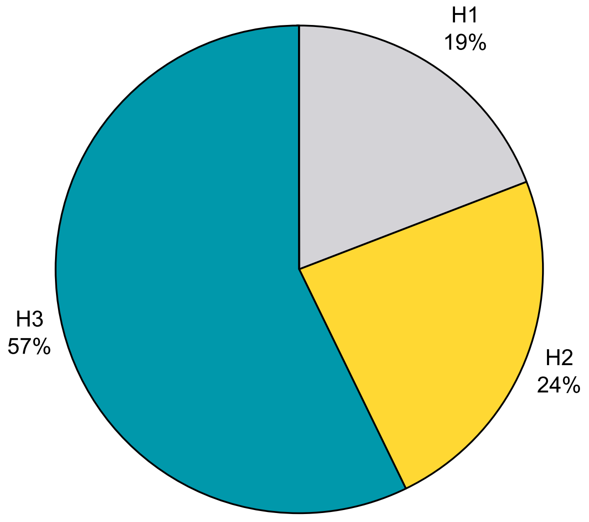


It is Environmental and Human Factors which dominate the contributing factors of operational accidents. A further breakdown of the environmental factors indicates that the most prevalent are weather (E1), aerodrome facilities (E5) and regulatory oversight (E11).

The breakdown of Human Factors is shown in the following chart, and clearly indicates pilot proficiency / skill failure (H3) as dominant. In fact, Skill Failures (H3) are seen to have contributed to 24 of the 56 (43%) operational accidents in 2001. Most (88%, 21 of the 24) skill failure classifications are identified with landing accidents, and 10 of these were combined with weather (E1).

Figure 2.2.F

Human Factors



The next greatest contributing influences were Technical and Organisational Factors with Selection and training (O1) contributing to 11 events in 2001, closely followed by Inadequate Control and Monitoring (O5) on the part of the company accounting for 8 events.

Of the 56 jet accidents, 16 are known to have happened in darkness, and on closer examination 63% of these 16 are also combined with skill failures (H3). Of note is the fact that 4 of the 16 accidents which are known to have happened in darkness also show that Aerodrome Facilities (E5) contributed to the accident.

The graph and table below show the contributory factors by phase of flight. 61% (16HL, 18SD) of the 56 operational accidents occured during the approach and landing phases of flight. 96% of the 24 skill failure accidents occur during the approach and landing phases of flight. There were 2 Hull Losses in the Approach phase, both resulting in CFIT. The classifications for the landing phase are significant in that they account for 57% of this year's operational accidents, 88% of the 24 skill failures (H3), and about half of these skill failures during the landing phase were also combined with poor weather (E1). A third of the landing accidents are known to have happened in darkness.

Figure 2.2.G

Contributing Factors by Phase of Flight

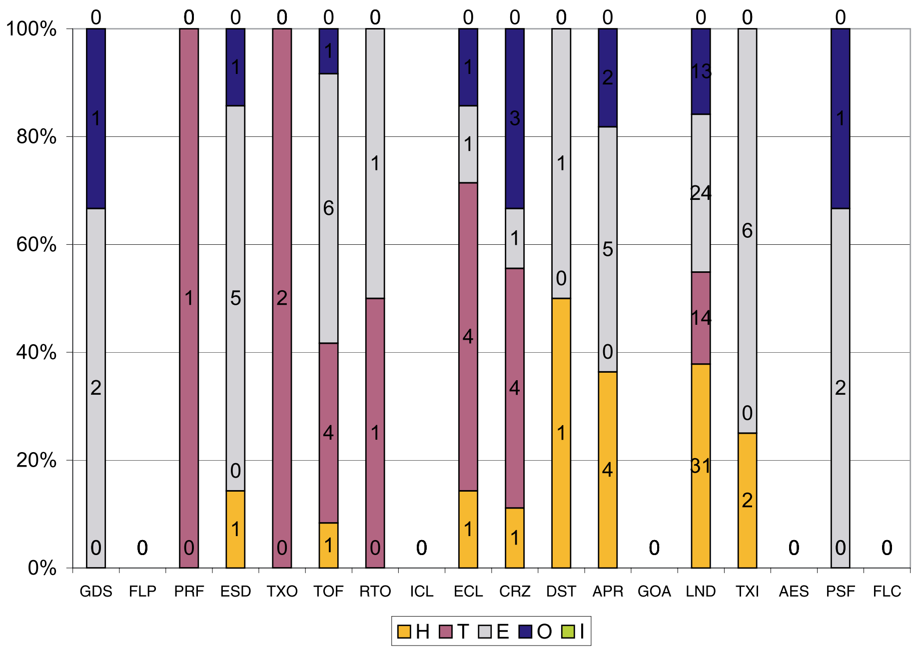


Figure 2.2.H

Phase	H	T	E	O	I	Total
GDS			2	1		3
FLP						
PRF		1				1
ESD	1		5	1		7
TXO		2				2
TOF	1	4	6	1		12
RTO		1	1			2
ICL						
ECL	1	4	1	1		7
CRZ	1	4	1	3		9
DST	1		1			2
APR	4		5	2		11
GOA						
LND	31	14	24	13		82
TXI	2		6			8
AES						
PSF			2	1		3
FLC						
TOTAL	42	30	54	23		149

2.2.5 REGIONAL DATA

The following graph and accompanying table illustrate the relationship between accident site regions and operator regions for the 56 operational accidents in 2001.

Figure 2.2.I

Accident Site Region Operator Region

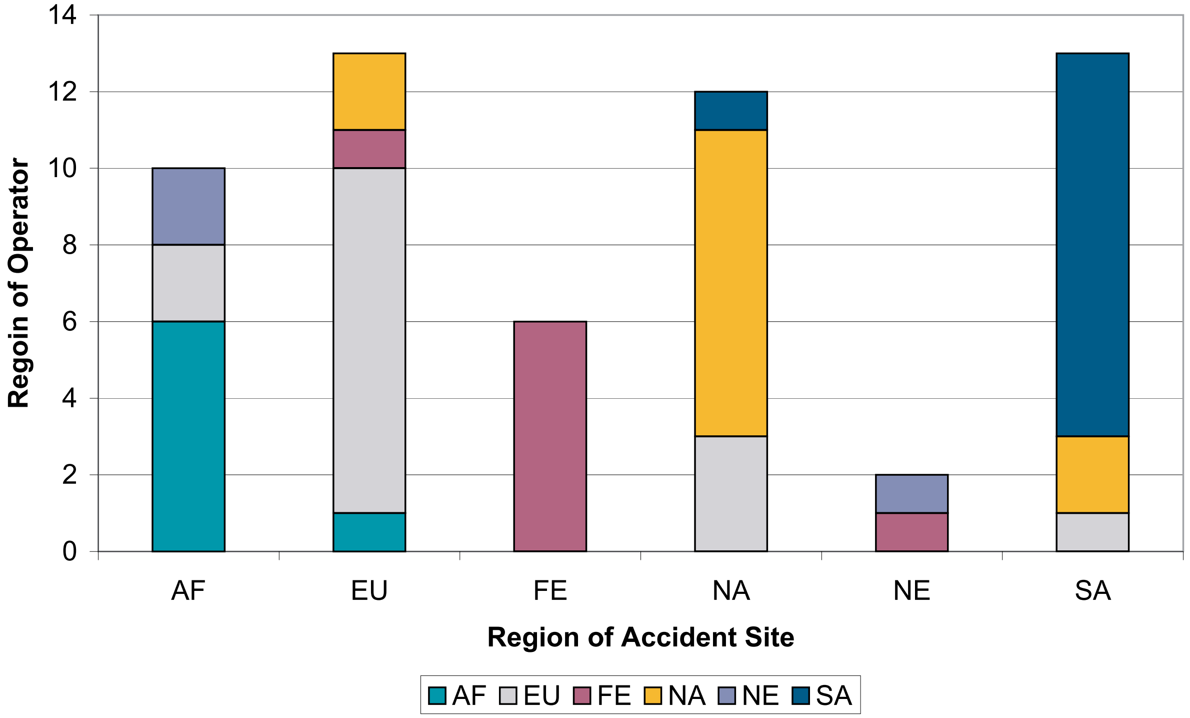


Figure 2.2.J

Region of Operator	Region of Accident site						
	AF	**EU**	**FE**	**NA**	**NE**	**SA**	**Total**
AF	6	1					**7**
EU	2	9		3		1	**15**
FE		1	6		1		**8**
NA		2		8		2	**12**
NE	2				1		**3**
SA				1		10	**11**
Total	**10**	**13**	**6**	**12**	**2**	**13**	**56**

2.2.6 CARGO VS PASSENGER OPERATIONS

Of the 56 operational accidents, 25% (7HL, 7SD) involved cargo operations. 5 of the 6 accidents where the aircraft landed short of the runway involved cargo aircraft. 79% of the cargo accidents happened during the landing phase. 50% of the 8 accidents in which Regulatory Oversight (E11) was seen as a contributing factor involved cargo operations.

2.3 STATISTICS FOR EASTERN-BUILT JETS

2.3.1 INTRODUCTION

This part of the Safety Report deals with Eastern-built aircraft, generally those manufactured in the former Soviet Union.

Definitions applicable to Eastern-Built Jets

Other Operators

Airline operators of Eastern-built aircraft that are based outside the former Soviet Union.

Eastern-built Aircraft

The main types in current service and considered in this portion of the IATA Safety Report 2001 are the Il-62, Il-76, Il-86, Tu-134, Tu-154, Yak-40 and Yak-42.

2.3.2 DATA FOR 2001

Hours and Sectors Flown

Hours and sectors flown are not available for the year 2001 but are projected to be in the region of 0.9 million hours and 0.36 million sectors (broad estimate): the same as in 2000. Traffic levels this year seem to be generally similar to 2000.

Utilisation of Eastern-built jets has decreased sharply during the 1990s. This significantly reduced exposure would explain, in part, the relatively few hull losses now compared with some earlier years.

Accidents

Hull Losses Former Soviet Union:	4 [1]
Hull Losses Others:	1 [0]
Substantial Damage:	3 [0]
Total Accidents:	**8 [1]**

Fatal Accidents

Former Soviet Union: There were 4 [1] fatal accidents involving aircraft operators of the former Soviet Union. 31 crew and 202 passengers were killed in the accidents.

Others: There was 1 [0] fatal accident in which 5 crew and 25 passengers were killed.

Hull Loss Rate

The operational Hull Loss rate is estimated to have been 13.8 [5.6] per million sectors and 5.6 [2.2] per million hours.

Accidents by Phase of Flight

Figure 2.3.A

Flight Phase	Operational Total Hull Loss	Fatal Accidents	Crew Fatalities	Passenger Fatalities	Substantial Damage
GDS					
TOF					2
RTO					
ICL	1	1	10		
ECL					
CRZ	1	1	12	66	
DST					
APR					
GOA					
LND	2	1	9	136	1
Not Known	1	1	5	25	
Total	**5**	**4**	**36**	**227**	**3**

Accident Locations (Hull Losses)

Figure 2.3.B

Date	State of Operator	State of Occurrence
5/17/2001	Iran	Iran
7/4/2001	Russia	Russia
7/14/2001	Russia	Russia
9/21/2001	Russia	UAE
10/4/2001	Russia	Russia

Accident Summaries

Descriptions of accidents involving Eastern-built aircraft are presented in Appendix E.

2.3.3 DATA FOR LAST 10-YEAR PERIOD (1992-2001)

Hours and Sectors Flown

The estimated exposure of Eastern-built aircraft for the 10-year period is as follows:

Figure 2.3.C

State	Hours (M)	Sectors (M)
Former Soviet Union:	13.0*	7.0*
Others:	2.0*	1.0*
Total	**15.0***	**8.0***

**Estimated.*

Loss Rates

Data relating specifically to Former Soviet Union and non- Former Soviet Union utilisation was not available from traditional sources. During this period, there were 64 HLs (40 Former Soviet Union and 24 non-Former Soviet Union) in an estimated 8.0 million sectors, giving a rate of 8 losses per million sectors for all operators (5.72 Former Soviet Union and 24.0 non- Former Soviet Union)*. The average rate, over the same period, for Western-built jets was 1.31 per million sectors.

**Because of the difficulty in estimating the utilisation for this class of aircraft, these loss rates should be considered only as possible broad indications.*

Fatal Accidents/Fatalities

The following chart shows the total number of fatal accidents and crew and passenger fatalities for 1992 — 2001.

Figure 2.3.D

Eastern-built Jets, 1992-2001 — Fatal Accidents vs Loss of Life							
Year	Fatal Accidents	Pax Fatalities	Crew Fatalities	Pax On Board	Crew On Board	% Pax Fatalities	% Crew Fatalities
1992	4	216	29	233	31	93	94
1993	3	304	26	308	26	99	100
1994	6	319	35	341	41	94	85
1995	3	156	10	240	20	65	50
1996	7	179	47	223	53	80	89
1997	4	199	23	219	29	91	79
1998	3	61	29	79	29	77	100
1999	3	68	17	95	21	72	81
2000	1	4	5	4	5	100	100
2001	4	227	36	227	36	100	100
Total	**38**	**1733**	**257**	**1969**	**291**	**88**	**88**

2.4 ACCIDENT CLASSIFICATION — EASTERN-BUILT JETS

2.4.1 INTRODUCTION

This Safety Report includes a subjective assessment of the most apparent contributory factors. The advantage of this practice is that it facilitates early identification of emerging problems. The disadvantages are that occasionally some accidents cannot be assessed at all because of insufficient data, and that no update of these initial assessments is made. However, experience has shown that these early assessments are invariably born out by the eventual publication of the accident reports.

2.4.2 EVENTS

The more significant events identified in 2001 that resulted in an operational Hull Loss (HL) or Substantial Damage (SD) accident were as follows:

- There were 2 Loss of Control Accidents resulting in HL;
- There were 2 rejected take offs which led to runway excursions and substantially damaged the aircraft;
- There was 1 Loss of Situational Awareness accident which resulted in a gear up landing and a HL and
- There was 1 fatal accident in which the aircraft was alleged to have been accidentally shot down by a missile from a firing range.

2.4.3 PHASE OF FLIGHT

The following table illustrates the distribution, in relation to the phase of flight, of operational:

- Hull Loss (HL) accidents;
- Substantial Damage (SD) accidents;
- Fatal Accidents; and
- Fatalities (crew and passenger).

Figure 2.4.A

Phase of Flight	HL	SD	Total	Fatal Accidents	Fatalities
TOF					
RTO		2	2		
ICL	1		1	1	10
ECL					
CRZ	1		1	1	78
DST					
APR					
LND	2	1	3	1	145
Unknown	1		1	1	30
Total	**5**	**3**	**8**	**4**	**263**

Figure 2.4.B
Operational Accidents by Phase of Flight

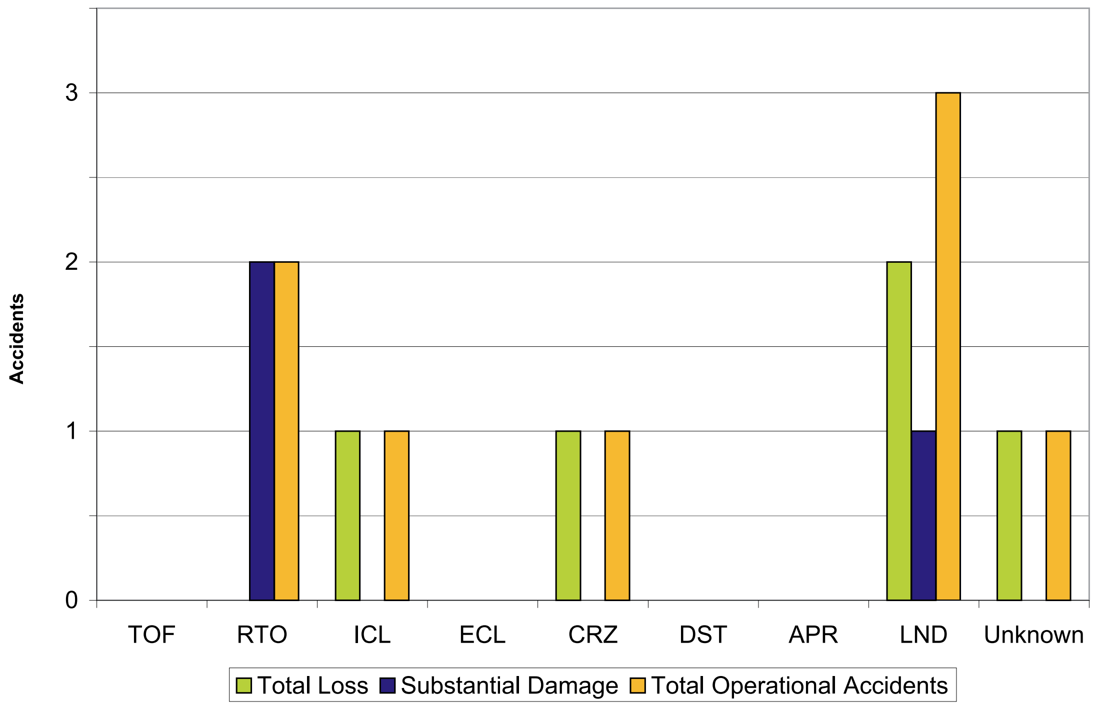
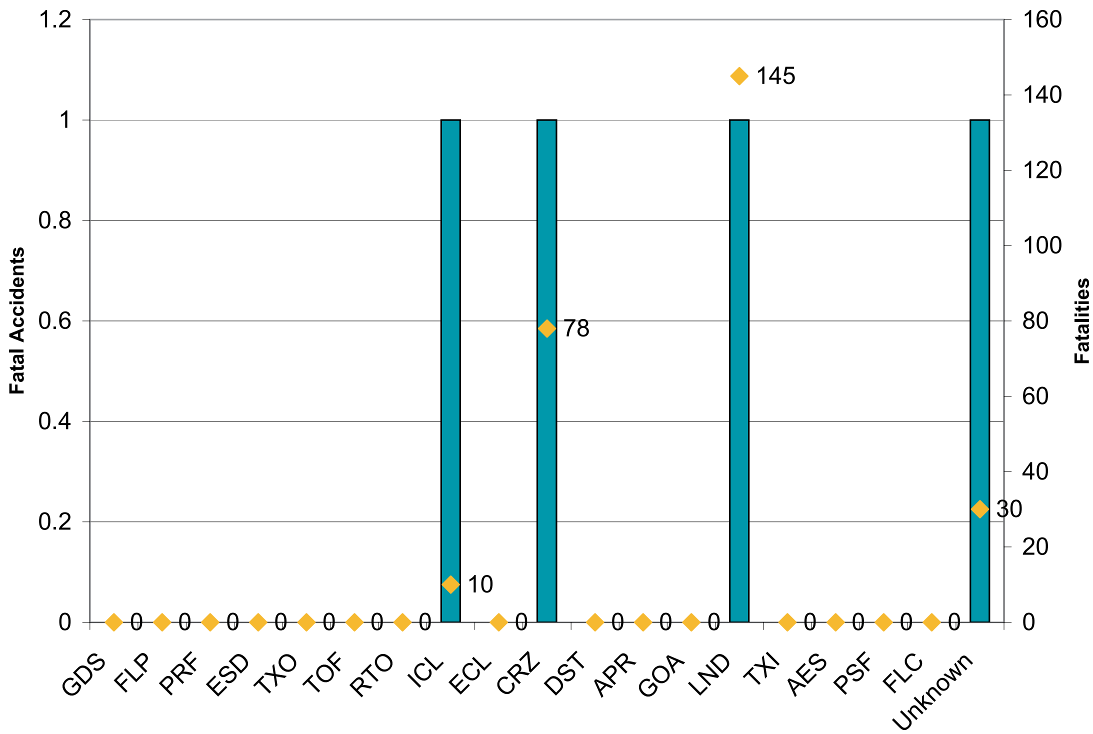


Figure 2.4.C
Fatal Accidents and Fatalities



2.4.4 IATA CONTRIBUTORY FACTOR CODING

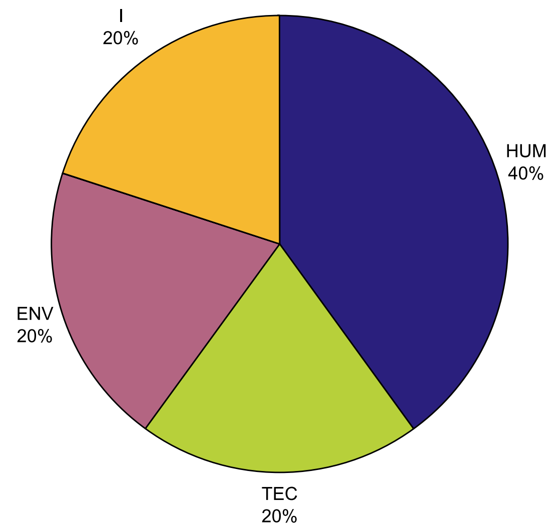
There was sufficient information to classify all but 2 of the 8 operational accidents. This resulted in a total of 10 classifications, grouped as indicated below. (See Appendix C for definitions).

			HUM		TEC		ENV		ORG	
Human	**HUM**	4	H1	1	T1	0	E1	0	O1	0
Technical	**TEC**	2	H2	1	T2	1	E2	0	O2	0
Environmental	**ENV**	2	H3	2	T3	1	E3	0	O3	0
Organisational	**ORG**	0	H4	0	T4	0	E4	0	O4	0
Incomplete	**I**	2			T5	0	E5	0	O5	0
					T6	0	E6	0	O6	0
					T7	0	E7	0	O7	0
					T8	0	E8	0	O8	0
					T9	0	E9	0		
					T10	0	E10	1		
					T11	0	E11	1		
					T12	0				
	Total	**10**		**4**		**2**		**2**		**0**

The relationship between contributory factor codes is illustrated in the diagram below.

Figure 2.4.D

IATA Contributory Factors



Human Factors dominate the contributing factors of operational accidents.
The breakdown of Human Factors is shown in the following chart, and clearly indicates pilot proficiency/skill failure (H3) as dominant.

Figure 2.4.E
Human Factors

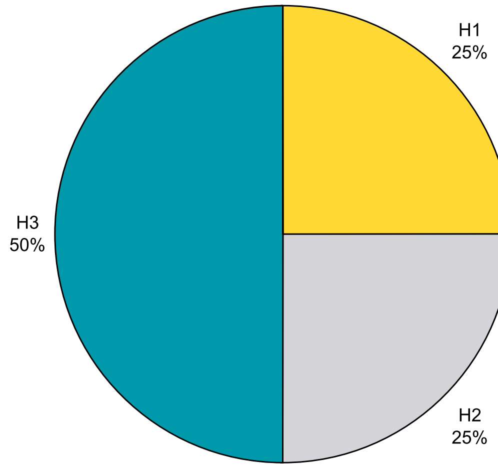


Figure 2.4.F
Contributory Factors by Phase of Flight

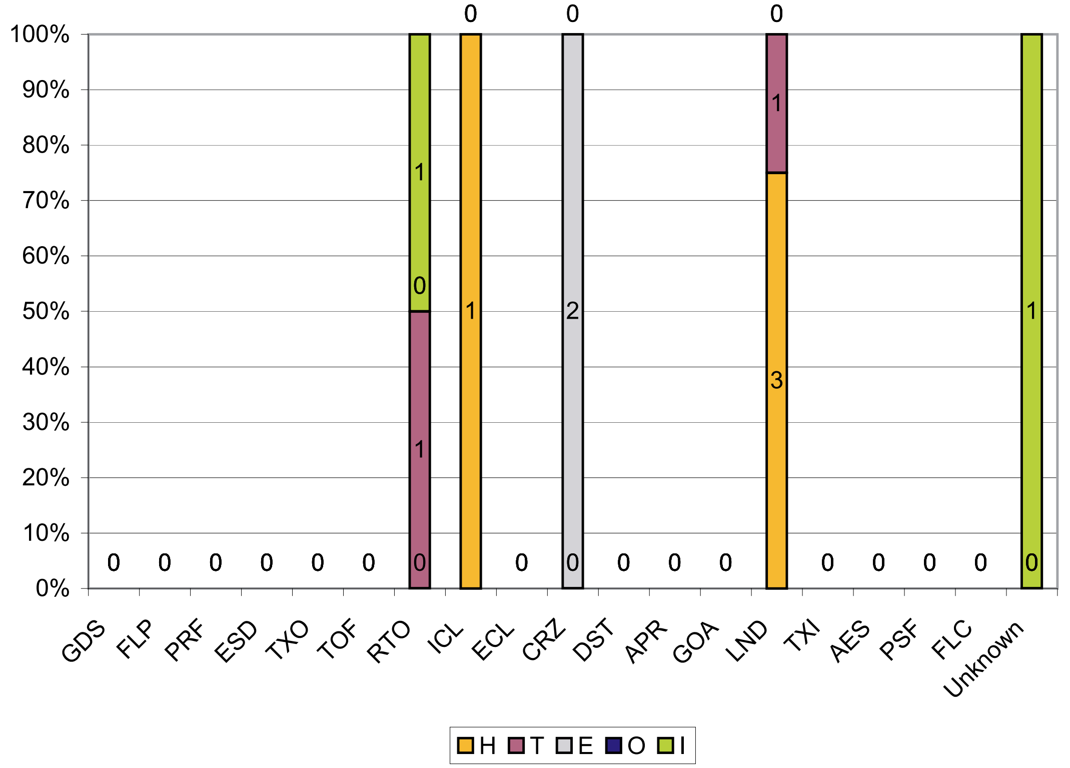


Figure 2.4.G

Phase	H	T	E	O	I	Total
GDS						
FLP						
PRF						
ESD						
TXO						
TOF						
RTO		1			1	**2**
ICL	1					**1**
ECL						
CRZ			2			**2**
DST						
APR						
GOA						
LND	3	1				**4**
TXI						
AES						
PSF						
FLC						
Unknown					1	**1**
Total	**4**	**2**	**2**		**2**	**10**

2.4.5 REGIONAL DATA

The following graph and accompanying table illustrate the relationship between accident site regions and operator regions for the 8 operational accidents in 2001.

Figure 2.4.H
Accident Site Region and Operator Region

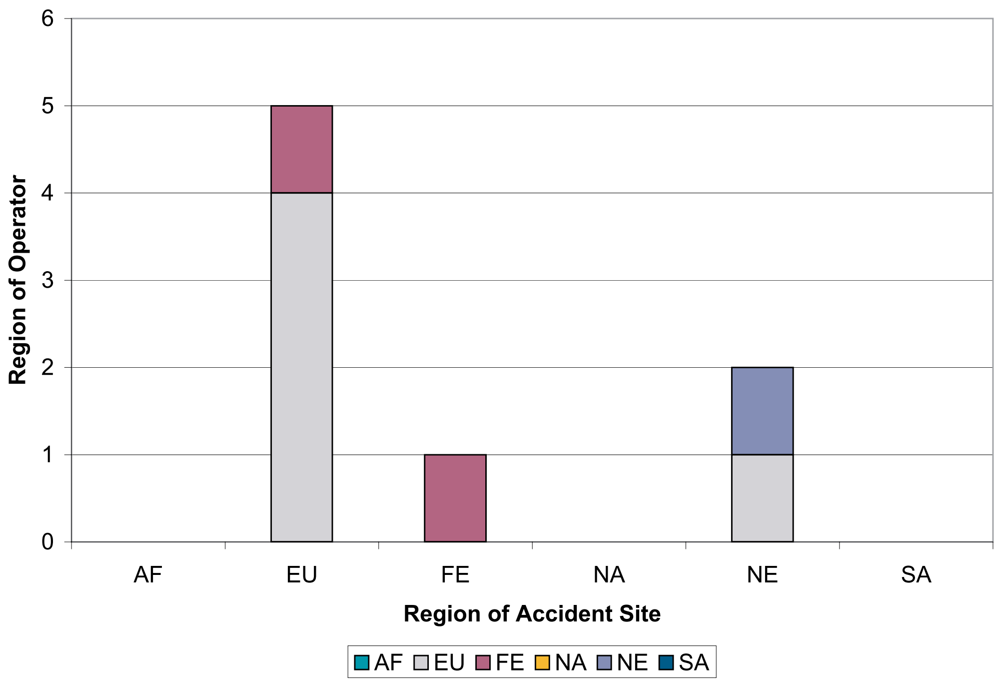


Figure 2.4.I

Region of Operator	Region of Accident site						
	AF	**EU**	**FE**	**NA**	**NE**	**SA**	**TOTAL**
AF							
EU		4			1		**5**
FE		1	1				**2**
NA							
NE					1		**1**
SA							
TOTAL		**5**	**1**		**2**		**8**

CHAPTER 3 — TURBOPROP SYNOPSIS

3.1 STATISTICS FOR WESTERN BUILT TURBOPROPS

3.1.1 DATA FOR 2001

Unless otherwise specified, figures provided in square brackets [ ] relate to data for the previous year.

Fleet-Aircraft Years Flown

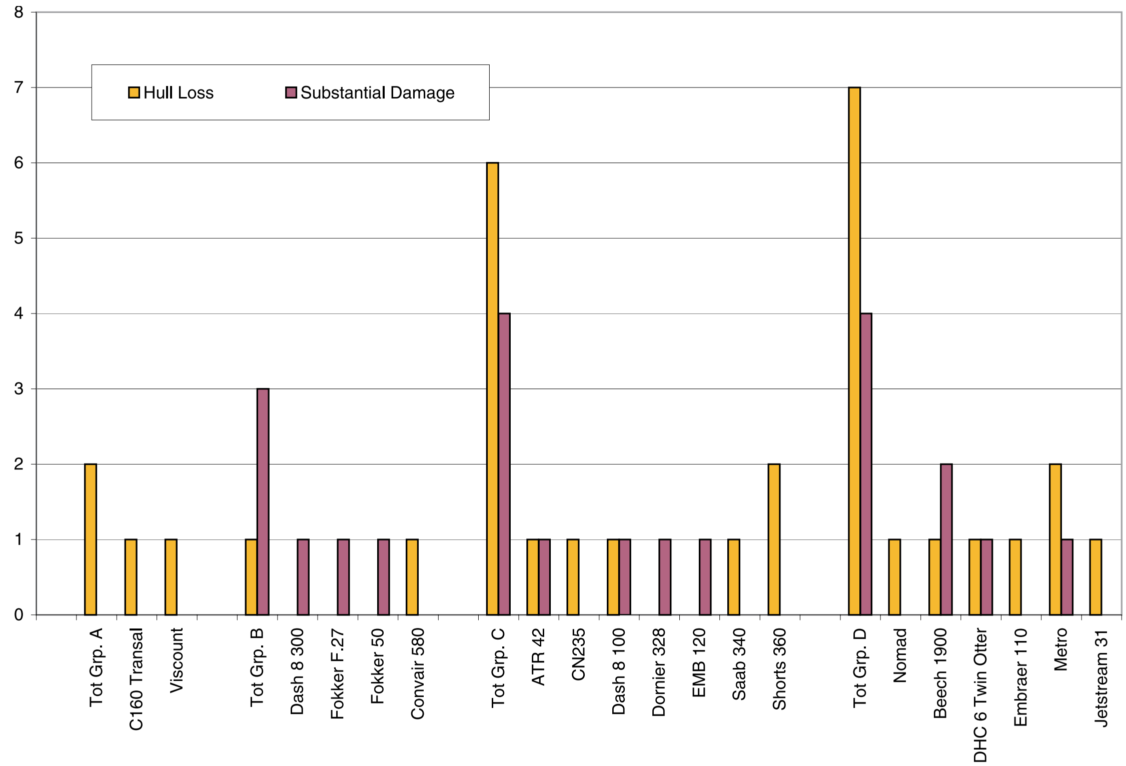
World Fleet (end of year):	5,312 [5,281]
Aircraft Years flown in 2001:	5,293 [5,321]

Accidents

All Hull Losses:	18 [24]	Operational Hull Losses:	16 [20]
All Substantial Damage:	14 [20]	Operational Substantial Damage:	11 [14]
Total accidents:	**32 [44]**	**Total Operational Accidents:**	**27 [34]**

The following table lists the operational Hull Losses (HL) and Substantial Damage (SD) accidents by aircraft group/type (Refer to Appendix C for definitions).

Figure 3.1.A



Operational Hull Loss Rates

There is insufficient data to calculate Turboprop operational Hull Loss rates on a per million sectors or per million hours basis. Hence, as in previous annual reports, the operational loss rate is expressed per 1000 aircraft-years. (See Appendix C for aircraft-year definition.)

Hull losses per 1000 aircraft-years 2001: 3.0 [3.8]

Fatal Accidents & Fatalities

Fatal accidents: 7 [12]

Fatalities:

Passengers: 44 [94]

Crew: 10 [21]

Total: 54 [115]

Of the 27 operational accidents (16 HL and 11 SD), 7 (26%) resulted in passenger and/or crew fatalities.

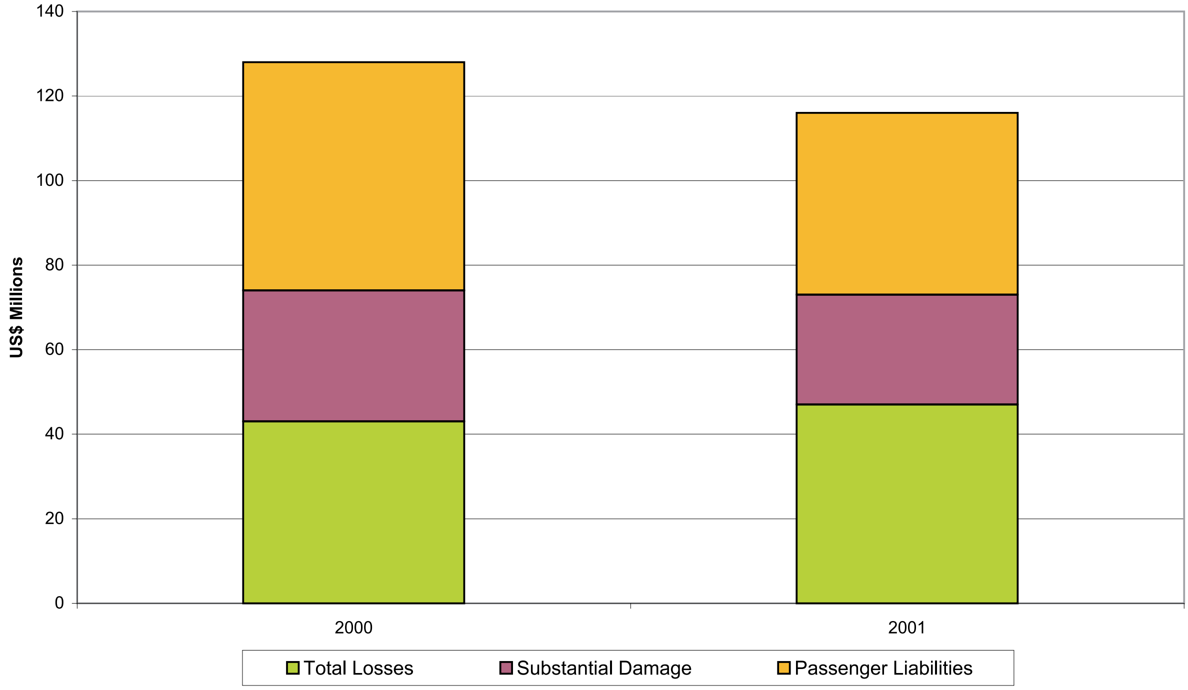
Estimated Cost

The direct cost (excluding lost revenue etc.) of the operational Hull Loss accidents is estimated at $47 [$43] million. These costs for all accidents are illustrated in the following diagram.

Figure 3.1.B

Cost of Accidents

(Excluding Deliberate Acts of Violence)



Registry-State of Operator-State of Occurrence

The following table lists the operational Hull Loss accidents which occurred in 2001.

Hull Losses: **16 [20]**

Figure 3.1.C

Date	Aircraft Registration	State of Operator	IATA Region	State of Occurrence	IATA Region
Passenger					
4-Feb-01	EI-BPD	Ireland	EU	United Kingdom	EU
10-Feb-01	PZ-TBP	Surinam	SA	Surinam	SA
17-Mar-01	S9-CAE	Sao Tome	AF	Angola	AF
24-Mar-01	F-OGES	Guadeloupe	SA	French Antilles	SA
14-Jun-01	LN-WIS	Norway	EU	Norway	EU
18-Jun-01	4X-ATK	Israel	NE	Israel	NE
25-Jun-01	VH-OZG	Australia	FE	Australia	FE
24-Jul-01	3D-OHM	Swaziland	AF	Chad	AF
29-Aug-01	EC-FBC	Spain	EU	Spain	EU
6-Sep-01	XA-ACK	Mexico	SA	Mexico	SA
11-Oct-01	C-GYPA	Canada	NA	Canada	NA
30-Oct-01	SE-LGA	Swedish	EU	Norway	EU
Cargo					
27-Feb-01	G-BNMT	United Kingdom	EU	United Kingdom	EU
15-Jun-01	PK-VTP	Indonesia	FE	Indonesia	FE
27-Nov-01	LV-WSD	Argentina	SA	Argentina	SA
6-Dec-01	N582HG	USA	NA	USA	NA

The following table lists the operational Substantial Damage accidents which occurred in 2001.

Substantial Damage: **11 [30]**

Figure 3.1.D

Date	Aircraft Registration	State of Operator	IATA Region	State of Occurrence	IATA Region
Passenger					
15-Jan-01	B-15235	Taiwan	FE	Taiwan	FE
18-Jan-01	EC-GRZ	Spain	EU	Spain	EU
18-Jan-01	PK-LTZ	Indonesia	FE	Indonesia	FE
10-Feb-01	N97UX	USA	NA	USA	NA
2-Mar-01	CN-CDV	Morocco	AF	Morocco	AF
29-May-01	D-COLB	Germany	EU	Finland	EU
22-Nov-01	LN-WIG	Norway	EU	Norway	EU
2-Dec-01	D-CATS	Germany	EU	Germany	EU
Cargo					
5-Jun-01	G-CEXF	United Kingdom	EU	United Kingdom	EU
14-Sep-01	C-GSKC	Canada	NA	Canada	NA
16-Oct-01	N120AX	USA	NA	USA	NA

Accident Summaries

For a description of Turboprop operational Hull Loss and Substantial Damage accidents, and certain other losses, refer to Appendix E.

3.1.2 DATA FOR LAST 10 YEAR PERIOD (1992-2001)

Introduction

To obtain a more complete picture of current operations, a 10-year period is considered sufficiently long to indicate significant trends and short enough to eliminate the influence of superseded practices and procedures.

Aircraft-Years

In this ten year period (1992-2001), Turboprop aircraft flew 51,057 aircraft years.

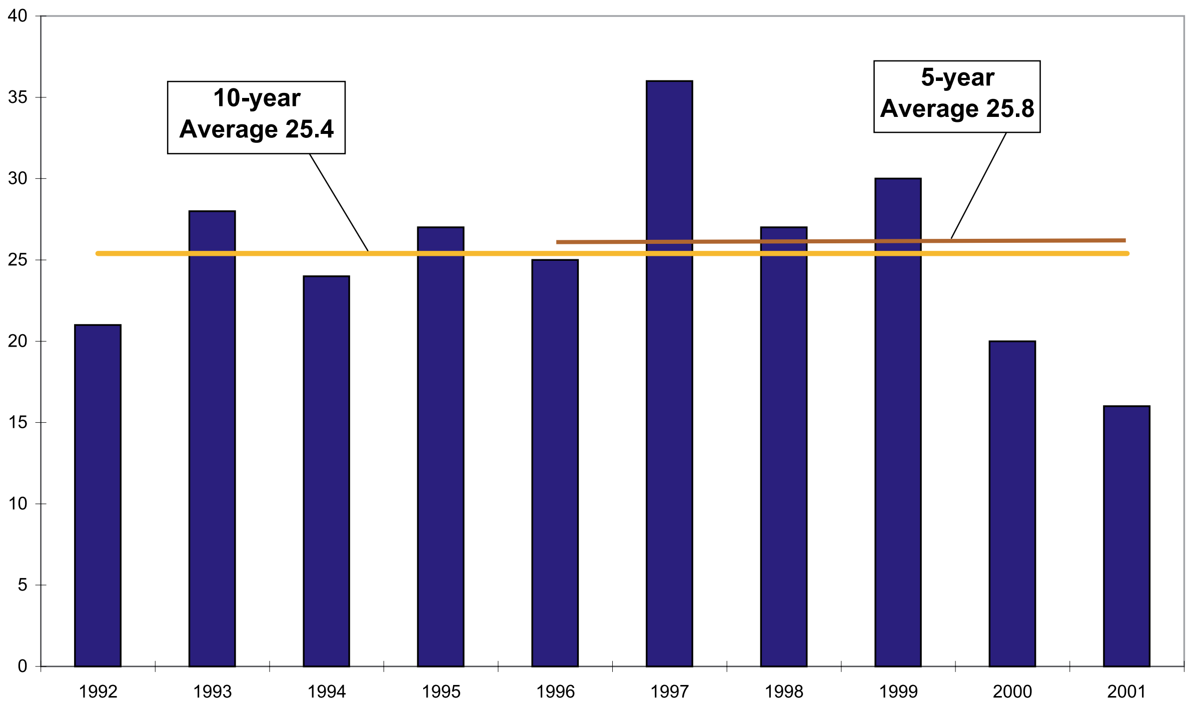
Operational Hull Losses

Operational Hull Losses:	254
Average over the period:	25.4
Average over last 5 years:	25.8

The following graphs depicts the operational Hull Losses and the 5 and 10 year averages for the 1992 -2001 period.

Figure 3.1.E

Operational Hull Losses (1992-2001)

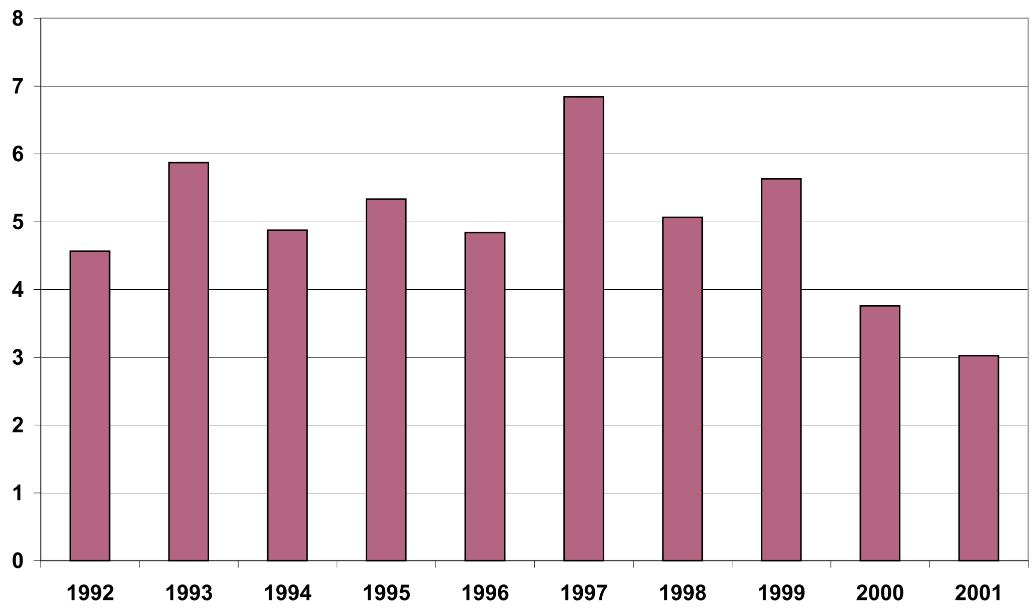


Loss Rates

The 10-year average rate was 4.98 Hull Losses per aircraft years.

Figure 3.1.F

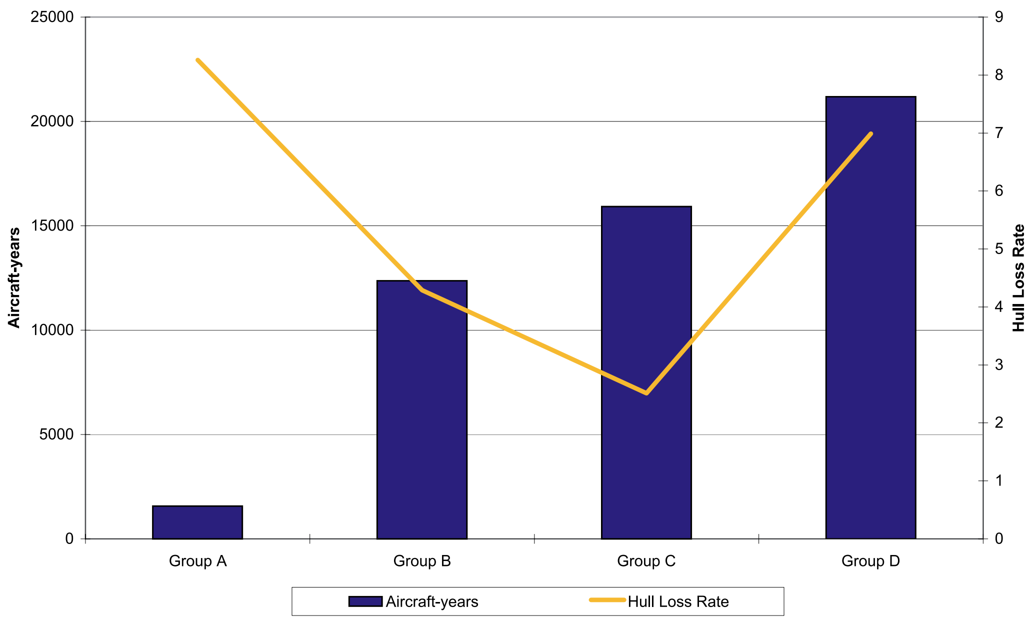
Hull Losses per 1000 Aircraft-years (1992-2001)



The following graph shows Hull Loss Rate per thousand aircraft years for the 1992-2001 period and the total aircraft years flown for the same period, by Aircraft Group. Refer to Appendix C for definitions of aircraft groups.

Figure 3.1.G

Loss Rate by Aircraft Group (1992-2001)



Passenger/Crew Fatalities 1992 — 2001

Fatal Accidents:	149
Passengers on board fatal flights:	2,139
Crew on board fatal flights:	420
Total on Board:	**2,559**

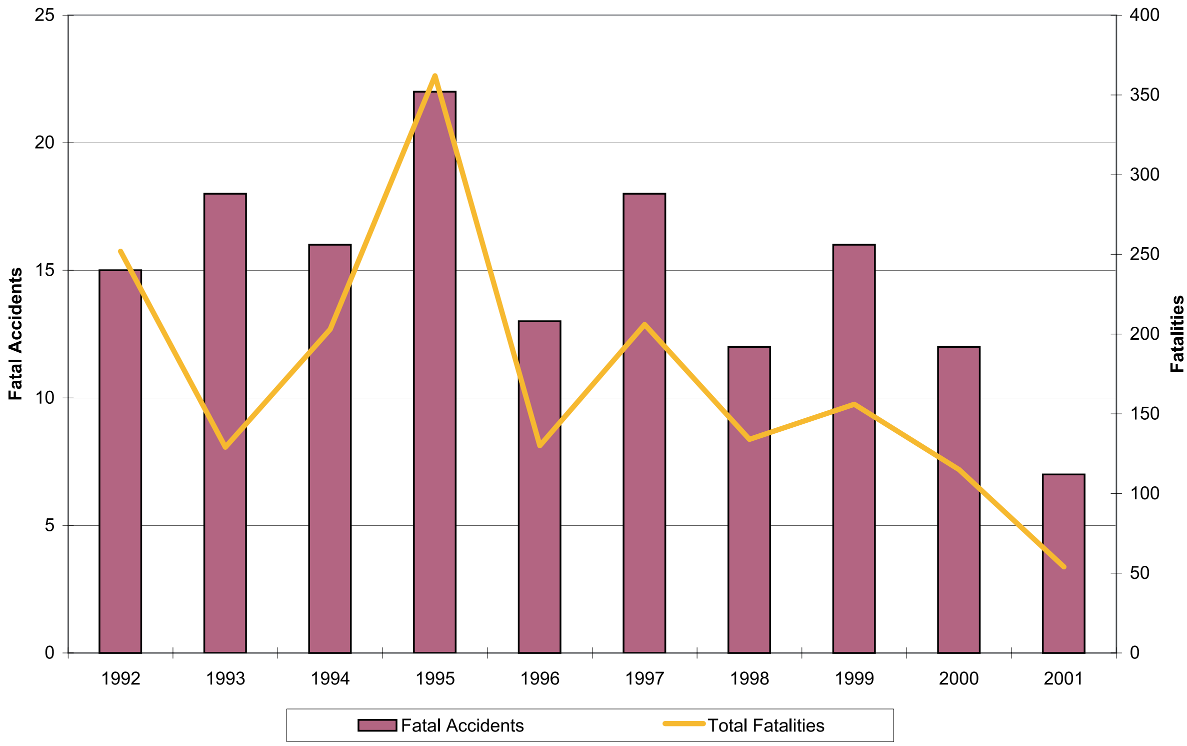
Fatalities:

Passenger:	1,411
Crew:	330
Total Fatalities:	**1,741**

% Passenger fatalities vs passengers on board:	66%
% Crew fatalities vs crew on board:	79%

Figure 3.1.H

Fatal Accidents and Fatalities (1992-2001)

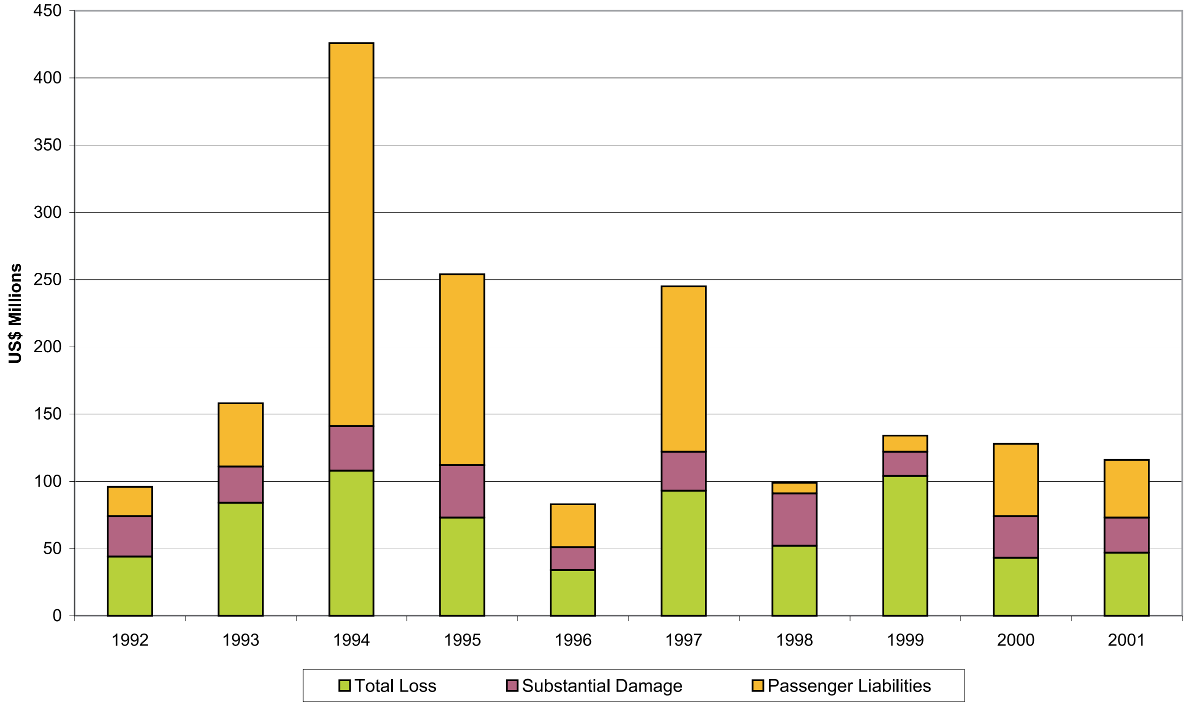


Estimated Cost

Costs of operational Hull Loss accidents for the 10-year period are shown graphically as follows:

Figure 3.1.I

Accident Costs (1992-2001)
(Excluding Deliberate Acts of Violence)



3.1.3 HISTORICAL RECORD

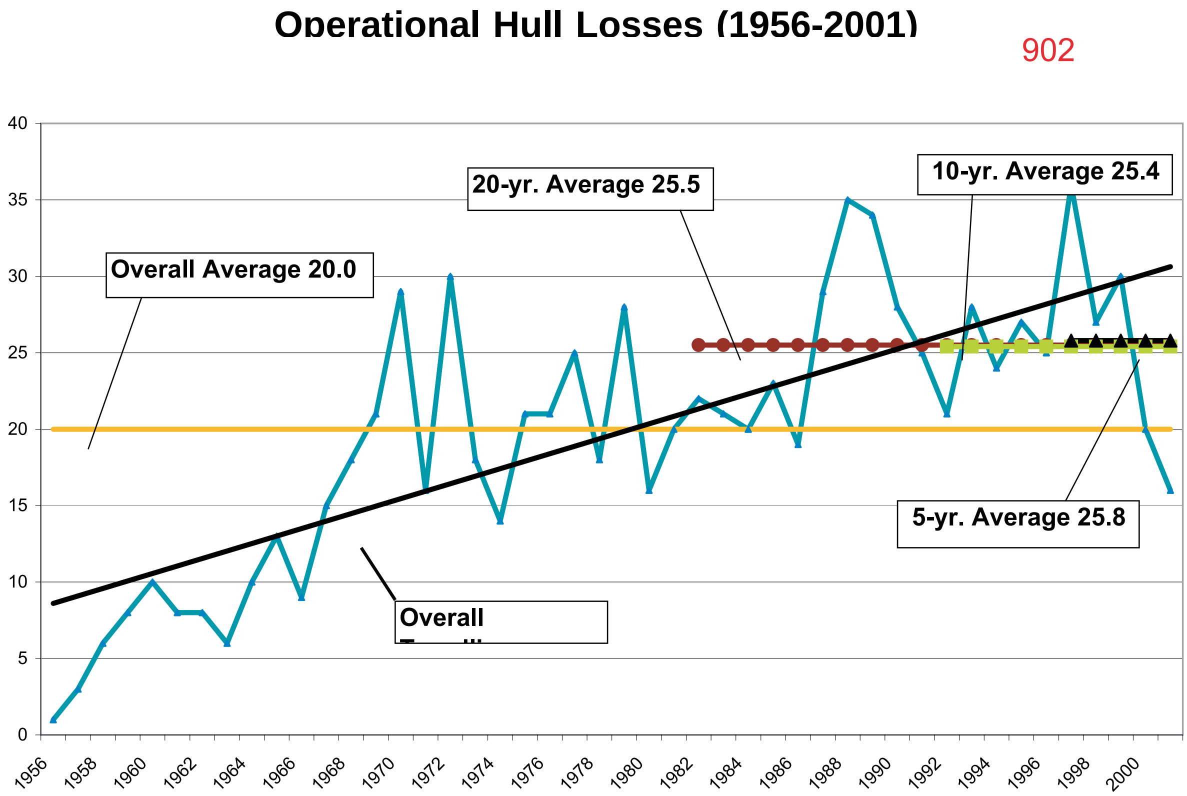
Hull Losses since 1956

Operational	902
Test & Training	112
Violence (operational)	25
Violence (non operational)	23
Non-operational (ground)	51
Non-airline/Unknown	101
Total Losses	**1214**

Operational Hull Losses 1956 — 2001

The first operational Hull Losses involving Turboprop aircraft occurred in 1956. Since then, there have been 902 Hull Loss accidents. The following graph charts the annual Hull Loss accidents by year, with a trendline and 5,10, 20, and 45 year averages.

Figure 3.1.J

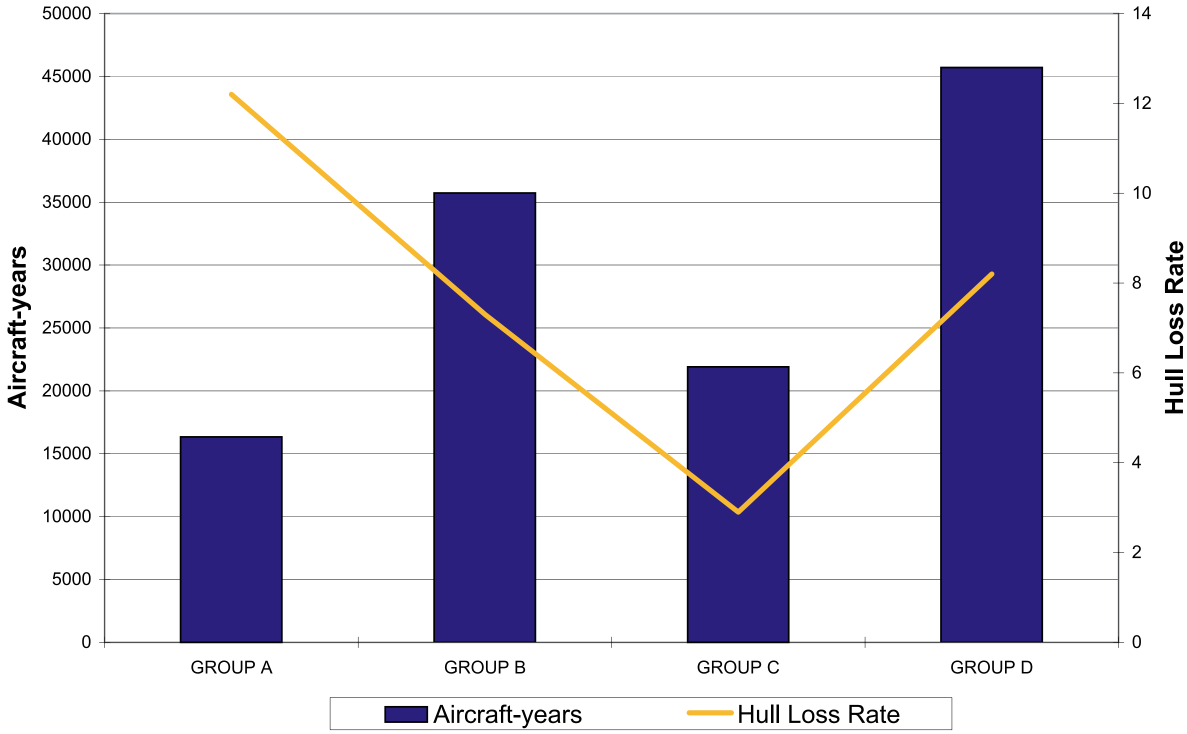


Aircraft years vs Hull Loss Rate

Since entry into service, Turboprop aircraft have accumulated 119,616 aircraft years and have suffered 902 operational Hull Loss accidents. This gives an average Hull Loss rate for the period of 7.54 per 1000 aircraft years. The Figure 3.1.K shows the aircraft years flown by each aircraft group and the corresponding Hull Loss rate. Refer to Appendix C for definitions of aircraft groups.

Figure 3.1.K

Loss Rate and Exposure (1950-2001)



3.2 ACCIDENT CLASSIFICATION — WESTERN-BUILT TURBOPROPS

3.2.1 INTRODUCTION

This Safety Report includes a subjective assessment of the most apparent contributory factors. The advantage of this practice is that it facilitates early identification of emerging problems. The disadvantages are that occasionally some accidents cannot be assessed at all because of insufficient data, and that no update of these initial assessments is made. However, experience has shown that these early assessments are invariably born out by the eventual publication of the accident reports.

3.2.2 EVENTS

The more significant events identified in 2001 that resulted in an operational Hull Loss (HL) or Substantial Damage (SD) accident were as follows:

- In 8 accidents (4HL, 4 SD), weather was a contributing factor;
- There were 7 (3HL, 4SD) accidents which resulted in a hard landing;
- In total, there were 3 Controlled Flight into Terrain (CFIT) accidents; 2 of these were combined with loss of situational awareness;
- There were 5 (3HL, 2SD) events which involved loss of situational awareness, 2 of which resulted in CFIT mentioned above;
- There was 1 HL accident resulting from loss of control of the aircraft;
- There were 2 accidents (1HL,1SD) involved a rejected take off;
- There was 1 undercarriage failure event;
- There were 2 (1HL, 1SD) runway excursions and
- There was 1 event related to fuel management.

3.2.3 PHASE OF FLIGHT

The following table illustrates the distribution, in relation to the phase of flight, of operational:

- Hull Loss (HL) accidents;
- Substantial Damage (SD) accidents;
- Fatal Accidents and,
- Fatalities (crew and passenger).

Figure 3.2.A

Phase of Flight	HL	SD	Total	Fatal Accidents	Fatalities
PRF		1	1		
ESD					
TXO					
TOF					
RTO	1	1	2		
ICL	1	1	2	1	2
ECL					
CRZ	2		2		
DST	1		1		
APR	4	1	5	4	49
LND	6	7	13	1	1
GOA	1		1	1	2
Total	**16**	**11**	**27**	**7**	**54**

Figure 3.2.B

Operational Accidents by Phase of Flight

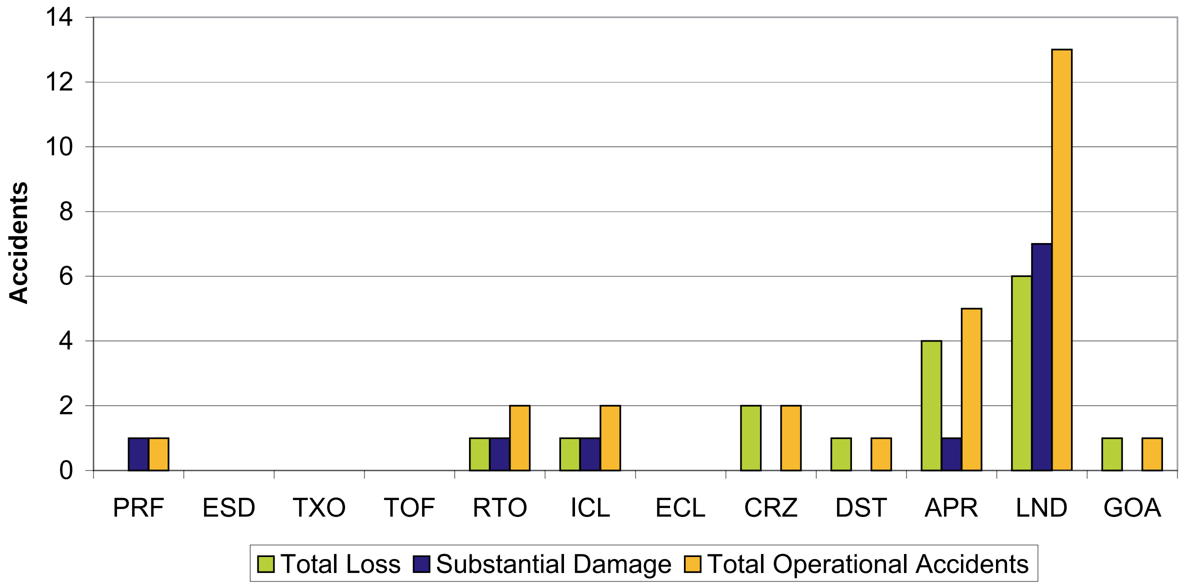
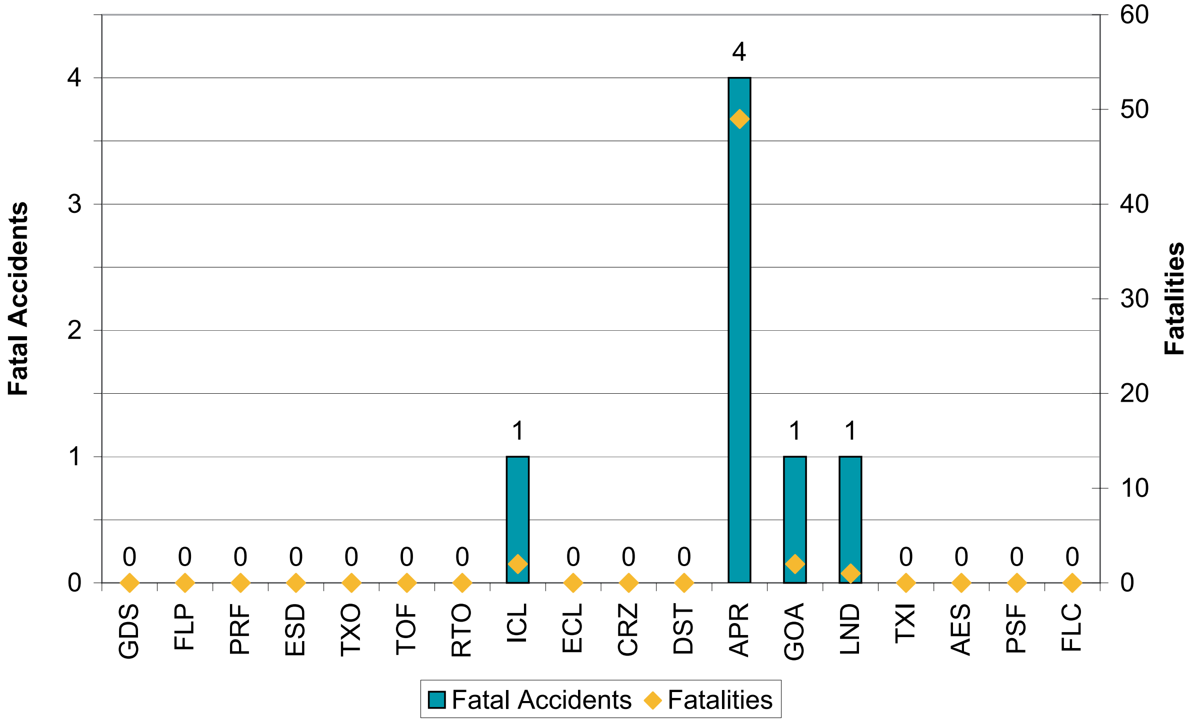


Figure 3.2.C
Fatal Accidents and Fatalities



FLP	Flight Planning
PRF	Pre-flight
ESD	Engine Start / Depart
TXO	Taxi-out
TOF	Take-off
RTO	Rejected Take-off
ICL	Initial Climb
ECL	En Route Climb
CRZ	Cruise
DST	Descent
APR	Approach
GOA	Go-around
LND	Landing
TXI	Taxi-in
AES	Arrival / Engine Shutdown
PSF	Post-flight
FLC	Flight Close
GDS	Ground Servicing

3.2.4 IATA CONTRIBUTORY FACTOR CODING

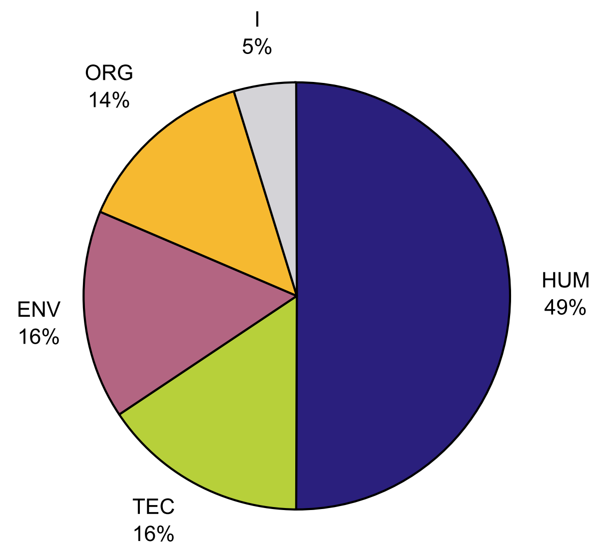
There was sufficient information to classify all but 3 of the operational accidents. This resulted in 64 classifications, grouped as indicated below. (Refer to Appendix C for definitions)

Figure 3.2.D

			HUM		TEC		ENV		ORG	
Human	**HUM**	32	H1	8	T1	1	E1	8	O1	1
Technical	**TEC**	10	H2	6	T2	5	E2	0	O2	0
Environmental	**ENV**	10	H3	18	T3	1	E3	0	O3	1
Organisational	**ORG**	9	H4	0	T4	0	E4	0	O4	2
Incomplete	**I**	3			T5	0	E5	0	O5	5
					T6	1	E6	1	O6	0
					T7	2	E7	1	O7	0
					T8	0	E8	0	O8	0
					T9	0	E9	0		
					T10	0	E10	0		
					T11	0	E11	0		
					T12	0				
	Total	**64**		**32**		**10**		**10**		**9**

The relationship between contributory factor codes is illustrated in the diagram below.

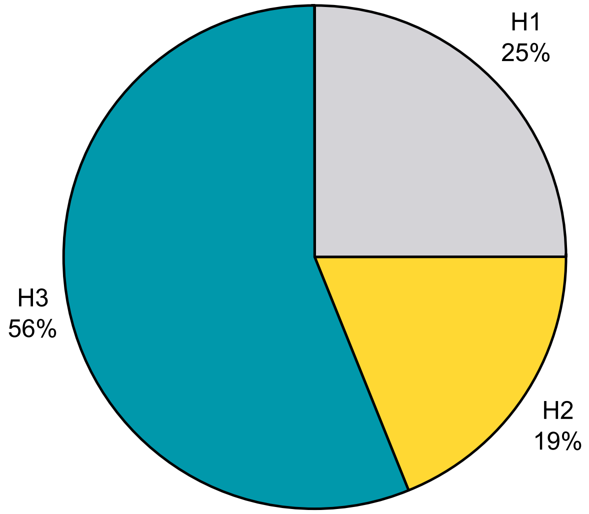
Figure 3.2.E
IATA Contributory Factors



Human Factors dominates the contributory factors of operational accidents.

The breakdown of Human Factors is shown in the following chart, and clearly indicates pilot proficiency/ skill failure (H3) as dominant. In fact, Skill Failures (H3) are seen to have contributed to 18 of the 27 (67%) operational accidents in 2001.

Figure 3.2.F
Human Factors



The next greatest contributing influences were Technical and Environmental Factors with weather (E1) accounting for 8 (30%) accidents in 2001. The most significant organisational factor is inadequate control and oversight (O5) which was attributed to 5 of the 27 accidents.

Of the 27 accidents 6 are known to have happened in darkness.

The graph and table below show the contributory factors by phase of flight. The approach and landing phases of flight are significant in that 78% of all Human Factors, and more specifically 78% of the skill failures (H3) and 75% of the weather related (E1) accidents occur during this stage.

Figure 3.2.G

Contributing Factors by Phase of Flight

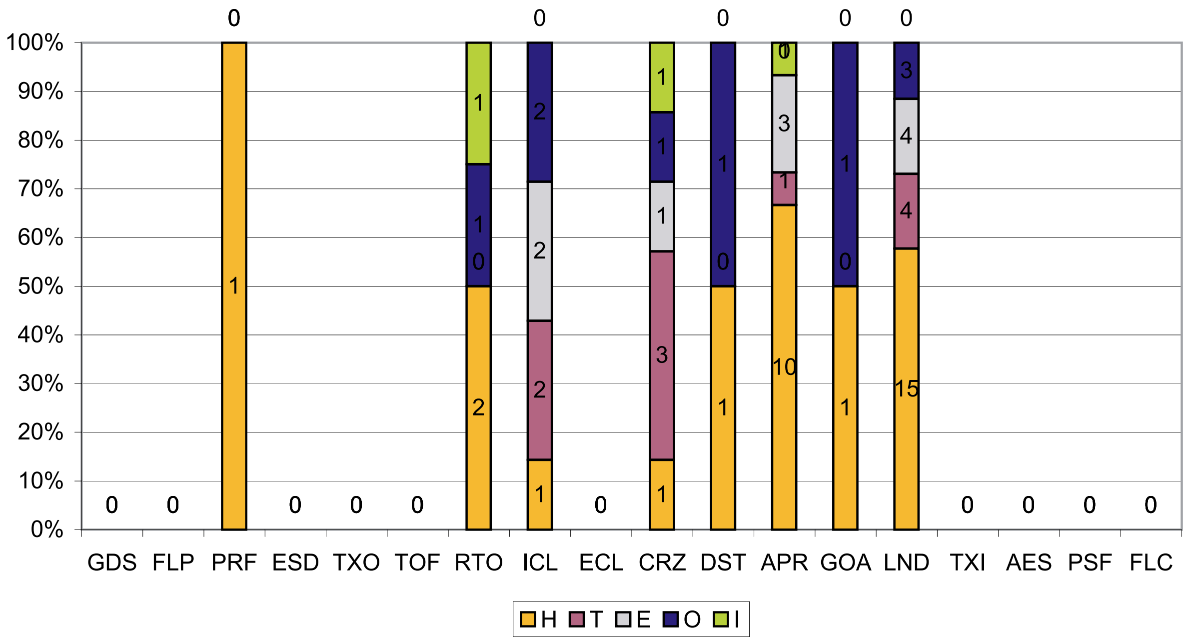


Figure 3.2.H

Phase	H	T	E	O	I	Total
GDS						
FLP						
PRF	1					**1**
ESD						
TXO						
TOF						
RTO	2			1	1	**4**
ICL	1	2	2	2		**7**
ECL						
CRZ	1	3	1	1	1	**7**
DST	1			1		**2**
APR	10	1	3		1	**15**
GOA	1			1		**2**
LND	15	4	4	3		**26**
TXI						
AES						
PSF						
FLC						
TOTAL	**32**	**10**	**10**	**9**	**3**	**64**

3.2.5 REGIONAL DATA

The following graph and accompanying table illustrate the relationship between accident site regions and operator regions for the 27 operational accidents in 2001.

Figure 3.2.I

Accident Site Region and Operator Region

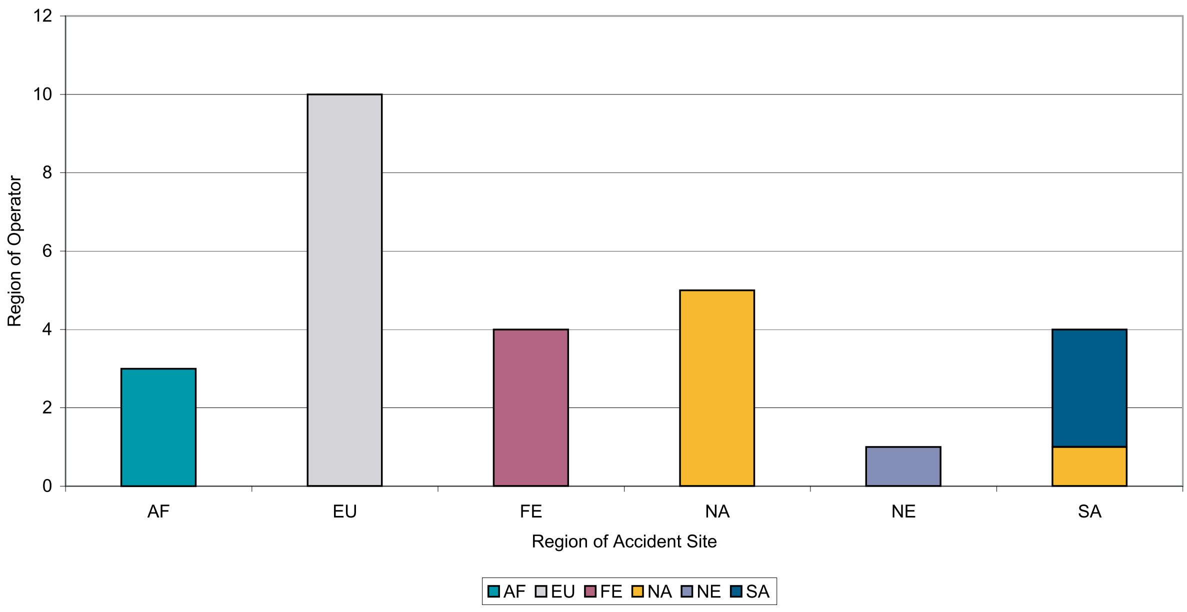


Figure 3.2.J

Region of Operator	Region of Accident site						
	AF	**EU**	**FE**	**NA**	**NE**	**SA**	**TOTAL**
AF	3						**3**
EU		10					**10**
FE			4				**4**
NA				5		1	**6**
NE					1		**1**
SA						3	**3**
TOTAL	**3**	**10**	**4**	**5**	**1**	**4**	**27**

3.2.6 CARGO VS PASSENGER

22% (3HL, 3SD) of the 27 (16HL, 11SD) operational accidents involved cargo operations. The only two operational accidents that occurred during the initial climb phase involved cargo aircraft.

3.3 STATISTICS FOR EASTERN-BUILT TURBOPROPS

3.3.1 INTRODUCTION

This part of the Safety Report deals with Eastern-built Turboprop aircraft, generally those manufactured in the former Soviet Union.

Definitions applicable to Eastern-Built Turboprop Aircraft

Other Operators

Airline operators of Eastern-built Turboprops that are based outside the Soviet Union.

3.3.2 DATA FOR 2001

Hours and Sectors Flown

No accurate exposure data is available for Eastern-built aircraft. However, broad estimates have been made for passenger aircraft in operation with Commonwealth of Independent States (CIS) airlines as follows:

Figure 3.3.A

	2001	2000	1992-2001
Hours, million	0.25*	0.25*	5.0*
Landings, million	0.2*	0.2*	4.0*

**Estimated*

Accidents

There were 9 known Hull Loss accidents to Eastern-built Turboprops compared with 12 in 2000.

There were 4 known Substantial Damage accidents to Eastern-built Turboprops compared with 3 in 2000.

Fatal Accidents

7 [10] of the operational Hull Loss accidents resulted in fatalities (18 crew and 68 passengers) [31 crew and 185 passengers].

Hull Loss Rates

The operational Hull Loss rate for Eastern-built Turboprop is estimated to have been 45 per million sectors and 36 per million hours.

Accidents by Phase of Flight — 2001

Figure 3.3.B

Flight Phase	Operational Total Hull Loss	Fatal Accidents	Crew Fatalities	Passenger Fatalities
TOF	1	1	1	8
RTO				
ICL				
ECL	3	3	6	36
CRZ	4	2	11	22
DST				
APR				
GOA				
LND	1	1		2
Total	**9**	**7**	**18**	**68**

Accidents: State of Operator/State of Occurrence

The following table lists the 9 operational Hull Loss and 4 Substantial Damage accidents which occurred during 2001.

Figure 3.3.C

Date	Registration	State of Operator	IATA Region	State of Occurrence	IATA Region
Hull Losses — Passenger					
1/23/01	9L-LCG	Sierra Leone AF	AF	Nigeria	AF
8/23/01	3C-LLA	DR Congo	AF	DR Congo	AF
9/12/01	XA-ACM	Mexico	SA	Mexico	SA
9/18/01	TG-CFE	Nicaragua	SA	Guatemala	SA
11/19/01	RA-75840	Russia	EU	Russia	EU
11/23/01	ES-NOV	Estonia	EU	Estonia	EU
11/27/01	XA-SYJ	Mexico	SA	Mexico	SA
12/14/01	5X-CNF	Uganda	AF	DR Congo	AF
12/16/01	HK-4175X	Colombia	SA	Colombia	SA
Substantial Damage — Passenger					
6/15/01	3C-KKL	UAE	NE	Saudi Arabia	NE
Cargo					
6/22/01	ER-AET	Moldova	EU	DR Congo	AF
7/10/01	LZ-SFK	Bulgaria	EU	United Kingdom	EU
10/16/01	ER-ADT	Moldova	EU	Solomon Islands	FE

Accidents Summaries

Descriptions of accidents involving Eastern-built aircraft are presented as Appendix E.

3.3.3 DATA FOR LAST 10-YEAR PERIOD 1992 — 2001

Hours and Sectors Flown

The estimated exposure of Eastern-built aircraft for the 10-year period is as follows:

Figure 3.3.D

State	Hours (M)	Sectors (M)
Total	5.0*	4.0*

**Estimated.*

Loss Rates

Data relating specifically to Former Soviet Union and non-Former Soviet Union utilisation was not available from traditional sources. During this period, there were 110 Hull Losses (50 Former Soviet Union and 60 non-Former Soviet Union) in an estimated 4.0 million sectors, giving a rate of 27.5 losses per million sectors for all operators.*

**Because of the difficulty in estimating the utilisation for this class of aircraft, these loss rates should be considered only as possible broad indications.*

Fatal Accidents/Fatalities — Eastern-built Turboprop Aircraft

The following chart shows the total number of fatal accidents and crew and passenger fatalities for 1992 — 2001.

Figure 3.3.E

Eastern-built Turboprops, 1992-2001 — Fatal Accidents vs Loss of Life							
Year	Fatal Accidents	Pax Fatalities	Crew Fatalities	Pax On Board	Crew On Board	% Pax Fatalities	% Crew Fatalities
1992	8	61	31	80	39	76	79
1993	5	130	20	131	20	99	100
1994	2	21	15	21	15	100	100
1995	5	87	18	144	26	60	69
1996	8	66	21	94	35	70	60
1997	4	101	15	104	17	97	88
1998	8	80	33	88	46	91	72
1999	5	31	10	59	16	53	63
2000	10	185	31	234	47	79	66
2001	7	68	18	87	22	78	82
Total	**62**	**830**	**212**	**1042**	**283**	**80**	**75**

3.4 ACCIDENT CLASSIFICATION — EASTERN-BUILT TURBOPROPS

3.4.1 INTRODUCTION

This Safety Report includes a subjective assessment of the most apparent contributory factors. The advantage of this practice is that it facilitates early identification of emerging problems. The disadvantages are that occasionally some accidents cannot be assessed at all because of insufficient data, and that no update of these initial assessments is made. However, experience has shown that these early assessments are invariably born out by the eventual publication of the accident reports.

3.4.2 EVENTS

The more significant events identified in 2001 that resulted in an operational Hull Loss (HL) or Substantial Damage (SD) accident were as follows:

- There were 3 Controlled Flight Into Terrain (CFIT) accidents;
- 3 Rejected Take Offs (1HL, 2SD), 1 HL resulted from Loss of Control of the aircraft, 1 SD was in response to undercarriage failure;
- 1 Loss of Control accident resulting in a Hull Loss;
- 1 hard landing resulting in Substantial Damage of the Aircraft and
- 1 event in which the aircraft landed short of the runway.

3.4.3 PHASE OF FLIGHT

The following table illustrates the distribution, in relation to the phase of flight, of operational:

- Hull Loss (HL) accidents;
- Substantial Damage (SD) accidents;
- Fatal Accidents and
- Fatalities (crew and passenger).

Figure 3.4.A

Phase of Flight	HL	SD	Total	Fatal Accidents	Fatalities
TOF	1		1	1	9
RTO		2	2		
ICL					
ECL	3		3	3	42
CRZ	4		4	2	33
DST					
APR					
LND	1	2	3	1	2
Total	**9**	**4**	**13**	**7**	**86**

Figure 3.4.B

Operational Accidents by Phase of Flight

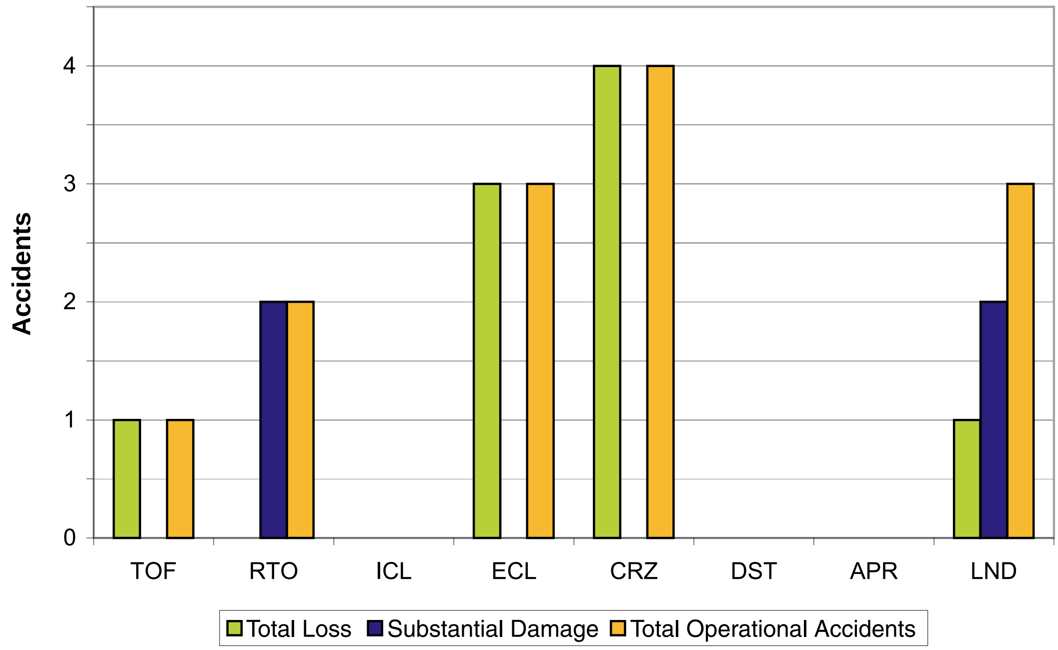
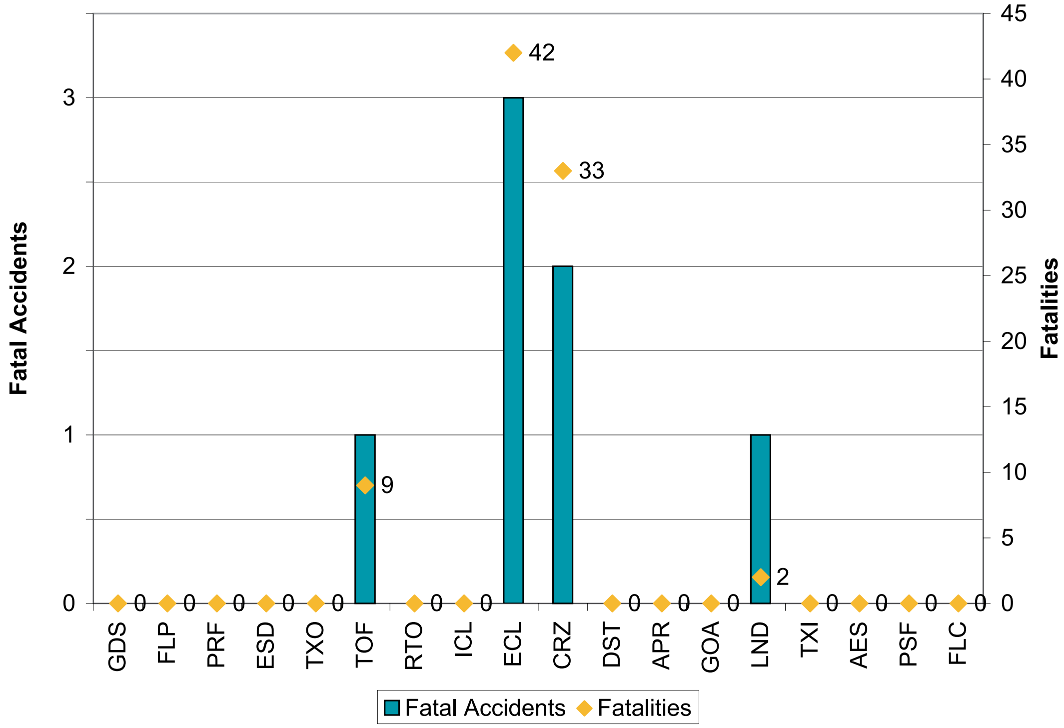


Figure 3.4.C

Fatal Accidents and Fatalities



3.4.4 IATA CONTRIBUTORY FACTOR CODING

There was sufficient information to classify all operational accidents. This resulted in 24 classifications, grouped as indicated below. (See Appendix C for definitions)

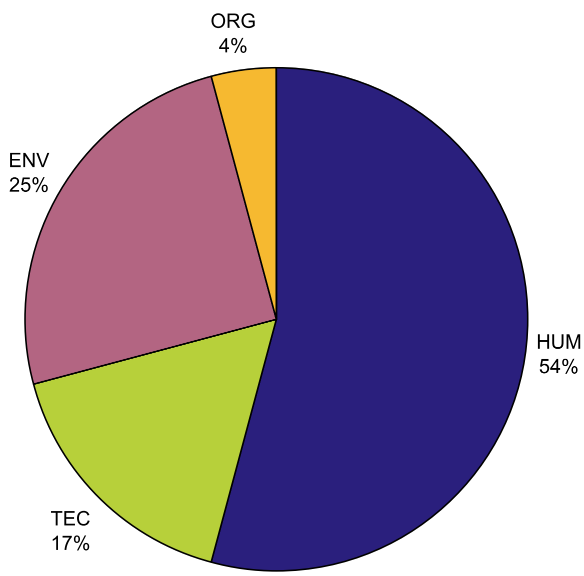
Figure 3.4.D

			HUM		TEC		ENV		ORG	
Human	**HUM**	42	H1	8	T1	4	E1	17	O1	11
Technical	**TEC**	30	H2	10	T2	0	E2	4	O2	2
Environmental	**ENV**	54	H3	24	T3	8	E3	3	O3	0
Organisational	**ORG**	23	H4	0	T4	1	E4	2	O4	1
Incomplete	**I**	0			T5	2	E5	10	O5	8
					T6	0	E6	6	O6	1
					T7	8	E7	2	O7	0
					T8	0	E8	1	O8	0
					T9	6	E9	1		
					T10	0	E10	0		
					T11	1	E11	8		
					T12	0				
	Total	**149**		**42**		**30**		**54**		**23**

The relationship between contributory factor codes is illustrated in the diagram below.

Figure 3.4.E

IATA Contributory Factors

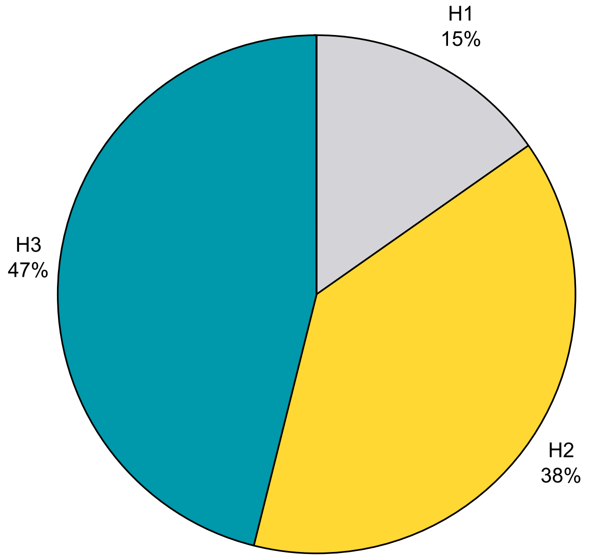


Human Factors dominate the contributory factors of operational accidents.

The breakdown of Human Factors is shown in the following chart, and clearly indicates pilot proficiency / skill failure (H3) as dominant. In fact, Skill Failures (H3) are seen to have contributed to 6 of the 13 (47%) operational accidents in 2001.

Figure 3.4.F

Human Factors



The next greatest contributing influences were Environmental Factors, with weather (E1) accounting for 5 cases in this category, which is 39% of all Eastern Built Turboprop accidents.

Of the 13 accidents, 3 are known to have happened in darkness.

Figure 3.4.G

Contributory Factors by Phase of Flight

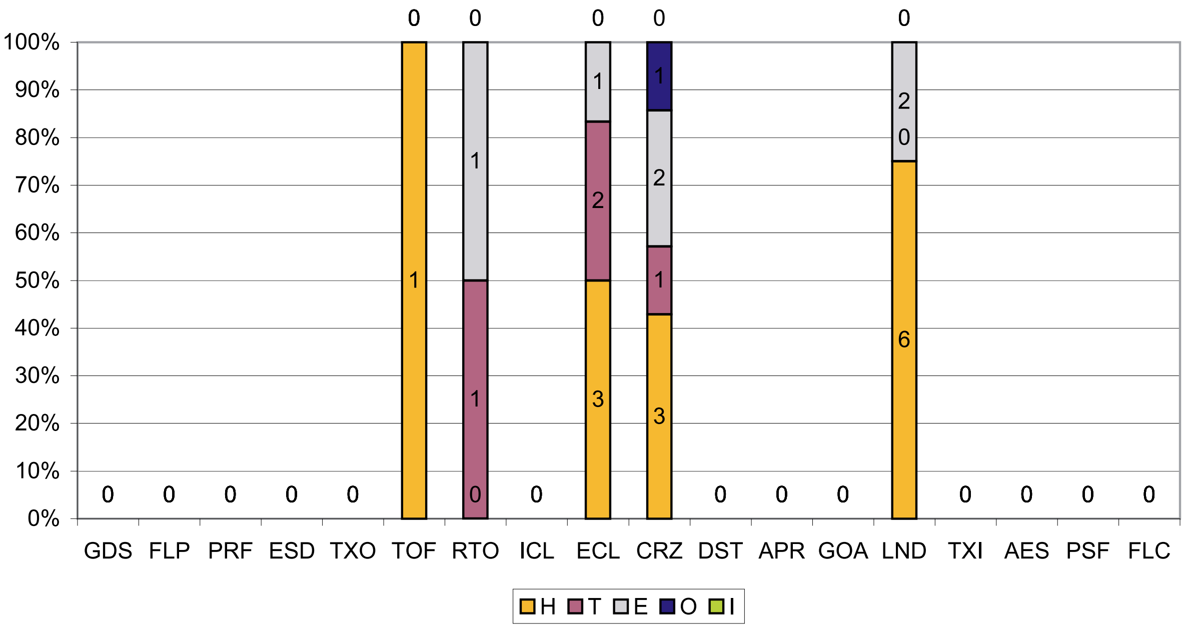


Figure 3.4.H

Phase	H	T	E	O	I	Total
GDS						
FLP						
PRF						
ESD						
TXO						
TOF	1					**1**
RTO		1	1			**2**
ICL						
ECL	3	2	1			**6**
CRZ	3	1	2	1		**7**
DST						
APR						
GOA						
LND	6		2			**8**
TXI						
AES						
PSF						
FLC						
Total	**13**	**4**	**6**	**1**		**24**

3.4.5 REGIONAL DATA

The following graph and accompanying table illustrate the relationship between accident site regions and operator regions for the 13 operational accidents in 2001.

Figure 3.4.I

Accident Site Region and Operator Region

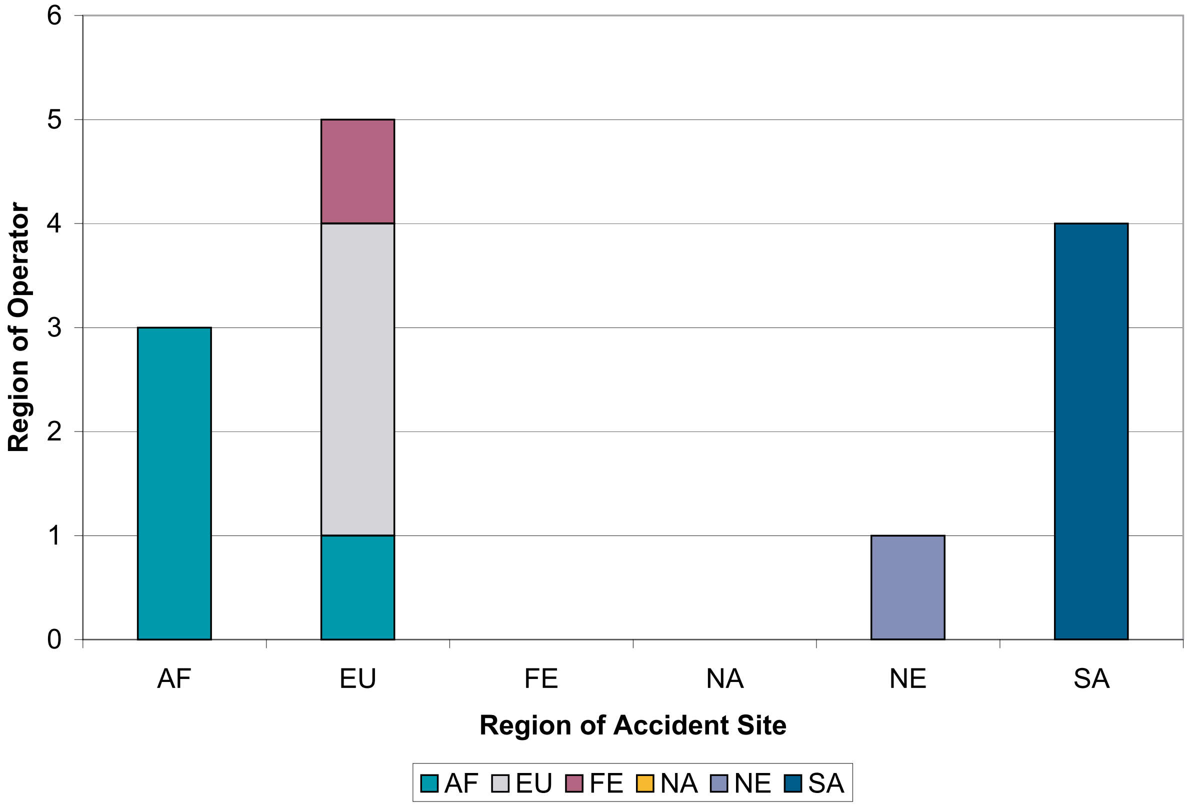


Figure 3.4.J

Region of Operator	Region of Accident site						
	AF	EU	FE	NA	NE	SA	TOTAL
AF	3						**3**
EU	1	3	1				**5**
FE							
NA							
NE					1		**1**
SA						4	**4**
TOTAL	**4**	**3**	**1**		**1**	**4**	**13**

CHAPTER 4 — ANALYSIS

4.1 REVIEW OF ACCIDENTS

4.1.1 DATA ANALYSIS

General

With reference to the statistics set out in Section 1, the figures for hours/sectors flown, fleet size and passengers carried by Western-built jet airliners are summarized below, showing how these statistics compare with the year 2000.

Figure 4.1.A

Hours, Sectors, Fleet, Passengers Carried (Variation) Jet

	2000	2001	Variation	Δ%
Hours (million)	37.492	37.000	-0.492	-1.3
Sectors (million)	19.936	20.000	+0.064	+0.3
Fleet	14,676	15,580	+904	+6.2
Passengers Carried (million)	1,926	1,810	-116	-6.0%

Figure 4.1.B

Aircraft Years, Fleet (Variation) Turboprop

	2000	2001	Variation	Δ%
Aircraft Years	5320.5	5293.1	-27.4	-0.52
Fleet	5281	5312	+31	+0.59

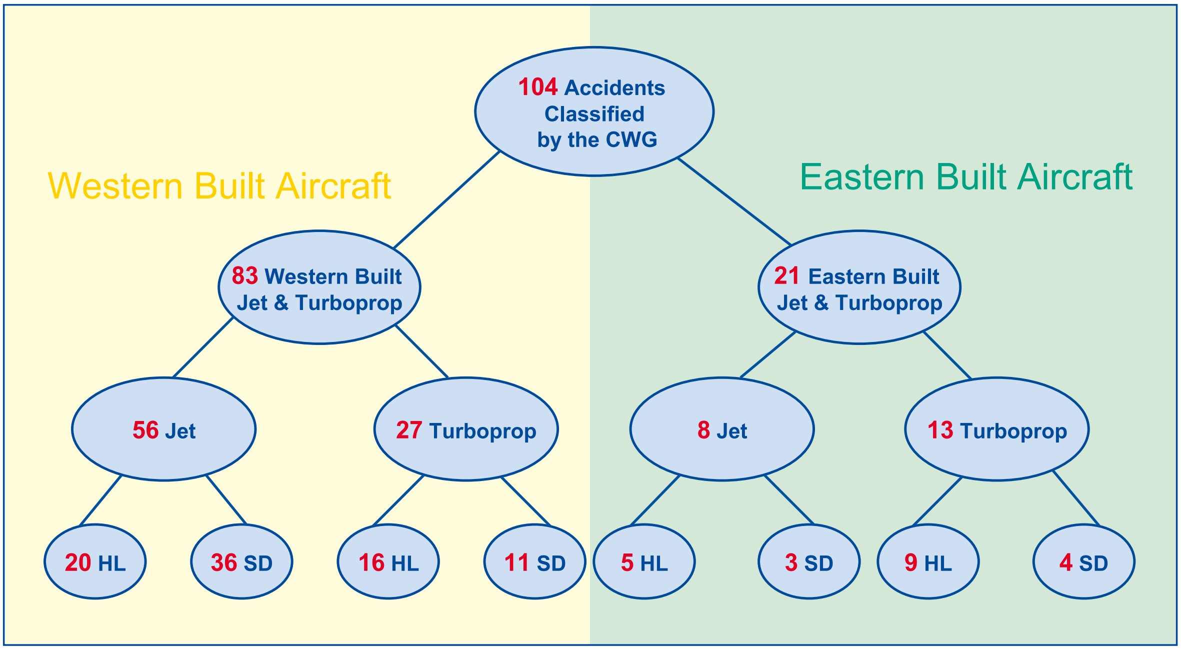
As can be seen from the above tables, **the world fleet size, both for Western Built Jet and Turboprop, has continued to increase in 2001.** Meanwhile, for the Jet fleets in 2001, **the hours flown reduced while the sectors flown increased fractionally** across the year as a whole, reducing markedly post 11 September 2001. Those for Turboprop are not known but viewed in terms of Aircraft Years flown in 2001, this figure reduced fractionally across the year as a whole.

Total of Accidents

The CWG Classified 104 accidents involving Western and Eastern Built Jet and Turboprop categories distributed as shown in Figure 4.1.C. These are the **Operational** Jet and Turboprop Hull Loss (HL) and Substantial Damage (SD) accidents that occurred in 2001 and are the primary focus of the Safety Report. Throughout this analysis it should be assumed that only operational accidents are being addressed unless specifically stated otherwise. An operational accident is one which occurred during normal revenue operations or positioning flights. This chart therefore **excludes** ground events where there was no intention of flight and **deliberate acts of violence such as the 4 aircraft involved in the 11 September 2001 terrorist attacks.**

Figure 4.1.C

Distribution of 2001 Accidents



HL = Hull Loss   SD = Substantial Damage

Operational Accidents

Western Built

Amongst the Western Built Jet and Turboprop fleets in 2001 there were **83 accidents** (HL plus SD), which is similar to the 84 accidents that occurred in 2000. **However,** the **Western Built Jet category is markedly worse by 6 accidents** compared with 2000.

There were **20 [22] Jet Hull Loss accidents** and **36 [28] accidents in which aircraft were Substantially Damaged.**

Of the Turboprop accidents, 16 [20] were HLs and 11 [14] aircraft were Substantially Damaged. Therefore there was a welcome overall improvement of 7 amongst the Turboprop fleet compared with last year.

Viewed over the 1992 — 2001 decade as a whole in terms of **Hull Losses** (Jet and Turboprop), the **Hull Loss figure of 36 was the lowest of the decade,** the next best being 2000 with a total of 40 and 1994 with a total of 42 Hull Losses.

Eastern Built

As far as can be determined by the CWG there were **21 Eastern Built Jet and Turboprop accidents (HL plus SD) during 2001.** Utilisation of Eastern Built Jet and Turboprop aircraft has reduced considerably during the 1990s and this significantly reduced exposure would explain, in part, the relatively few accidents now compared with earlier years.

On this basis the number of **Eastern-Built Jet accidents (HL & SD) was 8, comparing unfavourably with only 2 Hull Losses reported last year.** Moreover, there were **13 Eastern-Built Turboprop accidents (HL & SD) in 2001 which compares less well with the 14 encountered in the region in 2000.**

In terms of SD accidents, Eastern-Built Turboprops encountered 9 accidents compared with only 3 in 2000. Therefore, **amongst Eastern Built Jet and Turboprop fleets, 2001 was a step backwards in terms of safety performance.**

Operational Hull Loss Rates

The **Operational Hull Loss Rates per million sectors for Western Built Jets reduced from 1.1 per million sectors in 2000 to 1.0 per million sectors in 2001, with a corresponding reduction from 0.59 in 2000 to 0.54 per million flying hours in 2001.** This marginal improvement over the year is nonetheless the lowest loss rate figure achieved than in any other year in the 1992-2001 decade under review.

The **Operational Hull Loss Rates for Western Built Turboprops expressed in terms of losses per 1000 aircraft years reduced from 3.8 in 2000 to 3.0 in 2001** which is also represents an improvement in accident prevention over the 1992 to 2001 decade.

Hours and sectors flown are not available from traditional sources for Eastern Built Jets and Turboprops. Refer to sections 2.3.2 and 3.3.2 for estimates.

Fatal Accidents and Fatalities

In the public eye the number of fatalities resulting from aircraft accidents is a compelling feature of aviation safety. However, it is important to remember that the numbers of people who happen to be onboard an aircraft that is involved in an accident has nothing to do with the cause of the accident. These numbers, although highly regrettable, are not necessarily a measure of safety. However, for completeness, the figures are included here.

Amongst Western Built fleets there were **8 [9] fatal accidents involving Jet aircraft and 7 [12] fatal accidents involving Turboprop aircraft. Therefore in terms of fatal accidents 2001 saw a very significant reduction compared with the year 2000, especially in Turboprop operations.**

Sadly, in **2001 there were still 401 [782] fatalities involving Jet aircraft and 54 [115] involving Western Built Turboprop aircraft.** So the number of fatalities, excluding deliberate acts of violence, almost halved compared with 2000. Over the decade as a whole in terms of operational accidents fewer passengers and crew lost their lives in 2001.

The overall safety gains made by the aviation industry in 2001 cannot be divorced from the events that took place on 11 September 2001, which claimed the lives of so many people aboard the aircraft involved and many more on the ground. These events, of course, were no accident and at such a time accident statistics seem to be irrelevant. Yet behind these horrific events there is a safety performance from which the industry can take some satisfaction. Measured in terms of the IATA Safety Report metrics, which are deemed to be the most authoritative and relevant, 2001 did represent an improvement in aviation safety in terms of the Western Built Jet and Turboprop HL and SD loss rates. Indeed, **the reduction in the number of fatal accidents (Operational HL and SD, Jet and Turboprop) and the associated halving of the number of people who lost their lives** are statistics in which the industry can take some comfort. Had it not been for the terrorist attacks, 2001 would have been the best safety performance of the decade.

Cost of Accidents

In terms of direct costs (excluding lost revenue etc) the cost of HLs for both Jet and Turboprop dropped from US$539M in 2000 to US$275M in 2001, excluding deliberate acts of violence. To include the latter, a further US$4500M should be added for the HL figure alone!

Accident Perspective

When viewing this overall modest improvement in the accident statistics, it is important to understand that the industry already has a good safety record and a low rate of accidents. The task of reducing this rate still further is mainly concerned with the reduction of inherent risk in the system. Such risk management demands great effort and enterprise. It has much to do with learning from the experience of accidents. This analysis derives directly from the accident statistics and classifications presented in the earlier sections and will proceed to investigate further the contributing factors behind the Operational Jet and Turboprop accidents. It will not address the 11 September events but will report on the operational security measures surrounding those events.

4.2 FLIGHT SAFETY PRIORITIES

Approach and Landing Accidents (ALAs) and Controlled Flight Into Terrain (CFIT) accidents are together the primary causes of accidents in aviation and have necessarily attracted the greatest focus in the past decade. The Human Factors, Loss of Control and Situational Awareness categories have also featured strongly in recent IATA Safety Reports. Now, Operational Security is dominating the safety scene. Against a general analysis of the 2001 data those categories attracting the highest safety priority will be addressed in subsequent paragraphs together with other categories of accidents identified by the CWG as being in need of particular attention.

4.2.1 REGIONAL VARIATIONS

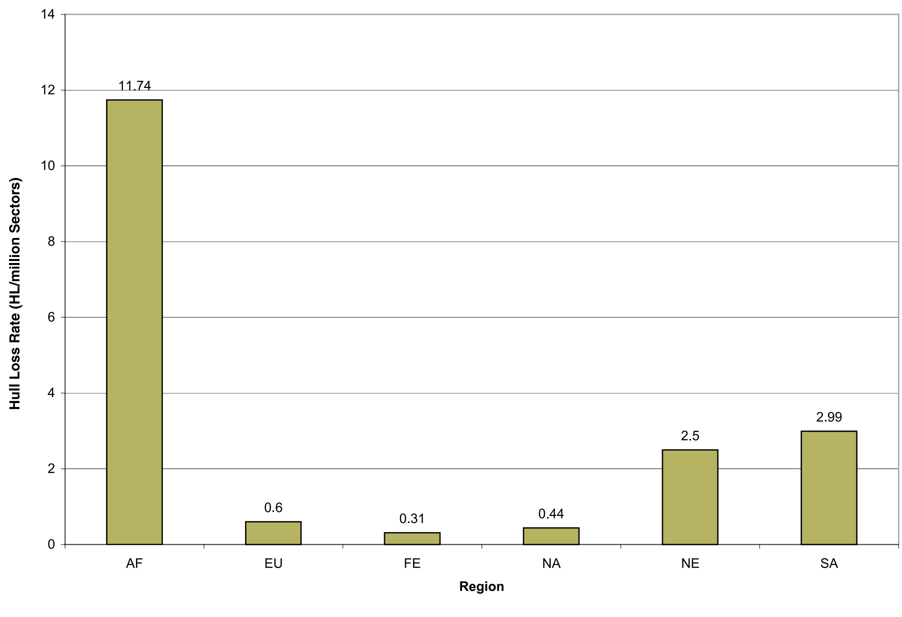
The data used for analysis of regional variations has had to be treated with great caution. Only that applicable to Hull Loss Western built fleets is available. Even with this data some estimation and approximation has had to be applied, partly as a result of the turbulence in the exposure data arising from 11 September and also because data is still being collected at the time of going to press. However, having applied a number of cross checks, IATA Safety is satisfied that the data is statistically significant.

Of the 20 Western Built Hull Losses in 2001, **6** occurred in **Africa (AF), 13** occurred in **Europe (EU), 1** occurred in the **Far East (FE), 4** occurred in **North America (NA), 1** occurred in the **Near East (NE), and 5** in **South America (SA).**

Representing this in terms of Hull Losses/million sectors, the following rates are apparent from the 2001 data obtained and depicted in figure 4.2.A.

Figure 4.2.A

2001 Hull Losses/Million Sectors By IATA Region



Therefore, in terms of Hull Loss Rates for 2001, FE, NA, and EU rank the best, NE and SA are middle ranked, while Africa continues to experience serious difficulties. Viewed over the 10 year period 1992 through 2001, using data obtained from other sources, it is apparent that the FE had a very good year in terms of Hull Loss rates while Africa continues to experience severe difficulties in this regard. Therefore the message that appeared in the 2000 Safety Report continues to be relevant. Africa's accident rates continue to be of serious concern to the aviation industry. Safety oversight of flight operations, aircraft maintenance standards and Air Traffic Control infrastructure are partly the responsibility of Governments and their Regulators. States are responsible for giving effect to ICAO standards (as a minimum) and for monitoring compliance with those requirements. Operators are responsible for complying with State requirements, as well as their own specific standards, remembering that minimum compliance is not necessarily enough to achieve the safety and security performance expected by Society.

IATA recognises that a co-ordinated approach with all of the key players in the regions is the one that is most likely to bring about improvements in these loss rates. Safety Strategy 2000+ calls for the development of targeted programmes on a regional basis. These involve the identification and establishment of Regional Team Leaders (RTLs) to tackle safety issues on a regional basis, like the Pan American Aviation Safety Team (PAAST) in the LAT/AM/CAR Region. PAAST has now gained sufficient support and momentum to permit a second similar regional initiative to be pursued in the AS/PAC Region. Plans are being formulated to extend this concept to other regions such as Africa, the Middle East, China and the Russian CIS.

4.2.2 PHASE OF FLIGHT

Takeoff, Climb and Cruise

Of the 56 Western Built Jet accidents, 6 occurred during the Take Off and Rejected Take Off phases, which is one more than in 2000. There were 2 accidents that occurred in the Cruise phase, compared with none in 2000. Of the accidents in Cruise phase, one involved degraded situational awareness and poor fuel management.

Of the 27 Western Built Turboprop accidents in 2001, there were 2 Rejected Take Off accidents, 2 accidents in the Initial Climb, and 2 in Cruise.

Approach, Landing and Go-around

Of the Western Built Jet accidents, 34 of the 56 accidents occurred during the Approach and Landing including one Go-around.

Amongst the Western Built Turboprop fleet, there was 1 HL accident in the Go-around phase which was accompanied by poor situational awareness. 18 of the 27 accidents occurred during the Approach and Landing phases of flight.

Pre-take Off and Post Landing Accidents

The new ATA Phase of Flight Definitions highlighted 3 Engine Start Depart (ESD) accidents amongst the Western Built Jets, but there were no other significant trends amongst these categories.

4.2.3 IATA CONTRIBUTORY FACTORS

The IATA Contributory Factors Classifications are groupings of factors attributable to accidents. They have been devised to help airlines develop training programmes for flight crew, cabin staff and other airline employees. These classifications can help to identify the main areas of concern where remedial action should be taken. They are arranged in five categories: Technical (T), Environmental (E), Organisational (O), Human (H) and Insufficient Data (I). It is generally difficult to classify accidents or incidents in only one category because they are often the result of a combination of different factors. Therefore a single event may be classified under more than one category.

Technical Factors

The technical category relates specifically to systems and components of the involved aeroplane and their suitability or serviceability.

Of the 104 operational accidents (Eastern and Western Built, Jet and Turboprop) there were 35 in which technical failure contributed. 11 aircraft were more than 20 years old and 6 in excess of 30 years old.

The most common form of technical occurrence was gear and tire failure (T3) which contributed to 11 of the 104 accidents. In 10 of these accidents the landing gear failed outright.

Company Maintenance, Servicing, including Human Error (T7) was identified as a contributing factor in 10 accidents, 3 of which were landing gear and tire failure (T3) events. Thus, as in previous years, the engineering domain continues to be at least partly responsible for about a third of accidents with landing gear being a dominant area of concern along with human performance issues which may need to be addressed.

Environmental Factors

The environmental category relates to the physical world in which the involved aeroplane and the infrastructure (other than corporate) resources required for successful performance. In the Western Built Jet Classifications the greatest number of classifications are seen with the Environmental factors, but there is no single environmental classification that comes close to the influence overall on the accident statistics as does a lack of Proficiency/Skill failures (H3).

Of the total 104 accidents (Eastern and Western built Jet and Turboprop) there were 30 accidents where weather was a contributing factor, making weather (E1) the most prevalent environmental factor. In 20 of these events Proficiency/Skill Failure (H3) was also seen as a contributing factor pointing to a need for more realistic (weather) scenarios in simulator training. The next most dominant Environmental factor is Airport Facilities (E5). Contributing to 10 accidents and Regulatory Oversight (E11) contributing to 9 accidents.

Night operations pose more difficulties caused, for example, by fewer visual cues or by spatial disorientation. The significant statistic here was apparent amongst the Western Built Jet accidents. Of the 56 accidents, 16 are known to have occurred in darkness.

Organisational Factors

The organisational category relates to the corporate environment in which the involved flight crew operated including cultural, administrative and management aspects.

Of the 104 Operational accidents, Inadequate Control and Monitoring (05) is most prevalent by contributing to 14 accidents. This is particularly discouraging because it indicates a lack of quality assurance and an underdeveloped safety culture within the company. This area will be discussed later in this analysis. But, as already highlighted in the Introduction of this Safety Report, organisations operating and maintaining aircraft must establish effective safety and quality management systems in a corporate culture which extends to the boardroom. The Organisational factor classifications for 2001 underline this requirement.

Also significant amongst the organisational factors is Selection and Training (01) which contributed to 12 accidents. The connection between this factor and Proficiency/Skill Failure has been discussed earlier and will be addressed in more detail later in the analysis.

Human Factors

In recent years a great deal of effort has been devoted to understanding how accidents happen in aviation and other industries. It is now generally accepted that most accidents result from human error. It would be easy to conclude that these human errors indicate carelessness or incompetence on the job but that would not be accurate. Air Safety investigators are finding that the human is only the last link in a chain that leads to an accident. In the 1990’s the term ‘organisational accident’ was coined because most of the links in the accident chain are under the control of the organisation. Since the greatest threats to aviation safety originate in organisational issues, making the system even safer requires action by the organisation to establish the right safety culture.

The IATA Accident Classification System accommodates this relationship in that it distinguishes between Human (H), and Organizational (O) factors but there is an inevitable overlap and certainly a connection between the two categories. For example, there is likely to be a strong association between H3 (Flight Crew Proficiency and Skill Failure) and O1 (Selection or Training of Crewmembers). Thus there may be a human performance issue for which the organisation should take some responsibility, perhaps, for example, in terms of the possible impact of flight crew currency/recency and fatigue on proficiency.

It should perhaps be explained at this point that the H category relates only to flight crew. However, the equivalent human factors implications are also present in the Technical, Environmental and Organizational areas. The H3 factor especially is often a consequence of an active failure or latent condition.

H Factors are seen to have contributed to 66 of the 104 accidents in 2001. The most commonly seen H Factor is H3 (Proficiency — Skill Failure) which is identified in 50 of the 104 accidents. Furthermore, 20 of these 50 accidents, where H3 was identified, also saw Weather (E1) as a contributing factor. Of the 50 H3 accidents, 41 occurred during the approach and landing phase. **Therefore 2001 points to a propensity of errors being made during the approach and landing in challenging weather conditions.**

Figure 4.2.B

Weather strikes again and again during ALA!

Photograph by Samuel Lo

4.2.4 APPROACH AND LANDING ACCIDENTS

As is already apparent from the above review of the 2001 Accident Contributory Factors, ALAs are dominated by proficiency and skill failures. This has been so for many years. In response to this concern the Flight Safety Foundation (FSF) created an Approach and Landing Reduction (ALAR) Task Force in 1996 as another phase of the CFIT accident reduction campaign launched in the early 1990s. This work, published in a FSF Digest in February 1999, provides a comprehensive analysis of ALA from 1980 to 1996. The IATA 2001 ALA statistics confirm that the recommendations made by the ALAR Task Force in 1999 remain valid.

The ALAR Task Force defines ALAs as events that occurred in flight phases after initiation of the descent (includes approach and landing, circling manoeuvres and go-arounds).

The need for improvement in the ALA record is reflected in the 2001 statistics where the data indicate that **61% (16HL, 18SD) of the 56 Western Built Jet accidents occurred during the ALA phases of flight. In 2001 there were 34 accidents during ALA compared with 28 in 2000. This 21% increase is of great concern. Moreover, 96% of the 24 (H3) skill failure Western Built Jet accidents occurred during ALA and most significantly there were 6 (5HL, 1 SD) undershoot accidents involving the Western Built Jet fleet.**

Of the 56 Western Built Jet operational accidents, 25% (7HL,7SD) involved cargo operations. **5 of the 6 accidents in which the aircraft landed short of the runway involved cargo aircraft.**

Within the Western Built Jet fleet there were 10 [11] runway excursions and 7 accidents that resulted in a hard landing. This persistently high number of runway excursions occurring during the landing phase for the past 3 years remains disturbing.

Of the 27 Western Built Turboprop accidents in 2001, **67% (18 of 27) occurred during the ALA phase,** which is similar to the numbers in 2000. A proficiency/skill failure H3 was identified as a contributing factor in 14 of the 18 ALA accidents, which is similar to the Jet statistics.

The ALAR recommendation in the 2000 report remains valid in the light of the 2001 ALAR statistics **i.e. that IATA and the Operators review training practices and quality of training devices in terms of the particular skills required by a pilot during the landing phase.**

Training Aids

The FSF ALAR Tool Kit became available in March 2001. The ALAR Tool Kit has been awarded the 2001 Flight International Aerospace Industry Training and Safety Award. In view of the increasingly adverse ALA record this training aid has come to the industry at a particularly opporture time making this a highly appropriate award. Operators are strongly advised by the CWG to incorporate the ALAR Tool Kit within their training programmes. **In view of the concerning increase in the number of ALA accidents, IATA has made special arrangements with the FSF to include a copy of the ALAR Tool Kit CD-ROM which accompanies this Safety Report.**

Discussions with the manufacturers indicate that they too are concerned about the ALA problem. Both Airbus and Boeing are expected to distribute training videos on various aspects of landing technique in 2002. Operators should obtain and incorporate this training material to update flight crew proficiency in those areas.

Noting the examples of ALA flight data animator readouts presented at the CWG and in other safety forums, IATA will provide a library of such readouts as one of the facilities on the STEADES suite of services due to be implemented in Spring 2003. These de-identified animated flight data readouts of accidents and serious incidents should be used primarily for flight training purposes.

Landing Skill

As in previous years, skill failures, particularly during the landing phase, are apparent in the 2001 analysis. The CWG feels that this weakness is due to a lack of adequate training for this point of high exposure. Firstly, it is considered that the Landing Phase is not well portrayed by the flight simulator due to inherent limitations in simulator performance i.e. their ability to reproduce a realistic operating environment late in the approach. It follows therefore that there is a significant weakness in the training that the simulator can provide. Secondly, the CWG recognise that simulator training requirements are mainly governed by the Regulatory Authorities. This sometimes leads to the exclusion of items which could be beneficial to the landing phase. To make training more effective below 200 ft, IATA encourages the sharing of FDR data captured in challenging weather conditions with the simulator manufacturers. This will allow development of realistic environmental models within which improved training can take place. Accurate portrayal of ‘ground effect’ coupled with the limitations of visual systems during the flare manoevre are notoriously difficult to simulate and need more attention by both simulator and aircraft manufacturers.

Undershoot

Compared with last year, there was a marked increase in the number of accidents in which the aircraft landed short of the runway. Of the 20 Western Built Jet HLs, 5 resulted from undershooting the runway. There was only 1 Turboprop accident of this kind. Every undershoot accident attracted an

H3 classification and all were regarded as skill failures. Reflecting on this type of accident the CWG expressed caution both with regard to the influence of time pressures and aiming to achieve an early turnoff from the runway. **The dominance of Cargo aircraft involved in undershoot accidents is a startling feature of the 2001 statistics.**

It is recommendated that:

1. *In view of the clear message coming from this year's safety report that the Approach and Landing Phases of flight present the highest risk — particularly in relation to undershoot accidents — airlines are urged to incorporate the Flight Safety Foundation ALAR Tool Kit in their training programmes.*
2. *Both Airbus and Boeing are expected to distribute training videos in 2002 covering various aspects of landing technique. Operators should obtain and incorporate this training material to improve crew proficiency.*

Landing Long

The CWG were aware of the high number of landing long incidents that had not resulted in accidents. There is a particular need for Flight Data Monitoring oversight to detect landing long incidents and for appropriate corrective campaigning and counselling to be undertaken.

It is recommended that:

3. *Airlines optimise their FDM systems to focus more closely on undershoot tendency, low level go-arounds and landing long. Animator analysis tools should be used to assist with timely counselling of flight crew.*
4. *Through its Flight Simulator WG IATA establish a means of sharing airline FDR data with the simulator manufacturers to allow development of more realistic environmental models for landing phase training.*
5. *IATA design the STEADES services web site, planned for March 2003, to include a collection of de-identified animated flight data readouts of accidents and serious incidents for flying training purposes.*

Go-around

There was only 1 accident in 2001 that occurred during the go-around phase. At first it may appear that the increased training emphasis during this high work load phase of flight is paying off. This conclusion could be misleading. In 2001 there were **18 Jet and 4 Turboprop accidents which indicate that if a "timely" Go-around had been carried out they may not have occurred. The CWG believe that there is a lack of Go-arounds being initiated.** As such the problem could be related to judgement and decision making skills rather than more task training required.

This concern is being explored more deeply by some airlines. In particular the CWG noted the investigation conducted by one of its members following a landing incident. The investigation focussed on the Go-around decision. The principal lesson learned was that a Go-around decision, even during the flare, could have prevented the accident. A strong message coming from this investigation was that Airlines must pay more attention to the Go-around decision process at low heights. Therefore, the CWG would like to commend a Survey conducted by one of its airlines to gain a better understanding of why flight crew do not initiate Go-arounds. **(Refer to Safety Toolkit on the CD-ROM for a Go-around Decision Survey).** This research highlights the point that even with, say, a routine daily approach stabilised down to 10 ft, anything can still happen! For situations such as GPWS alerts, destabilisation at low height, loss of visual references, windshear, turbulence, bounced or deep landing, and other unexpected situations at low height, a timely Go-around is safer than a landing. **There is always time to decide (before reverse thrust deployment)** but, as indicated earlier, the issue is as much to do with judgement and decision making skills as task training. The CWG encourage airlines to focus their recurrent training sessions on the Go-around decision at low height, perhaps assisted by the accompanying Go-around Decision Survey.

To further assist the understanding of this crucial flight phase, airlines should also embrace a retribution-free Go-around policy. Flight crews must therefore be assured that, in reporting Go-arounds, they are providing their operations management with greater visibility of the factors causing Go-arounds, and not on the Go-arounds themselves.

<u>It is recommended that</u>:

6. *In their recurrent training sessions, airlines focus on the Go-around decision at a low height, assisted by the pilot survey included on the CD-ROM enclosed with this report.*
7. *Operators adopt a retribution free Go-around policy.*

Visual Approaches

Visual approaches are seldom possible in the highly structured “checking” environment that currently prevails. There is little time available for training, as opposed to “checking”, but the CWG felt that where such training is carried out it was an effective way of mitigating the risks such operations pose. However the CWG offered no specific recommendation concerning visual approaches, **therefore the ALAR Briefing Note 7.4 included in the ALAR Tool Kit remains highly pertinent.**

4.2.5 CONTROLLED FLIGHT INTO TERRAIN (CFIT)

In general terms a CFIT accident is an in flight collision or near collision with terrain, water, or obstacle without indication of loss of control. The CWG has adopted this CFIT definition from the CAST/ICAO Common Taxonomy Team included at Appendix C — Definitions where more specific definition of a CFIT accident is provided.

During the first half of the 1990s, there were more fatalities due to CFIT than from any other type of accident. Although recent years have shown a decline in the number of CFIT accidents the annual average of CFIT accidents has been about 4 concerning the Jet fleets over the past decade and 7 amongst the Turboprop fleets when viewed over the past 5 years. In 2001 there were 2 [3] Jet and 3 [4] Turboprop CFIT HLs involving Western Built aircraft and a further 3 Eastern Built Turboprop CFIT Accidents. Therefore 2001 saw a welcome improvement in the number of CFIT Jet and Turboprop accidents, which results from a sustained programme of CFIT countermeasures.

Figure 4.2.C

CFIT Accidents/Fatalities for Jet

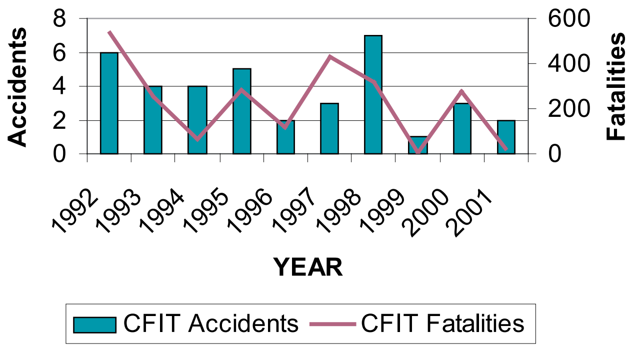
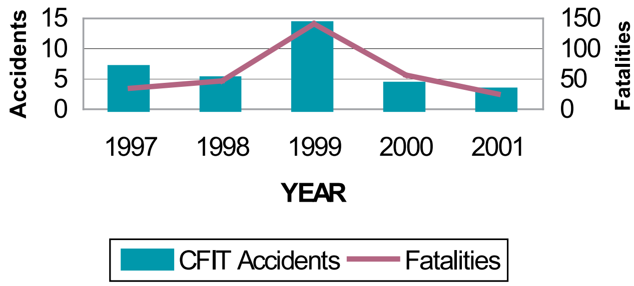


Figure 4.2.D

CFIT Accidents/Fatalities for Turboprop



It should be noted that the ALAR toolkit accompanying this Safety Report is not only designed to help prevent ALAs but also CFIT accidents. Additionally, the earlier mentioned FSF Safety Digest, which carries articles about CFIT accident prevention remains highly pertinent to this day. It is important to remember from these earlier analyses that 75% of the aircraft involved in those accidents lacked a GPWS and a significant percentage of CFIT accidents occurred in areas without high terrain. The advent of Enhanced GPWS has put another defence in place. However, this measure is not widespread and none of the 5 CFIT accidents involving Western Built aircraft occurring in 2001 had EGPWS installed. It is pleasing to note that in 2001 a potential CFIT accident involving a B777 aircraft was averted by a timely GPWS warning. **The momentum of the industry wide campaign to minimise CFIT accidents must be maintained. Most of the tools to prevent this type of accident are now available.** It is the adoption and implementation of these tools which is vital to achieving a further reduction and eventual elimination of CFIT accidents.

4.2.6 LOSS OF CONTROL

Of the Western Built Fleet there was **only 1 [4] Jet Loss of Control accident and 1 [4] Turboprop.** There were 2 Jet Loss of Control Accidents amongst the Eastern Fleet with 2 Turboprop.

Loss of Control preventative measures are being developed by the US Commercial Aviation Safety Team (CAST) and European Joint Safety Strategy Initiative (JSSI), before being considered by IATA. The CWG anticipates a review of the Jet Upset recovery training procedures during 2002 and offers additional comment at the Technical Knowledge and System Understanding paragraph.

4.2.7 SITUATIONAL AWARENESS

Helmreich & Foushee (1993) identify situational awareness as an ‘outcome rather than a specific set of mission management behaviours’. They nominate preparation, planning, vigilance, workload distribution and distraction avoidance as key factors when considering effective situational awareness. Orasana later describes situational awareness as the interpretation of ‘situational cues’. Alternatively it has been described as, a state of mind — a dynamic mental model of relevant aspects of the “world”. The CWG accepts these views, adding that situational awareness is not lost. Pilots are always forming some idea of what the system or process is doing. They always give a meaning to incoming cues and interpret data on the basis of what they already know, what they have just done, what they have set out to do, and what they expect to happen. When a mismatch occurs between how pilots understand their situation to be, and what the situation actually is, this can be regarded as loss of situational awareness.

Poor Situational Awareness continued to feature strongly amongst the Western Built Jet fleet by contributing to 5 (3HLs, 2SD) [7] accidents. 1 Jet accident ended in a CFIT accident, 1 in an undershoot, and 1 in a hard landing.

Amongst the Turboprop fleet there were also 5 (3 HLs,2 SDs), 2 of which resulted in CFIT.

Taking all 104 accidents into account, Western and Eastern, Jet and Turboprop for 2001, there were 15 resulting from poor situational awareness. In 9 of these accidents, Passive Failure (H2) was also identified as a contributing factor. Weather (E1) was identified as a contributing factor in 6 of the 15. Moreover, poor situational awareness combined with Weather (E1) resulted in a CFIT in 4 cases.

Although this category has seen a modest improvement in the number of accidents, the CWG focus on situational awareness should be maintained. The pilot must be aware that the source of information, or cues, may differ from aircraft to aircraft, and from flight to flight. Like other CRM concepts, situational awareness may have become too vague a concept to many pilots and the continuing evidence in 2001 suggests that this would be a most unfortunate trend. Acknowledging the outstanding contribution to aviation safety made by the CFIT and ALAR Task Forces, it is important to recognise that the ensuing training packages must be fully integrated into the overall pilot training programme which should include training in situational awareness. The essential tool for CFIT or terrain avoidance, along with other threats such as windshear and mid-air collision avoidance, is situational awareness. A CFIT accident is the result of a situational awareness failure. Airlines should therefore continue to review training practices and SOPs to ensure that specific training is given to pilots regarding situational awareness i.e. during initial conversion training as well as during recurrent training exercises.

As a result of an IATA Safety Committee action, the IATA Human Factors Working Group (HFWG) has been asked to investigate Situational Awareness from an ATC viewpoint. One particular area being considered in this work is the threat to situational awareness of using language other than English in the ATC environment and to continue the pursuit of wider use of English through ICAO, States, and Regions.

4.2.8 OTHER SAFETY ISSUES

Technical Knowledge and System Understanding

Some of the 2001 accidents and incidents indicated a lack of in-depth understanding amongst flight crew of the system architecture and principles of operation of many aircraft systems, particularly with regard to the power of modern flight control systems, but also in relation to fuel management and electrical system behaviour, fuel (including management/exhaustion) and electrics. The CWG feels that the development of newer generation aircraft has been driven from a “need to know” philosophy now reflected extensively in technical/systems training. When coupled with poorly executed and/or inadequate checklists it is evident that significant safety gains could be expected if training was re-focussed on these subjects. Aircraft manufacturers should conduct research to assess whether current technical/systems training of flight crews is matched appropriately to the level of understanding required for effective systems management. This research must also address the recent rapid expansion in the industry which required many new pilots being directed on to the most modern aircraft without the benefit of experience on older aircraft which required greater technical knowledge and system understanding.

It is recommended that:

8. *Aircraft manufacturers conduct research to assess whether current technical/systems training of flight crews is matched appropriately to the level of understanding required by crews for effective systems management during Non-normal procedures.*
9. *In the particular area of fuel management procedures aircraft Manufacturers should ensure that checklists enable flight crews to confirm whether their aircraft is leaking fuel.*

Aircraft System Design

The CWG discussed a number of so called “design traps”. The Group acknowledges that the use of this term is probably inappropriate but this was the one used by the group during the discussion. One particular “trap” concerned mis-setting of stabiliser trim while another attributed poor design to the handling characteristics of a Western-Built Jet Type, which has incurred three landing accidents in which the aircraft has turned up-side-down.

The important message here is that if accident investigations or incident reports from pilots or engineers reflect concern about system design they must be thoroughly investigated. These investigations should take account of the SOPs or procedures currently in place and assess whether these are reasonable and practical. The Industry dare not allow a breakdown in communication in this important area of flight safety with one party pointing to procedures that were not adhered to while the other suggests inadequacies in those procedures or, indeed, the design itself. If systems and handling related incidents continue to occur then they must be addressed realistically without vested interest and involve the best people to resolve them. Pointing fingers at design or procedures must be done with caution but if incidents persist the problem must be faced honestly and fearlessly.

The deeper involvement of the manufacturers in the CWG and SAC this year is welcomed. It reflects the increasing contribution that the manufacturers have been making at the operational safety interface in recent years, one which is reaping great dividends in the improvement of both design and procedures. IATA through its influence generally and particularly through its airline committees and working groups must continue to encourage this process.

It is recommended that:

10. *IATA Human Factors Working Group (HFWG) examine the examples of “design traps” cited in the Safety Report, e.g. mis-setting of stabiliser trim, and make recommendations to the Manufacturers.*

Recency and Fatigue

A report of one of the accidents analysed by the CWG in 2000 was published recently. Many members of the Group felt that the issues of currency/recency and fatigue highlighted in the report were familiar to them. There have been other such events made known to the CWG but the Group was also conscious of the effort that the Regulators, the Airlines, and the Airline Pilots Associations were devoting to the recency and fatigue issues. The HFWG is also studying this area.

A particular area of concern discussed by the CWG was the difficulties encountered by executive and management pilots in maintaining currency within a hectic work schedule. The management of this risk is seldom formally addressed, e.g. through rostering appropriately experienced or current pairings. The CWG has therefore called upon IATA SWAP to better understand how the Management pilot stays current while doing so little flying.

At the other end of the spectrum, there are indications that high-time, intensively flying Captains may develop a degree of over confidence in their ability to cope with all situations. This may lead to complacency and misjudgement and an unwillingness to make a decision that a less experienced pilot may take more easily. One “high time” pilot cited by a CWG representative had been heard to say when flying a non-precision approach, “I have never gone around, why start now?” Another example cited was that of a senior Captain, who had been involved in an accident, had not gone through a proper selection process when moving from one airline to another. His attributes had been simply read across without challenge, ignoring the impeccable selection procedures of the new airline.

Flight Safety Impact of Environmental Pressures at Airports

The CWG considered that there were 2 accidents in 2001 to which the use of inappropriate flight paths contributed. Some of the factors confronting the flight crews involved were likely to have been, for example,

- the use of a preferential runway (due to environmental constraints) with a Non precision approach, whereas there were other adequate runways at the airport with ILS:
- Poor weather conditions prevailing and at night:
- A late change of runway would require a new briefing:
- A procedure that invites (even requires) a portion of level flight at MDA:
- A descent path that initially aims beyond the runway then increases gradient for the final visual approach, has lateral offset and has a MAP at say 900ft, 1nm from the threshold.

The issue of enforced flight path choices is of increasing concern to IATA. However, Captains should always exercise their command prerogative to challenge unreasonable ATC instructions. They must be ready to exercise their responsibility in accepting inappropriate runway allocations from ATC, perhaps with challenging operational flight paths or high cross-wind situations. Operators must support their Captains, who for their part must realise that they have the right to exercise their option, perhaps to divert. IATA sees this as an increasing problem that must be tackled with the assistance of ICAO. IATA SAC should therefore set up a task force, including appropriate ICAO representation, to investigate the impact of environmental lobbyists and politically motivated initiatives on flight path and runway choices.

It is recommended that:

11. *IATA SAC forms a task force, with ICAO and IATA Management participation to investigate the impact on safety of environmental pressures on flight path and runway choices and develop recommendations.*

Commercial Pressure on Pilots

The CWG pointed to commercial pressure becoming a safety issue. European operators in particular are affected by slot pressures, traffic congestion, environmental issues, competitive company goals and customer expectations. Increasingly, Captains are having to make compromises in every day operation whilst judging their effect upon flight safety. Inadequate knowledge or experience may compromise these judgements, particularly if commercial pressure assumes more influence. Emphasis needs to be placed upon training, to help new and experienced Captains to make reasonable choices that do not compromise safety. Inexperience and or limited depth of experience amongst pilots is a factor that can surface in a rapidly expanding airline, or an airline subsidiary that is undergoing a drain of experienced pilots to, for example, the parent airline. Special care has to be taken in these cases to ensure that safety is not compromised. The 2000 Safety Report recommendation remains valid. IATA will endeavour to increase awareness about the external and environmental pressures affecting pilots.

Decision Making, Judgement and Leadership

All of the undershoot accidents show late or poor decision making by the crew. Once again, the philosophy is that all approaches should be carried out to a Go-around (rather than to a landing) until either reverse thrust is selected or the aircraft is at taxiing speed. Training for the last 100 feet must be reinforced. Events such as bounce recovery, tailstrike, low level (altitude) Go-arounds and windshear/crosswind scenarios should be included in pilot training. The issue of Pilot-in-Command decision making during Final Approach, Flare Landing and Go-around has been discussed by the IATA Safety Committee (IRM) and has been assigned to the IATA Flight Operations Committee to address. The CWG believe training for decision making to improve judgement and, indeed overall leadership qualities should commence at the earliest possible point in training and be continuously developed.

<u>It is recommended that</u>:

12. *Airlines ensure that training in judgement, decision making and leadership commence at the earliest possible point in flying training and be continuously developed. Scenarios such as bounce recovery, tailstrike, low level go-arounds and windshear/crosswind situations should be included.*

Language other than English in ATC

With several accidents the CWG noted that communication continues to be an area for attention. The need for the use of standard ICAO phraseology in flight crew ATC communications is essential. The standardised terminology is not used well enough. Last year's recommendation continues to need reiteration: **Highlight the threat to situational awareness of using language other than English in the ATC environment and purse wider use of English through ICAO, States, and Regions.**

An excellent summary of the measures being taken to respond to this threat appears in ICAO Journal No 3, 2001 Volume 56 entitled **"Provisions for Proficiency in Common Aviation Language to be Strengthened".** This account concludes as follows: "the potential consequences of communication errors are serious enough that the matter of language proficiency must be addressed. Half-measures would be inappropriate; rather, the benefits of improved operational safety and efficiency arising from a common language for ATC communications is a motivation for the aviation community to explore ways to achieve universal English language proficiency. International civil aviation has a long history of co-operation. It is precisely that spirit which must be tapped into once again in the search for solutions to the worldwide need for communication proficiency."

In view of past accidents and the potential consequences of an accident resulting from ambiguous communications or lack of language proficiency, IATA wishes to maintain pressure to address this issue as a matter of priority.

<u>It is recommended that</u>:

13. *Pressure to achieve superior proficiency in English Use by Air Traffic Control personnel and flight crew at International Airports be maintained by IATA and the Industry.*

PAN/Mayday

It was reported that in several countries the ICAO recognised PAN call was not recognised and in many cases crews were forced to resort to the use of Mayday in a situation where PAN was more appropriate. As part of the drive towards observing ICAO standard phraseology the benefits of two levels of priority, PAN and Mayday, should be reinforced by ICAO.

<u>It is recommended that</u>:

14. *As part of the drive towards ICAO standard phraseology, the benefits of two levels of priority, PAN and Mayday, should be reinforced by ICAO.*

Airfield Facilities and Marking

For the third year in succession, failure to denote adequately airfield construction work and adhere to recognised international standards of aerodrome marking has contributed to several accidents. The current practice where the flight documentation contains a vast amount of NOTAM information can lead to NOTAM saturation, and oversight of these documents may be of relevance. Additionally, the relationship between NOTAM'd information, ATC communications and ground markings may be in conflict or misleading.

<u>It is recommended that</u>:

15. *IATA work with ICAO to achieve timely and appropriate NOTAMS of Airport Work in Progress, supported by other forms of effective airfield communications, movement monitoring and observance of Standards for ground markings.*

Instrument Landing System Integrity

The CWG were aware of a number of serious incidents in which it was apparent that there were critical latent weaknesses in the communication process between ATC, the aircraft, and the ILS maintenance/calibration organisation. The CWG drew attention to the threat posed by the use of phraseology such as “clear for ILS approach, glideslope unserviceable”. A localiser approach should never be named “ILS approach”. The clearance should be “clear for localiser approach”. ICAO Annex 10 should be reviewed with this concern in mind.

Moreover, from the aircraft display perspective, the CWG felt that a steadily centred incorrect ILS signal, for whatever reason, which could be captured by the autopilot or flown manually, without any warning, should be banned. Such a feature goes against basic safety principles for flight instruments and equipment design. It should be considered by relevant authorities and regulators. The DME or OM cross check is seen by the CWG as being a weak defence, as too is the Morse Code call sign identification.

Therefore, the CWG see the need for System Manufacturers, the ATC authorities and ICAO to revisit the procedures for communicating maintenance and testing of ILS. Aircraft characteristics and crew procedures should also be reviewed.

It is recommended that:

16. *System Manufacturers, ATC authorities and ICAO together should enhance procedures for communicating the testing and maintenance of Instrument Landing Systems. Aircraft characteristics and crew procedures should also be reviewed by the Manufacturers.*

Figure 4.2.E

ATC Tower at HKG International Airport

Photograph by Samuel Lo

Windshear Warning

In view of the ALA issue, the CWG is particularly conscious of the threat posed by windshear. It noted the efforts being made around the world to improve windshear detection systems but felt that local operational/airline advice could be harnessed to assist other users of the airport. IATA Safety is investigating ways of achieving this through the use of SWAP and/or STEADES. One suggestion coming from the STEADES development work is for airlines to form a Destination Airports Safety Database compiled from local airline Air Safety Reports, Flight Data Monitoring Programmes and indeed Confidential Reporting Programmes. The database would be regularly updated and validated by the Flight Safety Department and the information selection criterion would be that the information should be operationally orientated and directly usable by flight crews. The data collected could then be shared under the IATA SWAP or STEADES process.

It is recommended that:

17. *Local knowledge of wind shear and other operationally orientated information about destination airports be shared through IATA SWAP or STEADES.*

Safety Incident Reporting Culture

The CWG identified 14 accidents in 2001 in which Control and Monitoring of the operation was considered to be inadequate. This particular category (05) points to a lack of quality assurance and safety culture.

One of the principal components of a mature Safety Management System (SMS) is an effective incident reporting scheme. Fundamental to the success of such a scheme is the willingness of pilots, flight attendants, engineers, ramp personnel, air traffic controllers, security staff, indeed any person concerned with supporting air operations to report events. IATA Safety Report 2000 highlighted the benefits of open retribution-free reporting within an airline and this year the CWG wishes to continue this emphasis by urging the establishment of a trusted non-punitive policy statement embracing all areas of the airline. This type of programme reaps the most benefits when settled in a corporate wide programme. A recent survey by the IATA Human Factors Working Groups indicates that these types of policies are often implemented in Flight Operations and it is less common to find them implemented throughout the entire company. **Refer to the Safety Toolkit section of the CD-ROM enclosed for the results of this survey and information that can be used in setting up a corporate-wide Non-Punitive Policy.**

The CWG would like to emphasise the need for industry to provide feedback to the manufacturer in the form of results from incident investigations. In many cases safety enhancement will be facilitated through such reporting. Invariably, only the manufacturer has the capability of fully interpreting and understanding air safety events. Sadly, many serious incidents never get reported and often the investigations of those that are communicated are not shared with the aviation community at large. Some useful tools for assisting with investigations in both the operations and engineering arena have been developed and are readily available but are not adopted. These can be adapted readily to the local culture and are compatible with most air safety reporting databases currently in use, including IATA STEADES.

IATA should therefore maintain emphasis on the promotion of just, non-punitive, air and ground safety reporting and investigation systems, with deeper involvement of the aircraft manufacturers and wider circulation of de-identified investigation reports. **IATA suggests the use of the Maintenance Error Decision Aid (MEDA) process and Procedural Event Analysis Tool (PEAT) refer to Web Links on the enclosed CD-ROM.**

It is recommended that:

18. *IATA maintain emphasis on the promotion of just, non-punitive, air and ground safety reporting and investigation systems, with deeper involvement of the aircraft manufacturers and wider circulation of de-identified investigation reports. IATA encourages the use of corporate-wide Non-Punitive Incident reporting policies and investigation techniques such as Maintenance Error Decision Aid (MEDA), the Procedural Event Analysis Tool (PEAT) and other error detection and prevention tools.*

CEO's Role For Safety Accountability

Having reviewed the accidents for 2001, the CWG wishes to emphasize the importance of proper assignment of Safety accountability in airlines. Safety must permeate the industry at all levels, from the shop floor all the way to the boardroom. The IATA Board of Governors has expressed its support to reinforce the airline CEO role for safety accountability but only limited material for implementing this initiative has so far been secured. More examples of suitable and convincing material is sought by IATA Safety.

IATA Safety is endeavouring to develop a paper entitled "A CEO's Responsibility For Safety" a copy of which is included on the accompanying CD-ROM. The paper is in the form of a script for eventual presentation to CEOs by the IATA Senior Executives. Airline safety executives and other interested parties are invited to contribute their views on this important Safety Strategy 2000 initiative.

It is recommended that:

19. *Airlines review and comment on the IATA paper included on the Safety Report 2001 CD-ROM concerning "A CEO's Responsibility For Safety."*

Ground Servicing

Of the 104 accidents (Eastern and Western Built, Jet and Turboprop) there were 35 in which technical failure played a part. The most common form of technical occurrence was gear and tire failure (T3) which contributed to 11 of the 104 accidents. In 10 of these accidents the undercarriage failed outright. Unfortunately the CWG does not have sufficient detail to establish any further trends at component level but it is clear looking back over a number of years that landing gear failures persistently dominate the accident statistics.

In focussing on this concern, however, the CWG noted that the Company Maintenance, Servicing, including Human Error (T7) Classification contributed to 10 accidents, 3 of which were gear and tire failure (T3) events. A fruitful area of accident prevention, not just with regard to landing gear failures but across the Maintenance and Engineering spectrum as a whole, undoubtedly lies in the area of human factors. It is generally accepted in the industry that Human Factors programmes in maintenance are less developed than those initiatives in Flight Operations. Therefore, the CWG and the HFWG advocate that such programmes developed to respond to Human Factors concerns in the Flight Operations arena should next be modified for application to Maintenance. **A good beginning would be for Companies to adopt the principles set out in the Guide for Human Factors in Maintenance published by the FAA. Refer to Web-links of the CD-ROM for more information.**

Maintenance Personnel

The CWG feels that the current climate in the aviation industry is one that will create significant difficulties in the engineering domain not just for airlines but also for third party maintenance organisations. The exodus of qualified maintenance personnel has the potential to pose significant difficulties for the industry when the upturn comes. Past experience indicates that a majority of those maintenance personnel leaving the industry seldom return, leaving a skill and experience deficit.

Life Limited Components

Additionally, the CWG wishes to draw attention to the importance of maintaining proper records on life limited components which may be recycled into technical organisations from aircraft which have been "parked". This has the potential to assume similar proportions to the bogus parts problem which has periodically plagued the industry.

Safety and Quality Oversight of Maintenance

The CWG notes the strong evidence amongst the accidents and incidents which shows that airlines are not exercising adequate oversight of maintenance contractors quality and therefore safety standards. Airline Operational and Engineering Executives are encouraged to ensure that they regularly review the key safety indicators they have set for their maintenance contractors. One effective way of achieving safety performance monitoring is to ensure that the Airline Safety Committee includes the operational executive of the maintenance contractor and other engineering service providers. The customer airline should also be adequately resourced to deploy periodically its own quality and safety people to their maintenance contractor for independent investigations and audits.

A particular area of concern revealed by a search of the IATA STEADES database is aircraft refuelling. Refuelling errors add pressure and complexity to the flight crew task during the turnaround. Poorly designed or maintained refuellng equipment does the same for ramp handling crews. The practice of refuelling with passengers on board requires careful control and oversight as does the running of aircraft fuel pumps with an unattended flight deck. Quality Assurance audits should ensure that comprehensive refueling procedures are in place and that they are adhered to when handling personnel are working under the pressure of time and in poor weather.

Ground Support

The CWG is concerned that Ramp safety failures continue to feature in aircraft accident statistics and represent a serious threat to aviation safety. Amongst the Western Built Jet Fleet in 2001 there were 5 accidents which involved ground damage. This topic was addressed in the 2000 Safety Report with the associated recommendations remaining applicable for 2001. A particular area of concern is the damage to aircraft caused by ground servicing vehicles. The greatly increased use of composite materials in aircraft manufacture brings with it a rather different set of damage detection difficulties thus increasing the need for operators to ensure that all ground damage is reported and properly assessed prior to flight. The need to establish and preserve an effective safety reporting culture is not only applicable amongst ground handling personnel but also in other ground support areas such as cargo loading and catering.

All of the 2001 events where the aircraft sustained ground damage were coded E6 which deals with the procedures and training of ground support personnel. Emphasis should therefore be placed on competency and skill levels. Whilst flight crew training and standards are mostly well developed, many airside ground handling personnel do not have the same understanding, for example, of airworthiness and operational standards which must be adhered to in order to achieve a safe operation. Turnover of ramp personnel is high, supervision often falls to the inexperienced, all amidst the ever present pressure of on-time performance. A better balance of the task and resources, consisting of properly trained personnel, would not only pay dividends in accident prevention but also in cost saving. In 2001 accidents and incidents on the ramp cost the industry about US$770M. The concerns raised about Ground Support and advice offered in the 2000 Safety Report are equally relevant to the 2001 Safety Report. **Refer to IATA Safety Report 2000 — Safety Oversight of Airline Service Providers on the Ramp.** IATA must continue to develop a template, which can form part of Service Level agreements, for safety performance monitoring of airline Service Providers, both Ground Handling and Maintenance.

4.3 REVIEW OF INCIDENTS

One of the recommendations appearing in the year 2000 Safety Report was for IATA to investigate the capture of serious incident data for analysis in the Report. IATA Safety has since taken great strides in developing STEADES project and now has a database of some 200,000 records. Much effort has gone into improving the database descriptors for Safety Information Exchange purposes and the fruits of this work will shortly be available to IATA. Meanwhile, it has been possible to use an earlier classification system to conduct basic analysis of the incident data held in the STEADES database. The approach taken has been to search the database for incidents below the accidents reviewed by the CWG during 2001, primarily with regard to tailstrikes and fuel management. Additionally, in view of the CWG concern about the high number of TCAS events appearing in their own safety databases, an analysis has been carried out by IATA to also provide a glimpse of the sort of analysis that will be possible using STEADES. However, to begin this review of 2001 air safety incidents the Report will address what is perceived by ICAO as one of two emerging threats to aviation safety, namely Runway incursions (the other being Security).

4.3.1 RUNWAY INCURSIONS

The CWG noted the continuing risk associated with runway incursions mentioned in last year's report. Although, according to the FAA statistics, the number of aircraft mistakenly entering runways declined last year, even with this decline there was more than one runway incursion a day in 2001. The FAA has reported 381 runway incursions compared with 431 in 2000. The recent fatal accidents in Europe confirm the necessity to urgently progress this issue and viewed globally, as highlighted by ICAO, the number of serious incidents is increasing.

The CWG feel that the reporting culture and safety awareness evident in the US under the FAA National Blueprint for Runway Safety and more recently the European Runway Safety Survey launched by EUROCONTROL needs to propagate internationally. Currently, the collection of reports at airports is sporadic and lacks effective follow-up and intervention. The Commercial Aviation Safety Team (CAST) and Joint Safety Strategy Initiative (JSSI) commitments to intervention are applauded but very serious incidents continue to occur. It is crucial to appreciate in detail the factors which underlie runway safety before proposing recommendations for improvement.

Some of those incidents have been set out in an **ALPA paper entitled "At the breaking point". A copy of this paper is included in the Supporting Documents on the CD ROM.** The CWG naturally supports the primary ALPA view in this regard that the most important safety feature on the flight deck is a well trained pilot. Runway Incursion Training should be incorporated into flight crew qualification, approved training, and other pilot training programmes. This training will increase the pilot's ability to recognise and avoid situations leading to runway incursions. The CWG also supports the data-driven, consensus based process adopted by CAST to identify the required organisational and technological solutions. Runway incursions occur primarily due to inadvertent mistakes made by pilots and Air Traffic Controllers. Technological efforts to improve pilot to controller situational awareness are a key factor in reducing the incident rate. The CWG feel that Regulators and airport/aircraft operators should be ready to invest in technology which reverses the rising global trend in runway incursions and near misses on airport surfaces. IATA should use its influence to improve the reporting of runway incursion incidents by ensuring that the STEADES programme implementation maintains a particular focus on this area to assist with the data-driven approach being adopted by EUROCONTROL, CAST and the FAA.

It is recommended that:

20. *Airlines incorporate Runway Incursion Training into flight crew qualification, approved training, and other pilot training programmes. This training should focus on enhancing the ability of flight crew to recognise and avoid situations contributing to runway incursions.*
21. *IATA seek to improve the reporting of runway incursion incidents by ensuring that the STEADES programme implementation maintains a particular focus on this area to support the data-driven approach being adopted by EUROCONTROL, CAST and the FAA.*

4.3.2 TAIL STRIKES

There were 5 Jet and 1 Turboprop tail strike accidents in 2001. The CWG were aware that the A321 and the Boeing 757-300 fleets, aircraft of similar proportional length increases from the generic types (A320 and B757-200), had each experienced a number of tail strikes. A review of the STEADES database covering the period April 2000 to September 2001 revealed 18 incidents as shown in Figure 4.3.A.

Figure 4.3.A

Tail Strike Incidents (Ref. from STEADES)

Phase of Flight	Circumstances
Landing	Not known
Landing	Nose high attitude on touchdown
Landing	Nose pitched up on firm landing in 90° crosswind
Landing	Touchdown in tailwind condition
Landing	Inexperienced F/O, speed drop at 50 ft.
Landing	Speed drop at 50 ft.
Take-off	Not known
Landing	Not known
Landing	Pilot reported down-draught at touchdown and subsequent bounce. Tail strike at first touchdown.
Landing	Abandoned go-around and continued landing, nose high attitude
Not Known	Not known
Take-off	Over-rotation in gusty wind conditions
Landing	Following late side-step to parallel runway, crew exceeded 11° attitude on touchdown
Not Known	Damage discovered during turn-round
Landing	Not known
Not Known	Not Known
Take-off	Nose high attitude on take-off
Landing	Inexperienced F/O

Analysis

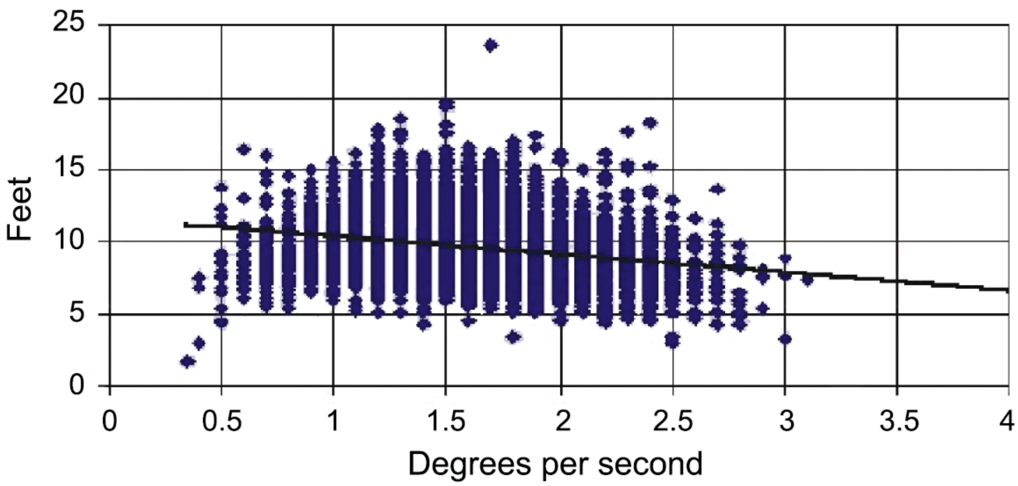
The data shows that the majority (12 — 66.7%) of tail strikes during the period under review occurred in the landing phase of flight, while only 3 (16.7%) occurred during take-off. Three incidents were unable to be categorised by phase of flight as they were discovered during turn-rounds, and no crew report was made. One third of tail strikes reported during the period under review involved the B727 aircraft type. Two incidents involved inexperienced handling pilots. Several tail strike incidents were not felt by the flight crew, but were reported by cabin attendants, ATC or other aircraft. One event occurred when a crew was distracted by a late clearing aircraft and abandoned a go-around in favour of continuing the landing. One event occurred following a late runway switch to a parallel runway, resulting in the crew allowing an excessive pitch attitude to develop.

Conclusion

The small data sample (18 events, from 40 operators) does not facilitate meaningful trend analysis. There are no significant trends to tail strikes other than the majority (two-thirds) occurred on landing, and one third of the events involved a single aircraft type. There is no obvious reason for the predominance of this type, as others have a normal landing pitch attitude that is higher than this type. The incidents involving crew inexperience, tail wind landing conditions and late changes to a planned course of action illustrate the importance of extra vigilance and concentration required at critical stages of flight. Several incidents were not felt by the flight crew, but were reported by other observers, indicating that the strikes were very light. These incidents highlight the need for crews to monitor pitch angles on touchdown accurately. Flight Data Monitoring is regarded by the CWG as being vital for assisting with the prevention of Tail Strike accidents. Figure 4.3.B, showing tail clearance against rotation rate, indicates the type of information that may be obtained from a Flight Data Monitoring programme for use in flight crew training. Similar information for the landing scenario may also be obtained.

Figure 4.3.B

Tail Clearance against Rotation Rate



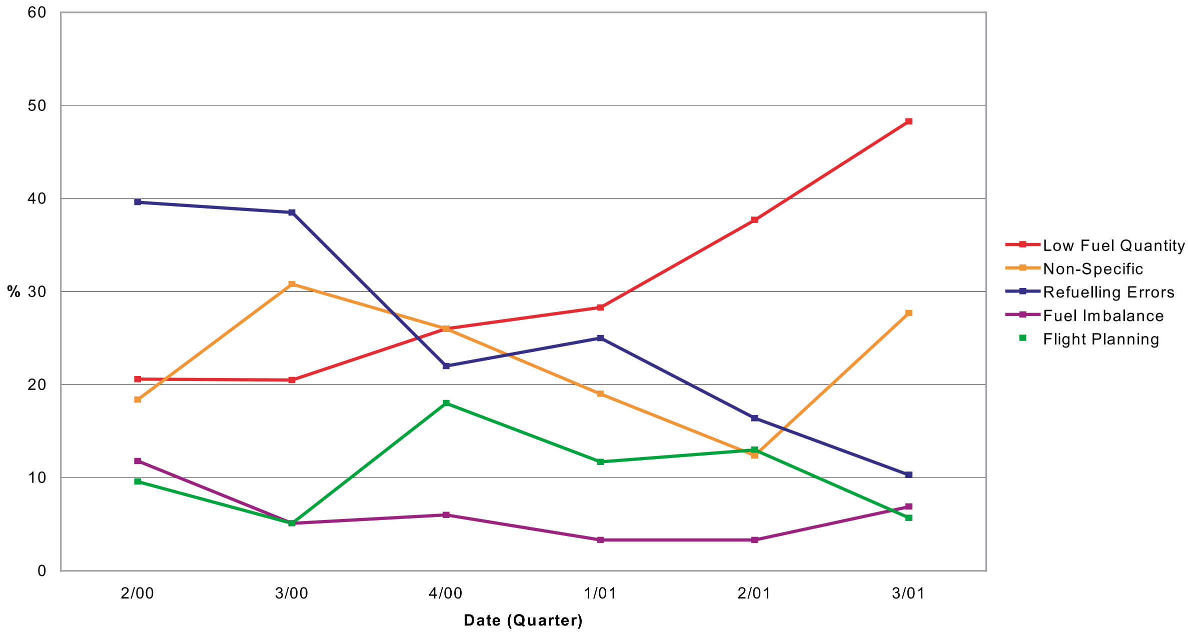
4.3.3 FUEL MANAGEMENT

Review of Incidents

There were 2 Jet and 2 Turboprop events related to Fuel Management. Amongst these there were 3 cases of fuel exhaustion and evidence that flight crew treated the event as a an unreliable fuel indication rather than a fuel leak. The CWG saw these events as a matter for fuel management training and a lack of system knowledge in the flight crew concerned. The STEADES database was again interrogated to establish whether there were any significant trends in the fuel management area. Some 550 reports were reviewed for the period April 2000 to September 2001. The results of this study are shown at Figure 4.3.C.

Figure 4.3.C

Fuel Events — April 2000 — September 2001



Analysis

The events were initially analysed to extract event types, looking particularly for fuel management related events. Event types are analysed in order of majority occurrences.

Refuelling Errors. Refuelling Errors accounted for 28.9% of the reported events. The category includes errors by refuelling operators, and fuel-related flight dispatch and loadsheet errors. The overall trend over the period under review has decreased from a high of nearly 40% of reports to approximately 10% of reports submitted during each quarter.

Low Fuel Quantity. Low Fuel Quantity accounted for 27.6% of the total events. Initial inspection of the low fuel quantity events revealed, through location or summary text, that the overwhelming majority of these events occurred in the U.S.A. The minority, which would have skewed the results, were extracted and form part of the 'non-specific' category. The majority of the remaining USA events were caused by excessive en-route weather deviations and/or destination weather precluding holding, and thus diversions. The Low Fuel Quantity (USA) event category shows a disturbing progressive upward trend over the analysis period. This includes one serious incident in which a flight diverted for low fuel state caused by weather and insufficient holding fuel, but then had to divert for fuel again because of ATC delays caused by the earlier weather problems.

Non-Specific Events. This category accounted for 26.6% of reported events, and comprises random events that, if taken as individual categories, would produce insignificant trends. The category includes events such as fuel spills during refuelling operations, non-US diversions caused by low fuel quantity (usually as a result of balked landing go-arounds) and other non-safety related fuel incidents. This category has shown no major trend during the period under review, averaging 22.4% of reported events, although there does appear to be an increase in fuel events during the July/August/September quarter of both years.

Flight Planning. Flight planning fuel errors accounted for 10% of reported events, showing no appreciable trends during the review period. The category does not include low fuel quantity events attributable to en-route/terminal weather conditions, but comprises mainly errors in the computation of routes (i.e. inadequate distance allowances or unavailable routings) and incorrect aircraft performance calculations at the planning stage (e.g. use of incorrect performance degradation factors).

Fuel Imbalance. This category comprises 6.9% of reported fuel-related events, and again shows no major trend over the review period. The majority of events were reports of fuel imbalances that developed in-flight and were adequately handled by crew action. Errors caused by incorrect refuelling procedures, discovered by crews before departure, have been included in the refuelling errors event category.

Conclusions

During the period under review, there are two discernible trends. Firstly, Refuelling errors have shown a marked decrease over the period, particularly during the last year. It is to be hoped that this success story is a result of more vigilance and supervision. Secondly, incidence of **Low Fuel Quantity (USA) has shown a disturbing increase** during the period under review. As most of these occurrences were related to either en-route weather deviations and/or destination weather conditions causing diversions, contributory factors may well be a combination of inadequate consideration of route weather, FAR domestic fuel reserve policies and commercial dispatch pressures. The commercial impact of diversions, both from the financial and convenience aspects, does not hold up against the relatively small cost of the carriage of extra holding fuel for adverse weather conditions. It should be noted that the relatively few international low-fuel quantity events were rarely caused by weather conditions.

The level of Flight Planning-related events, at 10.0% of fuel events shows a surprisingly high percentage of the total events, although the physical numbers only account for 3 events per month throughout the period. There is, however, evidence in the incident data to suggest that **more attention should be paid to flight planning accuracy.**

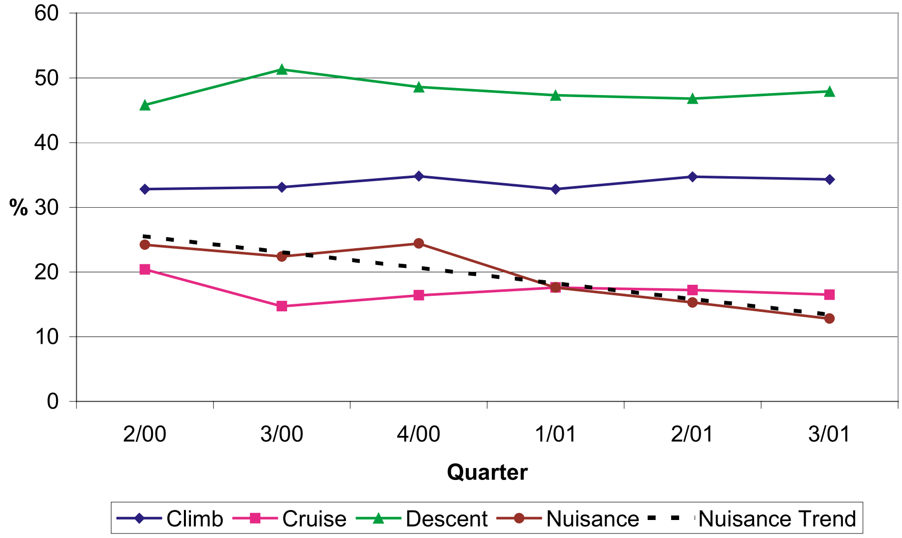
4.3.4 INCIDENTS RELATING TO AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS/TCAS)

The CWG was concerned that ATC events, particularly those involving TCAS encounters, ranked so highly in their respective safety databases. Although there had also been some serious airprox incidents during 2001, thankfully there had been no mid-air collisions. However, in view of the CWG's concern STEADES was used for the first time to analyse TCAS incidents occurring over the period April 2000 to September 2001. Some 3727 Air safety Reports concerning TCAS events involving 40 airlines were found. The value of STEADES was immediately apparent from the data which was grouped quarterly. Report samples ranged from around 900 (Q2/2000 & Q3/2000) to around 480 (Q2/2001 & Q3/2001).

The report was generated showing percentage of reports by generic Flight Phase (Climb, Cruise and Descent), plus the category of "nuisance" events (events which were filed under this category). The results of this study are shown at Figure 4.3.D.

Figure 4.3.D

TCAS Events From STEADES — April 2000 — September 2001



It can be seen that over the period the percentages of Climb, Cruise and Descent events remained relatively static, while the percentage of nuisance events dropped from an average of 23.7% over the period April — December 2000 to 12.8% by September 2001, which was broadly in line with the reduction in reported events over the period. It can be seen that from the 4th quarter 2000 onwards there has been a gradual reduction in the number of TCAS events reports submitted, and a corresponding reduction in the number of "nuisance" events reported.

TCAS Version 7 software became available for general retrofit during the last quarter of 2000. The improved software was intended "to yield at least a 20 percent reduction in Resolution Advisories (RA's) over the previous version", and in radar data simulations for the European environment "resulted in a 40 percent reduction in unnecessary RA's". The results shown indicate that the manufacturers' claims for TCAS 7 have indeed come to fruition, and serve as an incentive to all operators to upgrade to this version.

Military Interception Procedures — TCAS RA Manoeuvres

Since September 11, 2001 much greater use has been made of the U.S. National Airspace System Intercept Procedures. Early experience indicated that these procedures needed correction and refinement in order to avoid any possible misinterpretation of avoidance manoeuvres, carried out by the Pilot-in-Command of the intercepted aircraft, in response to an Airborne Collision Avoidance System (ACAS/TCAS) Resolution Advisory. As a result of IATA inputs, necessary improvements were secured not only to the U.S. procedures, but also to the International Interception Procedures, with the support of ICAO. All Pilots should refresh their knowledge of these revised procedures, particularly those relevant to a total radio communications failure.

4.4 SAFETY AND SECURITY

The tragic events of September 11, 2001 have left indelible images in all of our minds. Their impact upon the aviation industry, related industries, the world economy and society as a whole are such that some of the consequences must be mentioned in this IATA Safety Report. In the eyes of the Public, the Media and Politicians, Safety and Security have now become indistinguishable.

The aviation industry applies risk management techniques in order to deliver and sustain safe operations. Risks will increase, if safety vigilance is relaxed for more than a short period. Accidents and incidents have a tendency to occur when least expected and certainly cannot be easily predicted. So it becomes only a matter of time before that increased risk exposure results in the next accident or incident.

There is no doubt that the industry preoccupation with Security, the restoration of passenger confidence and airline survival is now taking precedence over Safety. However, accidents and incidents continue to occur. Therefore it is imperative that we resist the natural temptation to diminish our safety vigilance, whilst addressing these other pressing priorities. Nor should we expand security resources at the expense of safety resources. Both IATA, including the SAC and CWG, and the Flight Safety Foundation are concerned that fundamental and established safety processes are not sacrificed due to short-term imperatives. The ultimate challenge for the aviation industry is to maintain, let alone improve, safety in these financially troubled times, aggravated by low employee morale. To this end, the following comments are offered as guidance material and food for further thought.

- Senior Managers, throughout the aviation industry, must maintain and display courage and leadership as Safety advocates. It must not be assumed that we are safe enough. Emotion should be managed with facts, reason and sound logic. Remember that the safety priorities from before September 11, 2001 are still present.
- Recognise that aviation is at greater risk, in present circumstances and therefore needs extra vigilance. The aviation industry has a responsibility to the Public to at least maintain and strive to improve upon current safety levels, regardless of other distractions.
- Safety is an investment in current and future prosperity for the aviation industry. Safety activities should not be seen as just another discretionary cost. Safety generates long-term efficiencies and will enhance public confidence.
- Present circumstances will magnify the impact of any accident upon the aviation industry. Experience shows that austere times generate additional risks. Any significant change in process also increases risk. Therefore the industry cannot afford to defer, delay or stop Safety Management Processes at such times.
- Established Safety, Quality, and Risk Management principles and practices should be applied to Security. However, this objective will not be achieved easily. Changing an established security culture, attitudes and behaviours will need a concerted effort and take time before a new and more effective culture becomes established.
- The present operating environment places new responsibilities upon airline Managements and Governments to deliver and sustain safe and secure operations. Safety is the Operator’s responsibility. Security is a Government responsibility. The security threat to airlines is but one of many means whereby States may be threatened. Security is of equal interest to the non-flying population as it is to passengers and crewmembers. Governments, not airlines, should therefore shoulder the responsibility for funding the provision of aviation security. Comprehensive and harmonised Security Standards for civil operations, which meet or exceed ICAO requirements, must be implemented world-wide.

The IATA Mission is to “Serve and Represent our Members’ Interests”, with Safety and Security as top corporate priorities. The Safety Strategy 2000+ Goal is to “Lead the global airline efforts to achieve a continuous improvement in safety”. In accordance with this Mission and Goal, IATA established the Global Aviation Security Action Group (GASAG), to co-ordinate the global aviation industry’s inputs in order to achieve an effective world-wide security system and to ensure public confidence in civil aviation. **The GASAG developed Positions on a variety of security topics have now been adopted as IATA Positions and are shown at Annex 1 to this Safety Report.** It should be noted that these positions are being continually updated by ongoing industry activity. The latest version may be obtained on request to the IATA Safety or Security Departments. The topics currently appearing in the GASAG paper are as follows:

General

- Responsibility for Aviation Security and its Funding
- Harmonization of Aviation Security Standards

Airport/Baseline Secuirty

- Ground Security
- Enhanced access Control to Airport Restricted areas
- Background Checks for Persons Having Unescorted Access to Airport Restricted Areas
- New Technologies, including biometrics
- Passenger and Baggage Security Controls
- Cargo, Courier, Express Parcels and Mail Security Controls
- Passenger Risk assessment

Aircraft Security & Flight Procedures

- In-Flight Security Personnel (Sky Marshals)
- Transponders
- Cockpit access
- Enhanced Flight Deck Security Options
- Installation of Cameras to Monitor Passengers
- Crew Procedures/Training
- Weaponry Training
- Protective Devices for Use by the Crew
- Firearms and Other Weapons
- Security Risks Associated with Cabin and Safety Equipment
- Defensive Flight Manoeuvres and Depressurisation
- Need for Government Legislation to Deal with Unruly Passengers
- Transportation of Deportees and Inadmissible Passengers
- Improved Air/Ground Communications
- Security Prohibited Items
- Management of Response to Acts of Unlawful Interference

Many of the proposed security initiatives are naturally reactive solutions to a very complex problem. The threats and associated countermeasures outlined in the GASAG paper are changes that need to be implemented with broader aviation system implications in mind. This does not take away the need for enhanced security measures at a time when passenger confidence needs to be re-established throughout the aviation industry. However, the IATA Human Factors Working Group have identified a list of human performance threats, as a result of the proposed security changes, and examples of countermeasures currently being used by member airlines to mitigate these threats. **The threats and countermeasure identified by the HFWG are set out in a paper included at Annex 2 of this Safety Report.** It is hoped that this information may help operators better manage the risks associated with these changes.

Airlines should note and support IATA's initiative to set comprehensive and harmonised aviation security standards through the Global Aviation Security Action Group (GASAG)

It is recommended that:

22. *Airlines note and support IATA's initiative to set comprehensive and harmonised aviation security standards through the Global Aviation Security Action Group (GASAG).*

4.5 CONCLUSIONS

The overall safety gains made by the aviation industry in 2001 cannot be divorced from the events that took place on 11 September 2001, which claimed the lives of so many people aboard those aircraft and many more on the ground. These events, of course, were no accident and at such a time accident statistics seem to be irrelevant. Yet behind this horrific event there is a safety performance from which the industry can take some satisfaction. Measured in terms of the IATA Safety Report metrics, which are widely recognised to be the most authoritative and relevant, 2001 delivered an improvement in aviation safety for Western Built Jet and Turboprop HL and SD loss rates. Indeed, **the reduction in the number of fatal accidents (Operational HLs and SD, Jet and Turboprop) and the associated halving of the number of people who lost their lives** are statistics in which the industry can take some comfort. However, there was a 21% increase in the number of Approach and Landing accidents in the Western Built Jet Fleet compared with 2000.

When surveying this modest improvement in the accident statistics, it is important to understand that the industry already has a good safety record and low rate of accidents. The task of reducing this rate still further is mainly concerned with the reduction of inherent risk in the system. Such risk management demands great effort and enterprise and IATA is determined to play its part in bringing about these improvements. Safety Strategy 2000+ marked the beginning of a range of new safety initiatives, which have led to the formation of a safety management system embracing the airlines of IATA. The Safety Report has described these developments and looked over the horizon at initiatives that have the potential to make a further significant contribution to accident prevention.

Whilst 2001 had a better than average safety performance, there is still room for further improvement, most markedly in the area of Approach and Landing — particularly undershoot — accidents involving Western Jet fleets. The Hull Loss rate in Africa continues to be a serious concern. This Safety Report has also raised other concerns focusing on flight crew judgement, decision making and leadership, technical knowledge and system understanding, recency and fatigue, and commercial pressure. It has also identified particular safety threats at Airports in the ATC and ramp arena. The report has concluded with an analysis of Serious Incidents with early use of IATA STEADES to assess Tail Strikes and Fuel Management. Safety Report 2001 concludes with an important reminder to maintain vigilance in safety while tackling the new security imperatives arising from 11 September 2001.The recommendations made in the next section of the Safety Report reflect the areas of concern arising from this analysis by the IATA CWG of the accidents and incidents of 2001.

Figure 4.4.A
Safe Flying

Photograph by Samuel Lo

CHAPTER 5 — RECOMMENDATIONS

Recommendations provided in previous IATA Safety Reports must often be reiterated, especially since much of the readership may be new to the airline industry. Additionally, experienced airline managers, flight and ground personnel will often benefit from revisiting the recommendations made in this and previous IATA Safety Reports. It is therefore recommended that reference is made to the Supporting Documents Section of enclosed CD-ROM.

For the year 2001 it is recommended that:

1. *In view of the clear message coming from this year's safety report that the Approach and Landing Phases of flight present the highest risk — particularly in relation to undershoot accidents — airlines are urged to incorporate the Flight Safety Foundation ALAR Tool Kit in their training programmes.*
2. *Both Airbus and Boeing are expected to distribute training videos in 2002 covering various aspects of landing technique. Operators should obtain and incorporate this training material to improve crew proficiency.*
3. *Airlines optimise their FDM systems to focus more closely on undershoot tendency, low level go-arounds and landing long. Animator analysis tools should be used to assist with timely counselling of flight crew.*
4. *Through its Flight Simulator WG IATA establish a means of sharing airline FDR data with the simulator manufacturers to allow development of more realistic environmental models for landing phase training.*
5. *IATA design the STEADES services web site, planned for March 2003, to include a collection of de-identified animated flight data readouts of accidents and serious incidents for flying training purposes.*
6. *In their recurrent training sessions, airlines focus on the Go-around decision at a low height, assisted by the pilot survey included on the CD-ROM enclosed with this report.*
7. *Operators adopt a retribution free Go-around policy.*
8. *Aircraft manufacturers conduct research to assess whether current technical/systems training of flight crews is matched appropriately to the level of understanding required by crews for effective systems management during Non-normal procedures.*
9. *In the particular area of fuel management procedures aircraft Manufacturers should ensure that checklists enable flight crews to confirm whether their aircraft is leaking fuel.*
10. *IATA Human Factors Working Group (HFWG) examine the examples of "design traps" cited in the Safety Report, e.g. mis-setting of stabiliser trim, and make recommendations to the Manufacturers.*
11. *IATA SAC forms a task force, with ICAO and IATA Management participation to investigate the impact on safety of environmental pressures on flight path and runway choices and develop recommendations.*
12. *Airlines ensure that training in judgement, decision making and leadership commence at the earliest possible point in flying training and be continuously developed. Scenarios such as bounce recovery, tailstrike, low level go-arounds and windshear/crosswind situations should be included.*
13. *Pressure to achieve superior proficiency in English Use by Air Traffic Control personnel and flight crew at International Airports be maintained by IATA and the Industry.*
14. *As part of the drive towards ICAO standard phraseology, the benefits of two levels of priority, PAN and Mayday, should be reinforced by ICAO.*
15. *IATA work with ICAO to achieve timely and appropriate NOTAMS of Airport Work in Progress, supported by other forms of effective airfield communications, movement monitoring and observance of Standards for ground markings.*
16. *System Manufacturers, ATC authorities and ICAO together should enhance procedures for communicating the testing and maintenance of Instrument Landing Systems. Aircraft characteristics and crew procedures should also be reviewed by the Manufacturers.*

17. *Local knowledge of wind shear and other operationally orientated information about destination airports be shared through IATA SWAP or STEADES.*
18. *IATA maintain emphasis on the promotion of just, non-punitive, air and ground safety reporting and investigation systems, with deeper involvement of the aircraft manufacturers and wider circulation of de-identified investigation reports. IATA encourages the use of corporate-wide Non-Punitive Incident reporting policies and investigation techniques such as Maintenance Error Decision Aid (MEDA), the Procedural Event Analysis Tool (PEAT) and other error detection and prevention tools.*
19. *Airlines review and comment on the IATA paper included on the Safety Report 2001 CD-ROM concerning "A CEO's Responsibility For Safety."*
20. *Airlines incorporate Runway Incursion Training into flight crew qualification, approved training, and other pilot training programmes. This training should focus on enhancing the ability of flight crew to recognise and avoid situations contributing to runway incursions.*
21. *IATA seek to improve the reporting of runway incursion incidents by ensuring that the STEADES programme implementation maintains a particular focus on this area to support the data-driven approach being adopted by EUROCONTROL, CAST and the FAA.*
22. *Airlines note and support IATA's initiative to set comprehensive and harmonised aviation security standards through the Global Aviation Security Action Group (GASAG).*

ANNEX 1 — GLOBAL AVIATION SECURITY ACTION GROUP (GASAG) — INDUSTRY POSITIONS ON SECURITY ISSUES (Issue #5, 25 January 2002)

The Global Aviation Security Action Group (GASAG) is an industry group established to co-ordinate the global aviation industry's inputs to achieve an effective world-wide security system and ensure public confidence in civil aviation. Its members are IATA, Airline Regional Associations, International Air Carriers Association (IACA), Airports Council International (ACI), the International Federation of Airline Pilots Associations (IFALPA) and Airbus, with Boeing, the International Civil Aviation Organisation (ICAO) and INTERPOL participating and providing input as observers.

GENERAL

Responsibility for Aviation Security and its Funding

GASAG believes that governments have direct responsibility for aviation security and its funding. This responsibility includes the protection of its citizens (in the air and on the ground) as the security threat against airlines is a manifestation of the threat against the State, the provision and cost of aviation security should be borne by the State from general revenues and not from taxes and user fees.

Harmonization of Aviation Security Standards

GASAG believes that there is a need for States to work together in a co-operative manner, with input from the industry, to ensure the harmonized implementation of globally recognized standards based on ICAO Annex 17 — Security.

AIRPORT/BASELINE SECURITY

Ground Security

GASAG supports development of effective, efficient and operationally manageable ground security measures which meet or exceed the provisions of ICAO Annex 17.

Enhanced Access Control to Airport Restricted Areas

GASAG supports the establishment and effective maintenance of a restricted zone at the airport including the development of effective, economical, enhanced perimeter security and access control systems that combine identification media with personal information.

Background Checks for Persons Having Unescorted Access to Airport Restricted Areas

GASAG supports increasing the stringency of background checks and recurring checks on existing employees, in accordance with national legislation, undertaken on persons seeking unescorted access to airport restricted areas. GASAG believes that governments must be responsible for undertaking and funding such checks.

New Technologies

GASAG believes that governments and industry should jointly consider the role of technology including biometrics to address the new security threats to civil aviation.

Passenger and Baggage Security Controls

GASAG supports the development of long term solutions to screen and reconcile passengers and their checked baggage through effective application of new technology and procedures, which do not impede the flow of traffic.

GASAG believes that governments must urgently combine resources in a co-operative manner to share information and research and development costs for explosive detection technology and other technologies to enhance the current systems of screening passengers and baggage.

GASAG believes that in the short term, airports, airlines and regulatory authorities should jointly develop measures that would improve the flow of passengers and their hand baggage through security checkpoints.

Cargo, Courier, Express Parcels and Mail Security Controls

GASAG believes that governments must urgently combine resources in a co-operative manner to share information and research and develop harmonized measures to ensure the safe and secure carriage of cargo, courier, express parcels and mail world-wide without impeding the flow of traffic.

Passenger Risk Assessment

GASAG supports:

- Carefully defined individual passenger assessments, based on internationally accepted standards as incorporated into national legislation, as an element of risk analysis, to facilitate the identification of individuals who may pose a threat to safety and security of civil aviation.
- The development of programs designed to facilitate the transit of passengers who, through appropriate risk assessment, are deemed to pose no risk to safety and security.
- The exchange of relevant information between appropriate organizations to assist in performing passenger risk assessment.

AIRCRAFT SECURITY & FLIGHT PROCEDURES

In-flight Security Personnel (Sky Marshals)

GASAG believes that acts of unlawful interference should be prevented on the ground. However, where the State mandates the use of armed in-flight security personnel, they should be provided by the State which must have responsibility for funding, selection, training and tasking of such personnel. The selection, qualifications, training and control of in-flight security personnel must be of the highest standard.

Transponders

GASAG is in support of any measures which serve to enhance the identification and tracking of aircraft in the event of unlawful interference

Cockpit Access

GASAG recommends that the cockpit door should be locked at all times as far as practicable. Whenever the door is locked proper communication procedures between the cockpit and the cabin must be established.

Enhanced Flight Deck Security Options

GASAG supports the research and development of an advanced cockpit door technology capable of securing the flight crew against attack.

Installation of Cameras to Monitor Passengers

GASAG, in the longer term, recommends, taking into account all practical problems, the installation of cameras to monitor the entrance to the cockpit and passengers from the flight deck.

Crew Procedures/Training

GASAG considers that there is an urgent need for a comprehensive review, by government and industry, of policies, procedures and training including non-lethal self-defence training, to address any on board disturbance especially in regard to the new threat of using an aircraft as a weapon.

Weaponry Training

GASAG opposes arming flight crews and flight attendants with lethal weapons or requiring them to undergo training in the use of lethal force.

Protective Devices for Use by the Crew

GASAG believes that the potential measure of having non-lethal protective devices in the cabin area for use in emergencies (e.g. pepper spray, restraint devices, etc.) should be further assessed in close consultation with the crew representatives.

Firearms and Other Weapons

GASAG is opposed to the carriage of ammunition, firearms and other weapons in aircraft, except as authorised.

Security Risks Associated with Cabin and Safety Equipment

GASAG feels that there is an urgent need for a review of items from the cabin and safety equipment in the aircraft with regard to their potential security risk. These items include:

- all items which are in the cabin for passenger service reasons;
- all items which are brought into the cabin by both passengers and crew (in particular sharp-pointed items) including items sold in the tax-free shops of the secure area of airports; and
- certain safety equipment in the aircraft (e.g. crash axe)

Defensive Flight Manoeuvres and Depressurisation

GASAG supports research into the trained use of defensive flight manoeuvres only as a means of last resort to prevent the use of an aircraft as a weapon.

Need for Government Legislation to Deal with Unruly Passengers

GASAG urges governments to establish internationally co-ordinated legislation enabling the arrest and prosecution of unruly passengers as outlined in IATA’s submission to the ICAO AVSEC Panel in 2000 and in accordance with the work of the ICAO Study Group on Unruly Passengers.

Transportation of Deportees and Inadmissible Passengers

GASAG urges that in order to further minimize risks, governments must recognize their responsibility in co-ordinating their policies and regulations regarding deportees and inadmissibles transported on commercial airlines.

Improved Air/Ground Communications

GASAG believes that new means of improved air/ground communications, possibly including a secure transponder, need to be further studied.

Security Prohibited Items

GASAG supports the development and implementation by appropriate parties of a standard list of items prohibited for carriage on board the aircraft.

Management of Response To Acts of Unlawful Interference

GASAG supports the strict implementation of ICAO Annex 17 Standards which require the appropriate authority to make every effort to prevent a hijacked aircraft from departing an airport unless the safety of the passengers or crew is at risk.

ANNEX 2 — A WORD OF CAUTION FROM THE IATA HUMAN FACTORS WORKING GROUP (HFWG) ABOUT PROPOSED AVIATION SECURITY INITIATIVES

At the recent IATA Operations Committee (OPC) meeting in Montreal on 2-3 October 2001, the subject of security enhancements dominated the agenda. This discussion came in the wake of the events of September 11, which have had a profound effect on the aviation industry. One of the agreed outcomes of the meeting was the formation of the Global Aviation Security Advisory Group (GASAG), which aims to provide a coordinated industry view towards global harmonisation of security procedures. GASAG have since developed a position paper on security issues, the latest issue # 5 released on 25 January 2002. These security initiatives include aircraft security and flight procedures; namely:

- In-flight security personnel (Sky Marshals),
- Transponders,
- Cockpit access,
- Enhanced flight deck security,
- Installation of cameras to monitor passengers,
- Weaponry training and protective devices for aircrew,
- Defensive flight manoeuvres and depressurisation, and
- Enhanced ground/airport security.

While many of these initiatives may provide enhanced security protection for crew and passengers alike, it is important that the human performance implications of any changes be carefully considered. For example, the aim of Crew Resource Management (CRM) training programs since the mid 1980's has been to encourage flight and cabin crew to work together more effectively. Better aircrew coordination and teamwork has a direct impact on managing risk and reducing error. Restricted access to the cockpit door will undoubtedly alter the dynamics of crew coordination and teamwork, where the two teams are physically separated by both a physical and "mental" barrier.

The IATA Human Factors Working Group have identified a list of human performance threats, as a result of the proposed security changes, and examples of countermeasures currently being used by member airlines to mitigate these threats. It is hoped that this information may help operators better manage the risks associated with these changes.

Threat: *Restricted Cockpit Access.*

Restricted cockpit access will influence inter-crew communication. Communication will have to become more formalised as it is much more difficult to communicate via interphone than face to face. While flight safety occurrences involving sterile cockpit violations and cabin crew induced flight crew distractions are likely to decrease, are we going to see an increase in safety incidents where critical information from the cabin was not passed on to the flight crew? Human nature tends towards the path of least effort. Making inter-crew communication more difficult may result in the filtering of information, that otherwise may normally be exchanged. Restricted cockpit access will ultimately change the nature of CRM training in regard to the need for more formalised coordination and communication procedures. The opportunity to build rapport within a team will be markedly reduced as will informal communication and interaction.

Countermeasure: Many U.S. carriers have had cockpit doors locked in flight for several years. Evidence from these operators suggests that initially locked cockpit doors may have created a barrier to good crew communications but this problem was corrected through targeted training and enhancing crew procedures. Some operators established education programs designed to convince their crews of the importance of the pre-departure crew brief to clearly establish crew expectations and a common mental model. Any changes to communication procedures were reinforced through continual leadership training, annual recurrent courses, Captain Upgrade training or Operational Line Checks. The training emphasised the attributes necessary for solid team building.

Threat: ***Cabin crew may be less aware of when flight crew are busy.***
The increased reliance on the cabin interphone system as a communication device, means that the use of precise standard language to minimise ambiguity is even more important. Previously in many airlines, cabin crew could enter the flight deck and if they saw that the flight crew were busy, could wait before attracting the pilots attention. Because of restricted cockpit access the cabin crew have little insight as to the workload of the flight crew before calling on the interphone. Constant answering of the interphone for mundane matters may ultimately lead to more distractions for flight crew.

Countermeasure: Some operators have installed sterile cockpit lights to remind cabin crew of when flight crew may be engaged in high workload periods. These lights have now become a positive way to remind crews to stay focused and avoid unnecessary distractions during critical phases of flight. Training has also helped crews identify the threat that casual conversation presents during these critical phases of flight and how the “sterile cockpit” strategy is an effective countermeasure.

Threat: ***Non Lethal self defence training for cabin crew.***

Many of the security efforts are focused on protecting the “control room” of the aircraft and not those personnel that operate in the cabin. This places an added responsibility on cabin crew to manage hijack situations. However, cabin crew have not been selected, nor have they been trained, to manage in-flight security problems. In addition, cabin crews will now feel an increased psychological barrier as flight deck doors are strengthened and pilots will no longer come back to assist during cabin disturbances or medical emergencies. Before any significant change in security policies or procedures are introduced, it is important that a systemic analysis, including human performance factors, be conducted. For example, will sky marshals help or hinder cabin crew in their dealings with unruly passenger behaviour?

Countermeasure: Briefing methods need to be developed so that flight crew can help cabin crew overcome the feeling of isolation that they might feel during an in-flight disturbance or medical emergency. Procedures also need to be established to clearly define the role of flight crew and cabin crew in managing in flight security situations.

Threat: ***Restricted communication between flight and cabin crew in the event of in-flight disturbances and medical emergencies.***

The cocooning of flight crew may result in an increased sub-culture division between flight and cabin crew, which may lead to less understanding over time of each other’s roles and less opportunity to communicate effectively.

Countermeasure: Some airlines have provided additional training for crews on being very specific when relaying information. This training has the aim of helping flight and cabin crew better understand the limitations of communication in the absence of non-verbal cues. Other initiatives include training crews how to set up a three way communication link (if possible, using air phones, etc.) during a medical emergency, which will enable the flight deck crew, dispatch/MedLink and the cabin crew/medical personnel to all “stay in the loop.”

Operators should develop training techniques to enable cabin crews to effectively deal with in-flight disturbances using the resources they have in the cabin. Resources may include knowing whom the off duty crewmembers are, being able to identify passengers who are willing and able to assist, proper restraining techniques, etc. This training should also provide cabin crew with increased confidence during these types of situations.

Threat: ***Overreaction by the crew and/or passengers during situations that are not life threatening.***

Countermeasure: Setting up specific levels of passenger disturbances with guidelines for crew behaviour and performance based on expected risk and consequence. Operators need to provide crews with guidance to ensure that minor disturbances (eg, an isolated alcohol incident) are not handled with the same methods designed for more serious events.

Threat: ***The use of "rapid manoeuvres" and "depressurisation" may injure innocent passengers or crew.***

Flight crew may perform aggressive manoeuvres or depressurise the aircraft for an incident that may be only minor and not life threatening.

Countermeasure: Training must be very thorough and specific in this area, as most commercial pilots have not done this type of flying in years, if at all. The limits of the aircraft and the human must be very well defined.

In summary, many of the proposed security initiatives are reactive solutions in their nature to a very complex problem. The threats and associated countermeasures outlined above, are micro-based changes that need to be implemented with broader system implications in mind. This does not take away the need for enhanced security measures, in a time when passenger confidence needs to be re-established throughout the aviation industry. However, the IATA Human Factors Working Group provides a word of caution that the increased dialogue on aviation security issues should not take away or reduce the effort and resources that the industry has traditionally enjoyed in the safety arena. Prior to establishing new security procedures, operators should familiarise themselves thoroughly with the threats and countermeasures outlined above. Finally, contact can be made with other operators who can share the benefits of their experience with previous security changes.

ANNEX 3

INCIDENT REVIEW MEETING SAC/13

The Incident Review Meeting (IRM) was conducted in accordance with the IRM Guidelines.

- A proposed amendment of the IRM Guidelines, concerning the terminology of “Total Loss” vs. “Hull Loss” was referred to the CWG, for consideration.

  Action: CWG

- Following careful consideration, SAC agreed that, following the provision of all available weather and other operational information, the Commander should make the final decision whether or not to operate. However, it was accepted that individual runways, rather than airfields, could be closed for extreme or hazardous conditions. Policy guidance would be developed for the TOPM.

  Action: FOC

SAC identified the following items of general safety concern and desired follow-up actions.

- Campaign for improvements to known deficiencies in airfield markings, in conjunction with national Operators and Associations, for compliance with ICAO Annex 14 requirements.

  Action: IATA/ICAO

- Review pilot training and knowledge regarding the limitations of manoeuvring speed (Va) and the use of rudder. This includes Certification and Manufacturers’ guidance.

  Action: Manufacturers/FOC/FCTWG

- Identify and publish the national variations in Family Assistance Requirements for ERP Procedures

  Action: ERPWG

- Review Non-Normal Check-List presentation and crew use of such procedures and identify necessary improvements

  Action: Manufacturers

- Establish methods whereby current local safety and operational knowledge may be made more accessible to IATA Members and the rest of the aviation industry

  Action: IATA

- Secure greater industry awareness of animal carriage requirements, in accordance with the IATA Live Animal Regulations (2001), published in co-operation with the AATA.

  Action: IATA

- A subsequent review of the IRM identified the need for contributors to confine themselves to presenting factual information and personal opinions, rather than presenting conclusions in advance of the authoritative Accident Report. Better control of time keeping for presentations and discussions was also necessary. The IRM Guidelines would be revised to reflect these objectives.

  Action: IATA

INCIDENT REVIEW MEETING SAC/12

SAC identified the following items of general safety concern and established the desired follow-up actions.

• Fuel Tank explosions	EMC
• PIC decision-making during Final Approach, Flare Landing and Go-Around	FOC/FCTWG
• Runway grooving to improve water drainage and hence braking	ICAO/States
• Better quality reporting of weather and runway conditions to Flight Crew during Take-off and Landing	ICAO/States
• Landing Gear manufacturing quality	EMC
• Situational Awareness for both Flight Crew and ATC	HFWG
• Use of the English language and Standard Phraseology at International airports (Consider concerted industry action and obtain more data)	IATA/Others
• Optimise the training and use of the Terrain Data display, including database updates	Manufacturers
• Improve CRM and crew monitoring	FOC/FCTWG
• Pursue improvement to the legal framework, which inhibits effective prosecution of passengers, who mis-behave (Smoking)	SEC

APPENDIX A — THE ROLE OF THE IATA CLASSIFICATION WORKING GROUP (CWG)

INTRODUCTION

IATA is the only authoritative agency that regularly engages in early analysis of accidents in order to produce a safety review based on subjective evaluations for the classification of accidents. The advantage of this approach is that it achieves a rapid response to emerging or persistent problems However, this benefit is accompanied by three primary disadvantages: analyses are often based on incomplete data; some accidents cannot be assessed at all because of insufficient data; and initial assessments are not updated. Unlike statutory accident investigations, whose object is to isolate probable cause(s), this classification process involves identification of broader, and often more pervasive, contributing factors. Analysis is carried out by the IATA Classification Working Group (CWG) whose role is to:

- Record and analyse accident narratives and safety data on a global basis;
- Reactively and proactively identify hazards and matters of concern;
- Recommend defences against these hazards which serve to avoid, eliminate, and contain the effects of risk; and
- Consolidate these findings into an annual report to the IATA Safety Committee (SAC).

In this regard, it is imperative for the CWG to know details of each event and to assess the extent to which human, technical, environmental, and organisational influences were involved. Relevant information is drawn from many sources (manufacturer's publications, press releases, accident reports, etc). The experience and analytical skills of the CWG members are then applied to reach conclusions as to contributing factor(s) and preventative measures.

GENERAL

The International Air Transport Association (IATA) Safety Report 2001 was prepared by the IATA Classification Working Group comprising the following participants:

Captain Tom Croke	Aer Lingus	Chairman
Captain Doug Stott	Qantas	Vice-Chairman
Captain Deborah Lawrie	KLM	CWG Host
Captain Saad Al-Sheri	Saudi Arabian Airlines	
Captain Thomas Baberg	Lufthansa	
Captain Jurg Schmid	Crossair	
Captain Carlos Nunes	Air Portugal	
Captain Louis Theriault	Air Canada	
Captain Bertrand Courville	Air France	
Mr. Alan Rohl	British Airways	
Mr. Jean Daney	Airbus	
Mr. David Carbaugh	Boeing	
Mr. Jim Donnelly	Bombardier	
Mr. Nuno Aghdassi	Embraer	
Mr. Paul Hayes	Airclaims Ltd.	
Mr. David Mawdsley	IATA Facilitator/Co-Editor	
Ms. Jill Sladen	IATA Facilitator/Co-Editor	

PROCEDURES

Accident narratives are provided to the CWG members and IATA by Airclaims Ltd throughout the year as agreed between IATA and Airclaims Ltd.

The CWG members shall individually, based on their experience and information to hand, attempt to determine the contributing factor(s) of each accident for which a narrative is supplied. These classifications are submitted to IATA on the Excel sheet provided and sent back to IATA by email prior to the CWG meeting in January. Instructions for this process are provided by IATA.

The CWG shall meet twice a year. Once in August to coincide with the IATA SAC Incident Review Meeting (IRM) and once in January of the following year in order to consolidate and discuss findings, to make recommendations and prepare the draft Safety Report for approval by the SAC.

APPENDIX B — THE PURPOSE OF THE IATA SAFETY REPORT

PURPOSE OF THE SAFETY REPORT

The Safety Report:

- Supports the IATA Safety Committee's (SAC) submission to the IATA Operations Committee (OPC);
- Provides an exchange of safety information among IATA Members and other professional groups;
- Documents air accident classifications which direct attention to broad areas of safety concern;
- Identifies areas where action either by airlines or by IATA may serve to reduce accidents

BENEFITS

The benefits of the IATA Safety Report are that:

- It provides a consolidated source of diverse safety performance data;
- It is focussed on commercial air transportation operations;
- It provides practical guidance and recommendations to executive and operational managers to enhance safety performance; and
- It is produced by practising safety managers who have day-to-day exposure to line operations as well as access to wide-ranging safety resources;
- It reports on the achievement of the IATA Safety Management System (SMS).

BENEFICIARIES

The IATA Safety Report is a widely quoted and highly regarded document which enhances IATA's relevance in these matters. According to the results of the latest survey (conducted in 1997), the readership of the Jet Safety Report is 37,800.

Beneficiaries of the IATA Safety Report include (among others):

- Board of Directors;
- Airline management;
- Vice-Presidents, Operations;
- Airline Safety Managers;
- Flight crew;
- Flight training departments;
- Flight attendants;
- Human factors specialists;
- Insurance companies;
- Aircraft maintenance specialists;
- Airports; and
- National aviation authorities.

SCOPE

The scope of the IATA Safety Report is confined to Hull Loss, Substantial Damage and Fatal accidents involving aircraft operated in commercial airline service, comprising:

- Western- and Eastern-built jet aeroplanes with a Maximum Takeoff Mass (MTOM) of more than 15,000 kg; and
- Western- and Eastern-built turboprop aeroplanes with a Maximum Takeoff Mass (MTOM) of more than 3,900 kg.

However, the report is taking an increasing interest in air safety incidents.

EXCLUSIONS

The IATA Safety Report does not contain:

- Accident statistics related to non-airline operations (eg private operators, brokers, governments/military, etc.);
- Accident statistics related to any specific IATA Member or any other airline;
- Probable cause (human, technical or environmental) associated with individual accidents.

ASSUMPTIONS

The following assumptions are made in producing the IATA Safety Report:

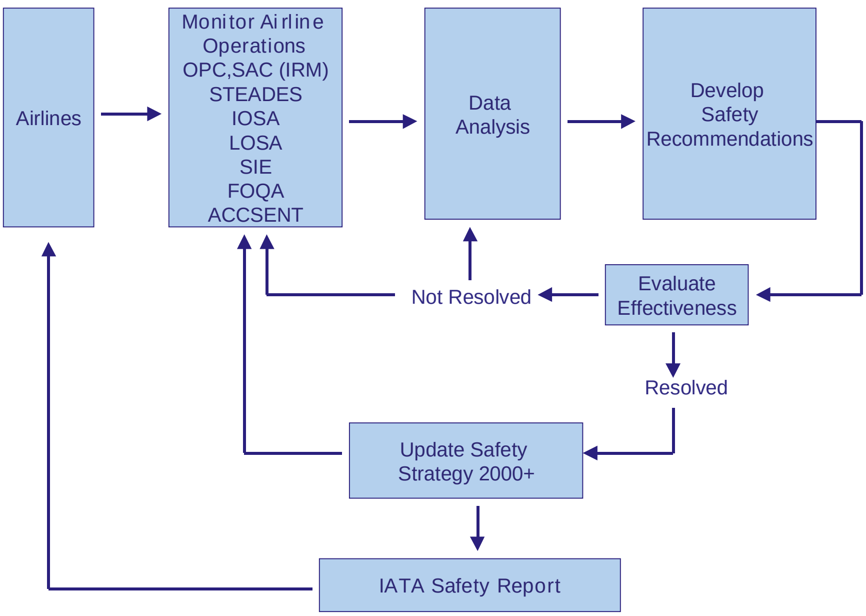
- Costs are stated in US dollars (US$);
- Substantial damages and Hull losses are equated to obtain a conservatively pessimistic view of the data; and
- Costs are based on a deflator according to the Aerospace Industries Association (AIA) Producer Price Index for Capital Equipment, in terms of constant current prices.

IATA SAFETY MANAGEMENT SYSTEM (SMS)

The role of the Safety Report is to document, analyse, comment and make recommendations of preventative measures regarding the airline industry's safety performance. The Safety Report is a key component of IATA's SMS that aims to monitor that safety performance in order to assist with accident prevention. Essentially the Safety Report is an exposition of IATA's SMS, refer to Figure 1 below.

Figure 1

IATA Safety Management System



PRODUCTION OF THE REPORT

Handling, interpreting and drawing conclusions from preliminary accident data can be strongly influenced by political, competitive, and legal factors. Stakeholders in each accident — operators, legislators, unions, special interest groups, insurers, vendors, etc. — will naturally perceive a given mishap from differing perspectives. Objective and professional assessment of the facts at hand by the members of the IATA CWG will advocate sensitivity to the reputations of involved individuals, companies, organisations, and governments.

There is an expectation on the part of SAC and OPC that the IATA Safety Report will yield useful information for formulating and monitoring IATA's safety management strategy and operational Safety Standards and Recommended Practices.

The IATA Safety Report must also provide operations executives with recommendations and guidelines for improving the safety performance of their individual airlines.

The development and production of the report is the responsibility of the IATA Safety Department and is authorised for distribution by the OPC.

TASK ENVIRONMENT

Official accident reports are not usually available at the time of drafting the IATA Safety Report and, at the extreme, many accidents are not investigated at all. Preliminary accident data is often incomplete or, worse, erroneous. For this reason, and given the sensitivities of the task, facts in evidence should be validated using information from more than one credible source.

There are many databases of aircraft accidents and incidents worldwide, of varying quality, detail, completeness and focus. These are usually maintained by manufacturers, legislators (ICAO, national airworthiness authorities, etc.), Publishers (Flight International, Aviation Week & Space Technology), pilots (IFALPA), insurance loss adjusters (such as Airclaims Ltd.), and dedicated researchers. Often two or more databases will be required to obtain the desired level of detail.

The accident classification process is also subject to a severe time constraint. The CWG is expected to debate the facts in evidence and draft its report in four days. It is clear that the results obtained cannot be expected to yield the same totality or accuracy from a task which normally occupies many experts for periods of up to several years.

APPENDIX C — DEFINITIONS SR 2001

Aircraft-years: means, for purposes of the Safety Report, the average fleet in-service during the year. The figure is calculated by counting the number of days each aircraft is in the airline fleet during the year and then dividing by 365. Periods during which the aircraft is out of service (for repair, storage, parked, etc) are then excluded.

Accident: an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

- a person is fatally or seriously injured as a result of:
  (a) being in the aircraft;
  (b) direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or
  (c) direct exposure to jet blast;

  except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew;
- the aircraft sustains damage or structural failure which:
  (a) adversely affects the structural strength, performance or flight characteristics of the aircraft; and
  (b) would normally require major repair or replacement of the affected component,

  except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennae, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or
- the aircraft is still missing or is completely inaccessible.

Note 1: *For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.*

Note 2: *An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.*

For purposes of this Safety Report, accidents are classified as either operational or non-operational.

Accident classification: means the process by which actions, omissions, events, conditions, or a combination thereof, which led to the accident, or incident are identified and categorised.

Aerodrome manager: means an aerodrome manager as defined in applicable regulations; and includes the owner of aerodrome.

Air Traffic Service unit: means an involved air traffic service (ATS) unit, as defined in applicable ATS, Search and Rescue, and Overflight regulations

Aircraft: means the involved aircraft, used interchangeably with aeroplane(s).

Captain: means the involved pilot responsible for operation and safety of the aeroplane during flight time.

Commander: means the involved pilot, in an augmented crew, responsible for operation and safety of the aeroplane during flight time.

Controlled Flight into Terrain (CFIT): *(From CAST-ICAO Common Taxonomy Team Occurrence Categories, Refer to Supporting Documents on CD-ROM)*

Inflight collision or near collision with terrain, water, or obstacle without indication of loss of control.

- CFIT is used only for occurrences during airborne phases of flight.
- CFIT includes collisions with those objects extending above the surface (for example: towers.).
- CFIT can occur during either Instrument Meteorological Conditions (IMC) or Visual Meteorological Conditions (VMC).
- This category includes instances when the cockpit crew is affected by visual illusions (e.g., black hole approaches) that result in the aircraft being flown under control into terrain, water, or obstacles.
- If control of the aircraft is lost (induced by crew, weather or equipment failure), do not use this category; use Loss of Control — Inflight (LOC-I) instead.
- For an occurrence involving intentional low altitude operations (e.g., crop dusting) use the Low Altitude Operations (LALT) code instead of CFIT.
- Do not use this category for occurrences involving intentional flight into/toward terrain. Code all suicides under Security Related (SEC) events.
- Do not use this category for occurrences involving runway undershoot/overshoot, which are classified as Undershoot/Overshoot (USOS).

Crewmember: means anyone on-board a flight who has duties connected with the sector of the flight during which the accident happened. It excludes positioning or relief crew, security staff, etc. (see definition of “passenger” below).

Eastern-built jet aircraft: The main types in current service and considered in this Safety Report are the Il-62, Il-76, Il-86, Tu-134, Tu-154, Yak-40 and Yak-42.

Eastern-built turboprop aircraft: The main types in current service and considered in this Safety Report are An-12, An-24, An-26, An-28, An-32, L-410 and Y-12.

Fatal accident: A fatal accident is one where at least one passenger or crew member is killed or later dies of their injuries as a result of an “operational” accident.

Events such as slips and falls, food poisoning, turbulence or accidents involving on-board equipment, which may involve fatalities but where the aircraft sustains minor or no damage, are excluded.

Most fatal accidents also result in the aircraft becoming a hull loss but this is not necessarily always the case and there have been a number of substantial damage accidents where deaths have occurred.

Fatality: A fatality is a passenger or crewmember who is killed or later dies of their injuries resulting from an operational accident. Injured persons who die more than 30 days after the accident are generally excluded, however, one or two cases where death came later but could reasonably be shown to have been a direct result of injuries sustained in the original accident, are included. (This does not conform to the ICAO Annex 13 definition but, in this context, is thought to be more meaningful).

Hull loss: An accident in which the aircraft is substantially damaged and is not subsequently repaired.

IATA Accident Classifications: Classifications are groupings of factors attributable to accidents. They have been devised to help airlines develop training programmes for flight crew, cabin staff and other airline employees. These classifications can help identify the main areas of concern where remedial action should be taken.

IATA accident classifications are arranged in five categories: human, technical, environmental, organisational, and insufficient data.

It is generally difficult to classify accidents or incidents in only one category because they are often the result of a combination of different factors. Therefore, a single event may be classified under more than one category.

Human (HUM): The Human (HUM) category relates only to flight crew. However, the equivalent human factors implications are also present in the technical, environmental and operational areas. The H3 factor especially is often a consequence of an operational error or latent failure.

CODE	DESCRIPTION	EXAMPLE EVENT(S)
H1	Active Failure	Non-adherence to standards and procedures — this can include non adherence to SOP, law violations, failure to follow written instructions, failure to manage cockpit resources, gross lack of appropriate vigilance, laziness.
H2	Passive Failure	Unawareness — Including possible breakdown of coordination, misunderstanding, communication failures, lack of expected support. It can be exacerbated by high workload, distraction, complacency, forgetfulness, boredom, and/or low arousal level, fatigue
H3	Proficiency/skill Failure	Inappropriate handling of aircraft or its systems — this can include misjudgement, making an incorrect decision. It can be exacerbated by lack of experience, lack of training or simple incompetence.
H4	Incapacitation	Flight crew member unable to perform his/her duty due to physical or psychological inability or impairment.

Technical (TEC).

CODE	DESCRIPTION
T1	Extensive engine failure, uncontained engine fire
T2	Engine failure, malfunction, fire warning
T3	Gear and tire
T4	Flight controls
T5	Structural failure
T6	Fire, smoke (cockpit, cabin, cargo)
T7	Company maintenance, servicing, (incl. Human error)
T8	Avionics
T9	Design, manufacturer
T10	Other
T11	System failure
T12	Autoflight

Environmental (ENV).

CODE	DESCRIPTION
E1	Meteorology (MET)
E2	Air Traffic Services (ATS)/Communications (COM)/conflicting traffic
E3	Ground-crew, cabin-crew, passengers
E4	Birds / Foreign Object Damage (FOD)
E5	Airport facilities
E6	Ground support (Procedures, Training)
E7	Navaids
E8	Dangerous goods
E9	Security
E10	Other
E11	Regulatory Oversight

Organisational (ORG).

CODE	DESCRIPTION
O1	Selection or training of crewmembers
O2	Inadequate SOPs, regulations
O3	Administrative deficiencies
O4	Latent failures
O5	Inadequate control and monitoring
O6	Incompatible goals
O7	Inadequate communications
O8	Other

Insufficient Data (I).

CODE	DESCRIPTION
I	Insufficient data to make any classification

Incident: An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

In-Flight Security Personnel: An individual who is trained, authorised and armed by the state and is carried on board an aircraft and whose intention is to prevent acts of unlawful interference.

Investigation: A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

Investigator in charge: A person charged, on the basis of his or her qualifications, with the responsibility for the organisation, conduct and control of an investigation.

Involved: means directly concerned, or designated to be concerned, with an accident or incident.

Level of safety: means a level of how far safety is to be pursued in a given context, assessed with reference to an acceptable risk, based on the current values of society.

Major repair: means a repair which, if improperly done, might appreciably affect mass, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness.

Non-operational accident: This definition includes acts of deliberate violence such as sabotage, war etc. and (an IATA constraint) accidents which occur during crew training; demonstration and test flights. (Sabotage, etc. is believed to be a matter of security rather than flight safety, and crew training, demonstration and test flying are considered to involve special risks inherent to these types of operation).
Also included in this category are:

- Non-airline operated aircraft (e.g. military or government operated, survey, aerial work or parachuting flights);
- Accidents where there has been no intention of flight

Occurrence: means any unusual or abnormal event involving an aircraft in flight, including but not limited to an incident.

Operator: A person, organisation or enterprise engaged in or offering to engage in aircraft operation.

Operational accident: means an accident is one which is believed to represent the risks of normal commercial operation, generally accidents which occur during normal revenue operations or positioning flights.

Passenger: means anyone on-board a flight who, as far as may be determined, is not a crew member. Apart from normal revenue passengers this includes off-duty staff members, positioning and relief flight crew members etc. who have no duties connected with the sector of the flight during which the accident happened. Security staff are included as passengers as their duties are not concerned with the operation of the flight.

Person: means any involved individual, including an aerodrome manager and/or a member of an air traffic services unit.

Phase of Flight: These phase of flight definitions were, and continue to be, developed by the ATA Flight Operations Working Group. The following is an excerpt from the Flight Operations Information Data Interchange — Phase of Flight Specification, ATA iSpec2200 (ATA POF Spec).

Flight Planning (FLP)

This phase begins when the flight crew initiates the use of flight planning information facilities and becomes dedicated to a flight based upon a route and an airplane; it ends when the crew arrives at the aircraft for the purpose of the planned flight or the crew initiates a “Flight Close” phase.

Pre-Flight (PRF)

This phase begins with the arrival of the flight crew at an aircraft for the purpose of flight; it ends when a dedication is made to depart the parking position and/or start the engine(s). It may also end by the crew initiating a “Post-flight” phase.

NOTE: *The Pre-flight phase assumes the aircraft is sitting at the point at which the aircraft will be loaded or boarded, with the primary engine(s) not operating. If boarding occurs in this phase, it is done without any engines operating. Boarding with any engine operating is covered under Engine Start/Depart.*

Engine Start/Depart (ESD)

This phase begins when the flight crew take action to have the aircraft moved from the parked position and/or take switch action to energize the engine(s); it ends when the aircraft begins to move forward under its own power or the crew initiates an “Arrival/Engine Shutdown” phase.

NOTE: *The Engine Start/Depart phase includes: the aircraft engine(s) start-up whether assisted or not and whether the aircraft is stationary with more than one engine shutdown prior to Taxi-out, i.e., boarding of persons or baggage with engines running. It includes all actions of power back for the purpose of positioning the aircraft for Taxi-out.*

Taxi-out (TXO)

This phase begins when the crew moves the aircraft forward under its own power; it ends when thrust is increased for the purpose of Take-off or the crew initiates a “Taxi-in” phase.

NOTE: *This phase includes taxi from the point of moving under its own power, up to and including entering the runway and reaching the take-off position.*

Take-off (TOF)

This phase begins when the crew increases the thrust for the purpose of lift-off; it ends when an Initial Climb is established or the crew initiates a “Rejected Take-off” phase.

Rejected Take-off (RTO)

This phase begins when the crew reduces thrust for the purpose of stopping the aircraft prior to the end of the Take-off phase; it ends when the aircraft is taxied off the runway for a “Taxi-in” phase or when the aircraft is stopped and engines shutdown.

Initial Climb (ICL)

This phase begins at 35 ft above the runway elevation; it ends after the speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise. It may also end by the crew initiating an “Approach” phase.

NOTE: *Maneuvering altitude is based upon such an altitude to safely maneuver the aircraft after an engine failure occurs, or pre-defined as an obstacle clearance altitude. Initial Climb includes such procedures applied to meet the requirements of noise abatement climb, or best angle/rate of climb.*

En Route Climb (ECL)

This phase begins when the crew establishes the aircraft at a defined speed and configuration enabling the aircraft to increase altitude for the purpose of cruise; it ends with the aircraft established at a predetermined constant initial cruise altitude at a defined speed or by the crew initiating an “Descent” phase.

Cruise (CRZ)

The cruise phase begins when the crew establishes the aircraft at a defined speed and predetermined constant initial cruise altitude and proceeds in the direction of a destination; it ends with the beginning of Descent for the purpose of an approach or by the crew initiating an “En Route Climb” phase.

Descent (DST)

This phase begins when the crew departs the cruise altitude for the purpose of an approach at a particular destination; it ends when the crew initiates changes in aircraft configuration and /or speeds to facilitate a landing on a particular runway. It may also end by the crew initiating an "En Route Climb" or "Cruise" phase.

Approach (APR)

This phase begins when the crew initiates changes in aircraft configuration and /or speeds enabling the aircraft to maneuver for the purpose of landing on a particular runway; it ends when the aircraft is in the landing configuration and the crew is dedicated to land on a specific runway. It may also end by the crew initiating an "Initial Climb" or "Go-around" phase.

Go-around (GOA)

This phase begins when the crew aborts the descent to the planned landing runway during the Approach phase, it ends after speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise. (Same as end of "Initial Climb".)

Landing (LND)

This phase begins when the aircraft is in the landing configuration and the crew is dedicated to touch down on a specific runway; it ends when the speed permits the aircraft to be maneuvered by means of taxiing for the purpose of arriving at a parking area. It may also end by the crew initiating an "Go-around" phase.

Taxi-in (TXI)

This phase begins when the crew begins to maneuver the aircraft under its own power to an arrival area for the purpose of parking; it ends when the aircraft ceases moving under its own power with a commitment to shut down the engine(s). It may also end by the crew initiating a "Taxi-out" phase.

Arrival/Engine Shutdown (AES)

This phase begins when the crew ceases to move the aircraft under its own power and a commitment is made to shutdown the engine(s); it ends with a dedication to shutting down ancillary systems for the purpose of securing the aircraft. It may also end by the crew initiating an "Engine Start/Depart" phase.

NOTE: *The Arrival/Engine Shutdown phase includes actions required during a time when the aircraft is stationary with one or more engines operating while ground servicing may be taking place, i.e., deplaning persons or baggage with engine(s) running, and or refueling with engine(s) running.*

Post-flight (PSF)

This phase begins when the crew commences the shutdown of ancillary systems of the aircraft for the purpose of leaving the flight deck; it ends when the cockpit and cabin crew leaves the aircraft. It may also end by the crew initiating a "Pre-flight" phase.

Flight Close (FLC)

This phase begins when the crew initiates a message to the flight-following authorities that the aircraft is secure, and the crew is finished with the duties of the past flight; it ends when the crew has completed these duties or begins to plan for another flight by initiating a "Flight Planning" phase.

Ground Servicing (GDS)

This phase begins when the aircraft is stopped and available to be safely approached by ground personnel for the purpose of securing the aircraft and performing the duties applicable to the arrival of the aircraft, aircraft maintenance, etc.; it ends with completion of the duties applicable to the departure of the aircraft or when the aircraft is no longer safe to approach for the purpose of ground servicing. e.g. Prior to crew initiating the "Taxi-out" phase.

NOTE: *This phase was identified by the need of information that may not directly require the input of cockpit or cabin crew. It is acknowledged as an entity to allow placement of the tasks required of personnel assigned to service the aircraft.*

Sky Marshal: see In-flight Security Personnel

Products: refer, in terms of accident costs, to those liabilities which fall on parties other than the involved airline.

Risk: means the combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

Safety: means freedom from unacceptable risk of harm.

Serious Incident: An incident involving circumstances indicating that an accident nearly occurred. (Note the difference between an accident and a serious incident lies only in the result).

Serious injury: An injury which is sustained by a person in an accident and which:

- Requires hospitalisation for more than 48 hours, commencing within seven days from the date the injury was received;
- Results in a fracture of any bone (except simple fractures of fingers, toes or nose);
- Involves lacerations which cause severe haemorrhage, or nerve, muscle or tendon damage;
- Involves injury to any internal organ; or
- Involves second- or third-degree burns, or any burns affecting more than five percent of the surface of the body; or
- Involves verified exposure to infectious substances or injurious radiation.

Substantial Damage: means damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.

Note: *Engine failure (damage limited to an engine), bent fairing or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, minor damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage" for purpose of this Safety Report.*

The ICAO Annex 13 definition is unrelated to cost and includes many incidents in which the financial consequences are minimal.

Western-built jet: Commercial jet transport aeroplane with a maximum certificated takeoff mass of more than 15,000 kg, designed and manufactured in the western world countries. They have been arranged into four groups, depending on the date of entry into service of the basic model.

BASIC MODEL	DATE OF ENTRY
GROUP 1	**1958-64**
Comet	30/09/58
B707/720	30/09/58
DC8	29/05/59
SE210	19/03/59
880/990	10/03/60
B727	29/10/63
Trident	19/12/63
VC10	22/04/64
GROUP 2	**1965-70**
BAC111	06/04/65
DC9	18/09/65
B737	28/12/67
F28	24/02/69
B747	12/12/69
GROUP 3	**1971-80**
DC10	20/07/71
L1011	05/04/72
A300	10/05/74
Mercure	16/05/74
VFW614	01/09/75
Concorde	19/12/75
MD80	13/09/80

BASIC MODEL	DATE OF ENTRY
GROUP 4	**1981-00**
B757	22/12/82
A310	25/03/83
BAe146/RJ	23/05/83
B767	19/08/83
A300-600	04/84
737 (CFMI)	07/12/84
F100	29/02/88
A320	26/03/88
B747-400	09/02/89
MD11	29/11/90
CRJ	19/10/92
A340	29/01/93
A330	30/12/93
A321	27/01/94
B777	17/05/95
FK70	09/03/95
MD90	24/03/95
EMB145	27/12/96
A319	25/04/97
B737 NG	Early 1988
EMB135	09/09/99
F/D328	06/10/99
B717	12/10/99

Western-built Turboprop: Commercial turboprop transport aeroplane with a maximum certificated takeoff mass of more than 3900 kg, designed and manufactured in the western world countries. They have been arranged into four groups, depending on maximum takeoff weight (MTOW) of the basic model.

GROUPS AND REPRESENTATIVE TYPES (BY MTOW)			
GROUP A (60,000 lbs and over)			
Super Guppy	Bae Vanguard	L100 Hercules	Shorts Belfast
BAe Argosy	Bae Viscount	L-188 Electra	Transall C160
BAe Brittania	Canadair CL44		
GROUP B (Over 40,000 lbs and under 60,000 lbs)			
ATR72	DHC Dash 7	Convair 580	NAMC YS-11
BAe 748	Fokker F27/F227	HP Dart Herald	Saab 2000
BAeATP	Fokker 50		
GROUP C (Over 20,000 lbs and under 40,000 lbs)			
Nord 262	DHC Dash 8	Gulfstream 1	Saab 340
ATR 42	Dornier 328	Jetstream 41	Shorts 330/360
CASA CN235	EMB 120		
GROUP D (Up to 20,000 lbs)			
ASTA Nomad	CASA 212	EMB 110	Jetstream 31
Beech 99	DHC-6 Twin Otter	Fairchild Metro	Saunders ST27
Beech 1300/1900	Dornier 228	IAI Arava	Shorts Skyvan

APPENDIX D — ASSIGNED GEOGRAPHIC AREAS OF RESPONSIBILITY OF REGIONAL TECHNICAL CONFERENCES AND REGIONAL OPERATIONS & INFRASTRUCTURE OFFICES

The geographic areas currently assigned to the respective IATA Regional Technical Conferences and respective Regional Operations & Infrastructure (ROI) Offices, are defined by countries, as set out below.

AF — AFRICAN REGION (AFI)

Algeria, Angola

Benin, Botswana, Burkina Faso, Burundi

Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo — Democratic Republic of the (former Zaire), Congo — Republic of the, Cote d'Ivoire

Djibouti

Ethiopia, Eq. Guinea, Eritrea

Gabon, Gambia, Ghana, Guinea, Guinea Bissau

Kenya

Lesotho, Liberia, Libya

Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique

Namibia, Niger, Nigeria

Reunion, Rwanda

Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Spain (Canary Is.), Sudan, Swaziland

Tanzania, Togo, Tunisia

Uganda

Western Sahara

Zambia, Zimbabwe

SA — CARRIBEAN/SOUTH AMERICAN REGION (LATAM/CAR)

Argentina, Aruba, Asencion Islands

Bahamas, Barbados, Belize, Bolivia, Brazil

Cayman Is., Chile, Colombia, Costa Rica, Cuba

Dominica, Dominican Republic

Ecuador, El Salvador

French Antilles, French Guiana

Grenada, Guatemala, Guyana

Haiti, Honduras

Jamaica

Mexico, Montserrat

Netherlands Antilles, Nicaragua

Panama, Paraguay, Peru, Puerto Rico

St. Kitts & Nevis, St. Lucia, St. Vincent & Grenadines, Surinam

Turks & Caicos Is., Trinidad & Tobago

Uruguay, USA (for matters related to traffic between Caribbean/USA)

Venezuela, Virgin Islands

EU — EUROPEAN REGIONAL (EUR)

Albania, Armenia, Austria, Azerbaijan

Belarus, Belgium, Bosnia/Herzegovina, Bulgaria

Croatia, Czech Republic

Denmark

Estonia

Finland, France

Georgia, Germany, Gibraltar, Greece

Hungary

Ireland, Italy

Latvia, Lithuania, Luxembourg

Macedonia, Malta, Moldova, Republic of

Netherlands, Norway

Poland, Portugal

Romania, Russian Federation (West of Ural Mts.)

San Marino, Slovak Republic, Slovenia, Spain, Sweden, Switzerland

Turkey

Ukraine, United Kingdom

Yugoslavia, Federal Republic of

NE — MIDDLE EAST REGION (MID)

Bahrain

Cyprus

Egypt, Arab Republic of Iran, Iraq, Israel

Jordan

Kuwait

Lebanon

Oman, Sultanate of

Qatar

Saudi Arabia, Syrian Arab Republic

Turkey (Anatolia only)

United Arab Emirates

Yemen

NA — NORTH ATLANTIC/NORTH AMERICN REGION (NAT/NAM)

Canada

Denmark (for NAT issues only)

France (for NAT issues only)

Iceland, Ireland (for NAT issues only)

Norway (for NAT issues only)

Portugal (for NAT issues only)

Spain (for NAT traffic issues only)

United Kingdom (for NAT issues only)

United States of America

FE — ASIA/PACIFIC REGION (AS/PAC)

Afghanistan, Australia (including Cocos Is.), American Samoa

Bangladesh, Brunei

Cambodia, China, Cook Islands

Easter Islands (Chile)

Fiji

Hong Kong

India, Indonesia

Japan

Kazakhstan, Kiribati, Korea, Kyrgyzstan

Laos

Malaysia, Maldives, Mariana Is, Marshall Is, Micronesia-Federated States of,

Mongolia, Myanmar

Nauru, Nepal, New Caledonia, New Zealand

Pakistan, Papua New Guinea, Philippines

Russian Federation (East of Ural Mts.)

Singapore, Solomon Islands, Sri Lanka

Tahiti, Taiwan, Tajikistan, Thailand, Tonga, Turkmenistan

USA — Anchorage (Oceanic Routes only), Oakland (Oceanic Routes only), Guam, Hawaii, Line Islands

Uzbekistan

Vanuatu, Vietnam

Western Samoa

APPENDIX E — ACCIDENT NARRATIVES 2001

WESTERN-BUILT JETS OPERATIONAL HULL LOSS

1. Date of Loss : 1/5/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 727
Year of Build : 1968
Operator : Air Gemini
Registration : S9-BAI
Accident Location : Dundo Airport, Dundo, Angola
Service : DNC
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 4
Crew Dead : 0
Pax on Board : 6
Pax Dead : 0

During the final stage of a visual approach to Dundo, it would appear that power was reduced too early and the aircraft subsequently undershot, touching down just before the runway threshold. The aircraft ran forward and struck the lip of the runway causing its right main undercarriage to fail and collapse. As the undercarriage collapsed the aircraft began to veer to the right and it ran off the side of the runway into long grass and scrub where its nose and left main undercarriage also failed and collapsed. After leaving the runway, the aircraft apparently struck and killed a local villager. The accident happened in daylight and in normal weather. The runway at Dundo is understood to be 2,000m. long and it is said to be normal practice to try and touchdown as soon after the threshold as possible. The aircraft was operating a cargo flight from Luanda.

2. Date of Loss : 1/9/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 727
Year of Build : 1981
Operator : Lloyd Aereo Boliviano
Registration : CP-2323
Accident Location : Ezeza International Airport, Buenos Aires, Argentina
Service : ISP
Phase of Flight : GND
Classification : Total Loss
Loss % : 22
Crew on Board : 9
Crew Dead : 0
Pax on Board : 126
Pax Dead : 0

On departure, as the aircraft was carrying out a left turn to line up on the runway, its left main undercarriage reportedly failed and collapsed allowing the left wing to strike the ground.

3. Date of Loss : 1/31/2001

Aircraft Manufacturer : Aerospatiale
Aircraft Type : Caravelle
Year of Build : 1966
Operator : Lineas Aereas Suramericanas
Registration : HK-3932X
Accident Location : (near) El Yopal, Colombia
Service : DNC
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 1
Pax on Board : 3
Pax Dead : 2

During the final stage of a visual approach to Mitu, the aircraft undershot, touching down just before the airfield perimeter fence. It ran forward, through the fence and its left main undercarriage struck a low mound and broke away. Meanwhile, power had been increased for a go-around and the aircraft got airborne again. The aircraft climbed away safely and the pilot elected to divert back to El Yopal. However, apparently due to the damage sustained during the undershoot, hydraulic pressure had been lost and the crew were unable to retract the undercarriage. The aircraft continued towards El Yopal but power was lost during the final approach and a forced landing was attempted in fields some three miles short of the airfield. During the landing the aircraft struck trees, broke up and caught fire. The accident happened in daylight and in clear weather. The aircraft was operating a cargo flight Bogota – El Yopal – Mitu with a general cargo including 14 earthenware jars of gasoline.

4. Date of Loss : 2/7/2001

Aircraft Manufacturer : Airbus Industrie
Aircraft Type : A320
Year of Build : 2000
Operator : Iberia
Registration : EC-HKJ
Accident Location : Sondica Airport, Bilbao, Spain
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 56
Crew on Board : 6
Crew Dead : 0
Pax on Board : 136
Pax Dead : 0

Following an ILS approach to Runway 30 at Bilbao, on landing, the aircraft touched down hard (1,200fpm.) in a nose-down attitude, causing its nose undercarriage to fail and collapse rearwards. The aircraft remained on the runway and came to rest after a ground slide of about 1,000m. The accident happened in darkness (2315L) and in VMC. Reported wind 240deg./8kt., gusting to 15kt. and 'light turbulence.' The aircraft was operating a flight (IB1456) from Barcelona.

On short final, while descending through 200ft., the aircraft apparently encountered 'heavy turbulence' and rapid changes in wind direction. At 120ft. a strong vertical gust made the aircraft climb above the glideslope. This was checked by a nose-down side-stick input. However, simultaneously with this input, the aircraft was caught by a strong downdraft resulting in a high sink rate. At this time, 80ft., the crew applied a nose-up input and then, with the aircraft continuing to descend, applied maximum power for a go-around. The aircraft continued to descend and impacted the runway hard. The combination of a 'severe' vertical gust together with the nose-up stick input resulted in the aircraft's AOA protection being triggered. As a result of this accident Airbus has decided to modify the AOA protection control laws to give the crew more authority during the short final approach phase.

5. Date of Loss : 3/3/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (CFMI)

Year of Build : 1991

Operator : Thai Airways International

Registration : HS-TDC

Accident Location : Bangkok International Airport, Bangkok, Thailand

Service : DSP

Phase of Flight : GND

Classification : Total Loss

Loss % : 100

Crew on Board : 5

Crew Dead : 1

Pax on Board : 0

Pax Dead : 0

While parked on the stand, prior to passenger boarding, the aircraft was destroyed by an explosion and fire. The aircraft had apparently arrived about 30min. earlier on another service and was in the process of being prepared for a flight to Chiang Mai when the explosion occurred. Apart from the five cabin crew there were also three ground staff onboard. A number of cleaners had also been onboard but had left a few minutes earlier. The explosion is believed to have originated below the cabin floor in the general area of the centre section fuel tank and the aft part of the forward cargo hold. The centre tank is believed to have had only residual fuel in it at the time. The Thai government initially stated that the explosion had been an 'act of sabotage' and a press statement issued on March 6th said that 'traces of RDX and chlorate compounds were found' in the residue from the explosion. However, it is understood that an initial brief inspection of the heavily burnt wreckage failed to note any immediately obvious physical evidence of the detonation of a high explosive device. Later, the NTSB, who are assisting the Thai Government, reportedly confirmed that there was no evidence of a bomb and that an explosion had apparently occurred in the aircraft's centre wing tank.

6. Date of Loss : 3/7/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 707

Year of Build : 1964

Operator : Skymaster Air Lines

Registration : PT-MST

Accident Location : Guarulhos International Airport, Sao Paulo, Brazil

Service : DNC

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

Following a (visual?) approach to Runway 09 (L or R?) at Sao Paulo, the aircraft reportedly undershot, touching down very hard about 30m. before the runway threshold. The aircraft's left main undercarriage subsequently failed and collapsed followed by the right. It continued forward on its belly for about 1000m. before coming to rest on the grass at right angles to the runway. The accident happened in darkness (0032L) but in clear weather. Wind, calm. The aircraft was operating a flight from Belem via Brasilia. After the accident the pilot reported that it had been an uneventful flight until final approach when he had experienced problems with the 'stabilizer trim.'

7. Date of Loss : 3/11/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 727

Year of Build : 1981

Operator : Express One International

Registration : N701NE

Accident Location : Pohnpei Airport, Kolonia, Pohnpei Island, Pacific Islands (Trust Territories)

Service : INC

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

The aircraft undershot on approach to Runway 09 at Pohnpei, touching down, apparently in a nose high attitude, just short of the runway. The aircraft then ran forward but its main undercarriage was substantially damaged as it struck the lip of the runway. After a ground run of about 1,000ft., the aircraft's right wing suddenly dropped and it began to veer towards the right. The aircraft came to rest on the runway. The accident happened in darkness (1902L). Weather, CAVOK, wind variable. The aircraft was operating a flight from Majuro Atoll.

8. Date of Loss : 3/23/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 707
Year of Build : 1969
Operator : Luxor Air
Registration : SU-BMV
Accident Location : Roberts International Airport, Monrovia, Liberia
Service : INP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 7
Crew Dead : 0
Pax on Board : 175
Pax Dead : 0

Following an ILS approach, just before touchdown, the aircraft reportedly entered a shallow fog patch and the pilot lost visual contact with the runway. The approach was continued but the aircraft touched down hard and bounced. The second touchdown was towards the left side of the runway in a marked right wing low attitude and both the right hand engines struck the ground and were torn off. The aircraft ran off the left side of the runway and continued for about 200m. It then veered back to the right and ran across the runway before eventually coming to rest near the terminal building. The accident happened in darkness (about 0430L). The aircraft was operating a flight from Jeddah, Saudi Arabia, with Hadj pilgrims.

9. Date of Loss : 4/4/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)
Aircraft Type : DC-8
Year of Build : 1970
Operator : Fine Air
Registration : N791AL
Accident Location : Palmaseca Airport, Cali, Colombia
Service : INC
Phase of Flight : LDG
Classification : Total Loss
Loss % : 40
Crew on Board : 3
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

On take-off from Cali, when the undercarriage was selected up, there was an unsafe indication for the nose undercarriage. The aircraft apparently held for about an hour while the crew attempted to trouble shoot the problem. During this time it is understood that they became aware that there was a body in the nose wheel well. The aircraft returned to Cali where it landed on a foamed runway with its nose undercarriage only partially extended. The aircraft was operating a cargo flight from Guayaquil and Quito to Miami with a refuelling stop at Cali. It would appear that, during the technical stop at Cali, two young men gained access to the aircraft and stowed away in the nose wheel well. Both were killed.

10. Date of Loss : 5/10/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 727
Year of Build : 1965
Operator : Angola Air Charter
Registration : D2-FCK
Accident Location : N'Zagi Airport, N'Zagi, Angola
Service : DNC
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 6
Crew Dead : 0
Pax on Board : 5
Pax Dead : 0

During the final stage of a visual approach to Runway 08 at N'Zagi, the aircraft apparently undershot and its right main undercarriage struck the top of a low earth mound (about 1 to 2m high) some 100m. short of the runway threshold. The landing was continued but, on touchdown, the right main undercarriage failed and collapsed. The approach and landing was flown by the co-pilot. The accident happened in daylight and in VMC. Wind, 130deg/12 to 15kt. Runway 08 at N'Zagi is an unpaved earth strip with no runway markings. It is understood that the runway has a marked upward gradient. The aircraft was operating a flight from Luanda.

11. Date of Loss : 5/22/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 737 (JT8D)
Year of Build : 1975
Operator : First Air
Registration : C-GNWI
Accident Location : Yellowknife Airport, Yellowknife, Northwest Territories, Canada
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 6
Crew Dead : 0
Pax on Board : 98
Pax Dead : 0

Following an ILS approach to Yellowknife flown by the co-pilot, the aircraft touched down hard on its main undercarriage and bounced. There was a second bounce on the main undercarriage but at this point the pilot took over control and attempted to recover the situation. The aircraft subsequently touched down nose wheel first sustaining substantial damage. The aircraft remained on the runway and was brought to a safe stop. The accident happened in daylight (1325L) and in good weather, CAVOK; wind, calm. The aircraft was operating a service from Edmonton.

12. Date of Loss : 5/23/2001

Aircraft Manufacturer : Fokker

Aircraft Type : 100

Year of Build : 1992

Operator : American Airlines

Registration : N1419D

Accident Location : Dallas/Ft. Worth International Airport, Dallas, Texas, USA

Service : DSP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 13

Crew on Board : 4

Crew Dead : 0

Pax on Board : 88

Pax Dead : 0

Following a visual approach, 'backed up with localizer and PAPI', to Runway 17C at Dallas, on touchdown there was a 'loud bang' and the aircraft immediately began to settle on the right. The pilot managed to maintain control and brought the aircraft to a stop on the runway. An initial inspection found that the lower portion of the right main undercarriage assembly had separated from the aircraft. The crew described the approach as 'stable' and the touchdown as 'normal'. The approach was flown by the co-pilot. The accident happened in daylight (1504L) and in VMC. Wind 220deg./10kt. The aircraft was operating a flight (AAL1107) from Charlotte, North Carolina.

13. Date of Loss : 8/1/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 727

Year of Build : 1979

Operator : Yemenia

Registration : 7O-ACW

Accident Location : Asmara International Airport, Asmara, Eritrea

Service : ISP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 8

Crew Dead : 0

Pax on Board : 132

Pax Dead : 0

Following a visual approach to Runway 25 at Asmara, during the landing roll, the aircraft was not stopped before the end of the runway and overran onto the asphalt stopway. The aircraft's left main undercarriage struck a large concrete block (a disused base for a light?) towards the left side of the stopway and was torn off. The aircraft continued, sideways, for a further 200m before coming to rest. The accident happened in daylight (0700L) and in clear weather. Wind 200 deg/6kt. Runway 25 at Asmara has an asphalt surface and is 3,000m long. Runway 25 is not equipped with VASIS. The runway was wet from overnight rain. The airfield elevation is 7,618ft. After the accident the crew reported that it had been a normal approach and touchdown but that, despite full reverse thrust and autobraking, the aircraft had not slowed as expected during the landing roll. The aircraft's touchdown point has not been reported. The aircraft was operating a flight from Sana'a, Yemen.

14. Date of Loss : 9/7/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 707

Year of Build : 1967

Operator : HC Airlines

Registration : TN-AGO

Accident Location : Luano Airport, Lubumbashi, Congo (Democratic Republic)

Service : Ferry

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the take-off roll at Lubumbashi, the forward part of the bogie beam on the right main undercarriage failed and, as the aircraft got airborne, part of the bogie fell away. Due to the subsequent misalignment of the remaining part of the bogie, the undercarriage would not then retract. The crew initially considered continuing to Kinshasha but apparently decided that they had insufficient fuel to make the flight safely with the undercarriage extended. They therefore elected to return to Lubumbashi. During the subsequent landing roll, as the aircraft slowed, directional control was lost and it began to veer to the right. The aircraft ran off the right side of the runway and across a ditch sustaining substantial damage.

15. Date of Loss : 9/16/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (JT8D)

Year of Build : 1974

Operator : VARIG

Registration : PP-CJN

Accident Location : Santa Genoveva Airport, Goiania, Brazil

Service : DSP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 5

Crew Dead : 0

Pax on Board : 62

Pax Dead : 0

On landing on Runway 14 at Goiania, the aircraft apparently touched down hard and bounced. The aircraft came down a second time towards the left side of the runway and ran off the side. It then continued parallel to the runway for some 500 or 600m before veering back onto the runway and ground looping. During the runway excursion the aircraft's nose undercarriage apparently dug into the soft ground and collapsed rearwards and its right main undercarriage fell into a lighting conduit and was torn off. The right engine was also torn off. The accident happened in daylight (1110L) but in poor weather with heavy rain.

16. Date of Loss : 10/8/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : MD-80

Year of Build : 1991

Operator : SAS

Registration : SE-DMA

Accident Location : Linate Airport, Milan, Italy

Service : ISP

Phase of Flight : TOF

Classification : Total Loss

Loss % : 100

Crew on Board : 6

Crew Dead : 6

Pax on Board : 104

Pax Dead : 104

The aircraft was destroyed by impact and post impact fire when it struck another aircraft (Cessna Citation Jet, D-IEVX of Air Evex) at a late stage in its take off run and then crashed into a baggage handling building. The Citation was also destroyed and its four occupants killed. The building partially collapsed when it was struck by the MD87 and caught fire. Four of the people working in the building are believed to have been killed and others injured. According to press reports, the MD87 had been cleared for take off from Runway 36R and struck the Citation on the runway shortly after it had entered it from Taxiway R6. The MD87 had apparently begun its rotation and its nosewheel had already left the ground when the collision happened. After the collision the MD87 began to veer to the right and crashed into the baggage building at a point (some 460m beyond the end of the runway and about 130m to the right of the extended centreline?). The accident happened in daylight (0810L) but in reduced visibility in fog. Runway 36R RVR 225m and overcast cloud base 100ft. The MD87 was operating a flight to Copenhagen, Denmark while the Citation was apparently taxiing out to depart on a flight to Paris.

17. Date of Loss : 10/17/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A300

Year of Build : 1983

Operator : Pakistan International Airlines

Registration : AP-BCJ

Accident Location : Dubai International Airport, Dubai, United Arab Emirates

Service : ISP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 11

Crew Dead : 0

Pax on Board : 193

Pax Dead : 0

During the approach to Dubai, when the undercarriage was selected down there was a 'loud bang.' The approach was continued but, on touchdown, the aircraft's right main undercarriage reportedly collapsed. The aircraft veered to the right and ran off the side of the runway. The accident happened in darkness (0215L). The aircraft was operating a flight from Peshawar.

18. Date of Loss : 11/12/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A300

Year of Build : 1987

Operator : American Airlines

Registration : N14053

Accident Location : Belle Harbor, NY

Service : ISP

Phase of Flight : CLB

Classification : Total Loss

Loss % : 100

Crew on Board : 9

Crew Dead : 9

Pax on Board : 251

Pax Dead : 251

The aircraft was destroyed by impact and fire when it crashed in a residential area of Queens very shortly after take-off from JFK International Airport, New York. The point of impact was in the general area of Belle Harbor/Rockaway Beach, about 6 or 7km. from the airfield. It would appear that some parts of the aircraft, including both of its engines and its vertical stabiliser, separated prior to impact with the ground and were found remote from the main crash site. There was no distress call. The accident happened in daylight (0917L) and in fine, clear weather. The aircraft was operating a flight (AA587) to Santo Domingo, Dominican Republic.

19. Date of Loss : 11/24/2001

Aircraft Manufacturer : BAE SYSTEMS (Avro)

Aircraft Type : RJ Avroliner

Year of Build : 1996

Operator : Crossair

Registration : HB-IXM

Accident Location : Birchwil, (near) Zurich, Switzerland

Service : ISP

Phase of Flight : APP

Classification : Total Loss

Loss % : 100

Crew on Board : 5

Crew Dead : 3

Pax on Board : 28

Pax Dead : 21

The aircraft was destroyed by impact and post impact fire when it crashed on a low wooded hillside during the final stage of a VOR/DME approach to Runway 28 at Kloten

Airport, Zurich. The point of impact was at the 1,784ft. level, 368ft. above the airfield elevation, approximately on the extended centreline of the runway but some 3km. short of the threshold. The accident happened in darkness (2207L) and in poor weather. Wind, calm, visibility 3.5km. in light snow, cloud scattered at 600ft., broken at 1,500ft and overcast at 2,200ft., and temp. and dew point 0 C. The aircraft was operating a flight from Tegel Airport, Berlin.

During the initial descent, the captain apparently expected that the flight would be cleared for an ILS approach to Runway 14 and conducted the briefing based on that assumption. However, on contact with Zurich Arrival, the flight was cleared for a VOR/DME approach to Runway 28, apparently because, under the terms of a Swiss/German agreement signed on October 19th., aircraft landing at Zurich after 2200L would be directed to Runway 28 rather than Runway 14 so as to avoid aircraft noise possibly disturbing communities in Southern Germany. The captain subsequently carried out a briefing for Runway 28 including mentioning that the Minimum Descent Height (MDH) was 2,390ft. amsl.

During the turn to intercept the approach heading, the captain told the co-pilot that he had some visual contact with the ground. On final approach, on reaching the MDH, the captain again confirmed that he could see the ground and the approach was continued. There was then an automated call out of '500ft.' followed by another automated call of 'minimum' (?). Shortly after this the captain called for a go-around. This was confirmed by the co-pilot but, 'seconds later,' the aircraft hit the trees.

20. Date of Loss : 11/27/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 747

Year of Build : 1980

Operator : MK Airlines

Registration : 9G-MKI

Accident Location : Port Harcourt (PHC) Nigeria

Service : INC

Phase of Flight : APP

Classification : Total Loss

Loss % : 100

Crew on Board : 5

Crew Dead : 0

Pax on Board : 8

Pax Dead : 1

The aircraft was destroyed by impact and post impact fire when it undershot on final approach to Runway 21 at Port Harcourt. The accident happened in darkness (0145L). The aircraft was operating a flight from Luxembourg to Johannesburg via Port Harcourt.

WESTERN-BUILT JETS OPERATIONAL SUBSTANTIAL DAMAGE

1. Date of Loss : 1/3/2001

Aircraft Manufacturer : Fokker

Aircraft Type : 100

Year of Build : 1991

Operator : Mexicana

Registration : XA-TKR

Accident Location : Miguel Hidalgo Airport, Guadalaja, Mexico

Service : DSP

Phase of Flight : TOF

Classification : Substantial Damage

Loss % : 5

Crew on Board : 4

Crew Dead : 0

Pax on Board : 101

Pax Dead : 0

During the take-off roll at Guadalajara, the right tyre on the aircraft's nose wheel apparently shed its tread just before it got airborne. The take-off was completed, however, debris from the tyre had struck and damaged the hydraulic lines for the nose wheel steering and, when the undercarriage was retracted, the misaligned nose wheel became jammed in its bay. The crew subsequently elected to return to Guadalaja and, after holding for two hours to use up fuel, landed with the nose undercarriage retracted. The pilot was able to hold the nose up for the first 1,900m. of the landing roll but it eventually settled onto the runway and was in contact with the ground for some 300m. The right nose wheel tyre had apparently been recapped three times with the last time having been in October 2000.

2. Date of Loss : 1/14/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 747

Year of Build : 1981

Operator : Air France

Registration : F-GCBE

Accident Location : Houston Intercontinental Airport, Houston, Texas, USA

Service : ISC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 16

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

On landing on Runway 15 at Houston, on or shortly after touchdown, the aircraft's No. 4 engine apparently struck the ground, followed by the No. 1 engine. The landing roll was completed safely and the aircraft taxied to the ramp. The accident happened in darkness (1941L) and in poor weather with visibility reduced in fog.

3. Date of Loss : 1/15/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 747

Year of Build : 1994

Operator : Malaysia Airlines

Registration : 9M-MPH

Accident Location : Heathrow Airport, London, United Kingdom

Service : ISP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 2

Crew on Board : 22

Crew Dead : 0

Pax on Board : 367

Pax Dead : 0

On arrival at the entrance to Stand J2, the commander noted that the Automatic Positioning and Information System (APIS) was on but that there were a number of tugs and baggage dollies parked, apparently unattended, on the right of the stand. However, he judged that there was sufficient clearance to continue to follow the APIS guidance onto the stand. The aircraft taxied forward but, as it neared its final parking position, there was a 'bump' and the pilot immediately brought it to a stop. The aircraft's No.4 engine had collided with one of the tugs, causing it to tip onto its side and become wedged under the engine. The accident happened in darkness (0538L). Three tugs and a number of baggage dollies had been positioned on the right side of the stand sometime earlier by a driver from the airline's handling agent. The driver had used two white lines painted on the ramp, parallel to the stand centreline, to judge a safe distance from the centreline to leave the vehicles. The ramp supervisor, responsible for parking the aircraft, then arrived and carried out a safety check. He noted the tugs and dollies on the right side of the stand and a high loader positioned on the left side. Although he could see no stand markings by which to assess safe clearance, he judged that the tugs and dollies were far enough from the stand centreline to be clear of the aircraft. Stand J2 is part of a Multiple Choice Apron designed to accommodate different size aircraft. Stands J2 and J6 can each accommodate Boeing 747s but, if smaller aircraft are using these stands, a third similar aircraft can then use Stand J4 between them. These aprons may be marked with any number of centrelines in order to accommodate various combinations of large and small aircraft. Interstand clearways are marked at either ends of the apron but there are no similar markings between stands within the apron. The two parallel white lines, used by the diver to judge a safe clearance, had been painted to indicate the maximum wingspan of MD80 aircraft which frequently used the stand. They were not distinctive and between them 'No Parking' was written on the ramp in faint white paint. Apparently no guidance was provided as to what the lines actually represented. Specific information on apron surface markings at Heathrow is contained in the UK Air Information Publication (AIP) and in Operational Safety Instructions (OSI) issued by the airport operator. The AIP provides some information on taxiway guidelines and specifically mentions the use of yellow and white alternately coloured centrelines on large aprons used for 'double parking' but the information given is described as 'generally sparse.' OSI 52/97 provides additional details of stand markings but only describes the marking of centrelines and the interstand clearway at either end of the apron on Multi Choice Aprons. Apparently no other markings are shown. The markings on Stand J2 were not in accordance with the airport operator's OSI and were not described in the variations to standard ramp markings listed in its Appendix. In addition, several different markings are used at Heathrow to indicate wingspan and the significance of the white parallel lines on J2 is not clear and can be 'easily mis-interpreted.' The AAIB describes the use of such markings on multi-choice aprons as 'problematic' since the variety of different aircraft using these aprons makes it difficult to mark the ramp clearly.

4. Date of Loss : 2/25/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (CFMI)

Year of Build : 1993

Operator : Asiana Airlines

Registration : HL7592

Accident Location : Kimpo International Airport, Seoul, South Korea

Service : DSP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 7

Crew on Board : 8

Crew Dead : 0

Pax on Board : 120

Pax Dead : 0

The aircraft, which was parked on Stand 25, was being prepared to operate a service to Pohang. The towbar had been connected to its nose undercarriage and the tug had been positioned just in front of it ready to move forward and connect to the tow bar. However, it is reported that, (when the driver selected 'drive'?), the tug moved forward 'on its own' and, despite his stated application of full braking, his actions appeared to have little or no effect. The tug subsequently struck the aircraft's nose undercarriage and its lower forward fuselage causing substantial damage. During the accident sequence the nose undercarriage collapsed and the aircraft settled onto the tug, crushing its cab. However, fortunately, the driver was able to escape without serious injury. The tug, which is understood to have been built and supplied to Asiana by Shinjeong Development Co., was virtually brand new and had only been in service for three days. It is understood that this was the first tug of this model to enter service with an airline although a small number of similar vehicles had earlier been supplied to the military.

5. Date of Loss : 3/6/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : DC-10

Year of Build : 1972

Operator : FedEx

Registration : N375FE

Accident Location : Logan International Airport, Boston, Massachusetts, USA
Service : DNC
Phase of Flight : TOF
Classification : Substantial Damage
Loss % : 26
Crew on Board : 3
Crew Dead : 0
Pax on Board : 1
Pax Dead : 0

During the take-off roll on Runway 04R at Boston, the crew felt some vibration but, as all cockpit indications appeared normal, did not consider it to be significant. The take-off was continued but, as the aircraft became airborne, ATC advised the flight that there were 'sparks' coming from the No.2 engine. There were still, apparently, no abnormal indications in the cockpit but, as the aircraft climbed away, the crew noted that there was still a vibration coming from somewhere. The captain reduced power on the No. 2 engine and noted that the vibration decreased. He subsequently declared an emergency and elected to return to Boston. The No. 2 engine was left at 'idle' but the vibration continued and, during the base leg of the approach to Runway 04R, the No. 2 engine hydraulic system low pressure warning came on. The aircraft landed safely but, after reverse thrust was selected, ATC advised the flight that the No.2 engine was on fire. The engine was shut down and one fire bottle was fired but this appeared to have no effect. The aircraft was brought to a stop on the runway and an emergency evacuation was carried out. Meanwhile, the fire was brought under control and extinguished by the AFS. A subsequent inspection of the engine found that two fan blades had broken away just below their mid span shrouds. There were punctures in the right hand inlet and fan cowls in line with the bellmouth and inlet adapter ring and both these assemblies were missing. No penetration of the fan case was discovered but there was a 360deg circumferential crack in the fan case and there was a fan cowl burn-through on the left hand side. The main fuel line was found to be cut at a point about 6in aft of the bulkhead attachment and it is assumed that leaking fuel had been the source of the fire noted during the landing. The accident happened at night (0100L) and in IMC. The aircraft was operating a flight (1610) to Memphis.

6. Date of Loss : 3/15/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 767
Year of Build : 1997
Operator : CityBird
Registration : OO-CTR
Accident Location : in flight, (near) Puerto Plata, Dominican Republic
Service : INP
Phase of Flight : CLB
Classification : Substantial Damage
Loss % : 2
Crew on Board : 12
Crew Dead : 0
Pax on Board : 200
Pax Dead : 0

While climbing through FL310 after take-off from Puerto Plata, the crew felt a strong vibration, which continued for a few seconds but there were apparently no other indications of any problems. However, a few minutes later, the cabin altitude warning sounded. The crew noted that the cabin was slowly losing pressure and therefore elected to descend and return to Puerto Plata. The aircraft later landed safely. A subsequent inspection found that the left off-wing escape slide and slide compartment door were missing and that there were two small holes in the left side of the fuselage aft of the wing. The slide inflation bottle was also apparently found to be discharged. It is assumed that the slide had accidentally deployed in flight and struck the side of the fuselage as it left the aircraft. The accident happened in daylight and in normal weather. The aircraft was operating a flight to Munich.

7. Date of Loss : 3/17/2001

Aircraft Manufacturer : Airbus Industrie
Aircraft Type : A320
Year of Build : 1998
Operator : Northwest Airlines
Registration : N357NW
Accident Location : Metropolitan Airport, Detroit, Michigan, USA
Service : DSP
Phase of Flight : TOF
Classification : Substantial Damage
Loss % : 13
Crew on Board : 6
Crew Dead : 0
Pax on Board : 148
Pax Dead : 0

During the take-off run on Runway 03C at Detroit, as the aircraft accelerated through about 110kt, its nose began to lift off. The pilot attempted to lower the nose but without success and the aircraft became airborne. As the aircraft climbed through about 20 to 30ft, the pilot reduced power on both engines. It subsequently settled back onto the runway, touching down in a nose high attitude, striking its tail on the ground. It then overran the end of the runway by about 700ft. onto soft ground. The accident happened in daylight (0715L). Weather, wind 350deg/8kt and visibility 0.75sm in snow. The aircraft had been de-iced prior to departure. Runway 03C is 8,500ft. long and has a grooved asphalt/concrete surface. The aircraft was operating a flight (NWA985) to Miami.

8. Date of Loss : 3/22/2001

Aircraft Manufacturer : Airbus Industrie
Aircraft Type : A320
Year of Build : 1999
Operator : Tunis Air
Registration : TS-IMM
Accident Location : Melita Airport, Djerba, Tunisia
Service : Ferry
Phase of Flight : LDG
Classification : Substantial Damage

Loss % : 28

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

On arrival at Djerba, the aircraft reportedly landed long and subsequently overran the end of the runway. After leaving the runway the aircraft's nose undercarriage failed and collapsed rearwards.

9. Date of Loss : 4/4/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (JT8D)

Year of Build : 1973

Operator : Canada 3000 Cargo

Registration : C-GDCC

Accident Location : St. Johns International Airport, St. Johns, Newfoundland, Canada

Service : DNC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 52

Crew on Board : 2

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

Following an ILS approach to Runway 16 at St. Johns, the aircraft overran the runway on landing and struck a snow berm, sustaining substantial damage. The accident happened in daylight (0615L) but in poor weather. Wind 020deg/20kt., visibility 5/8sm. in blowing snow, 300ft cloud base and sky obscured. The aircraft was operating a flight from Halifax.

10. Date of Loss : 4/18/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A321

Year of Build : 1998

Operator : Airtours International

Registration : G-VOLH

Accident Location : Funchal Airport, Funchal, Madeira, Portugal

Service : INP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 4

Crew on Board : 8

Crew Dead : 0

Pax on Board : 167

Pax Dead : 0

The aircraft suffered a heavy tail strike on touchdown at Funchal. The landing was completed and the aircraft taxied to its stand for normal passenger disembarkation.

11. Date of Loss : 4/21/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 727

Year of Build : 1981

Operator : Allegro Air

Registration : N728FV

Accident Location : Metropolitan Airport, Detroit, Michigan, USA

Service : INP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 13

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

The aircraft had been parked over night on the Signature Flight Service ramp at Detroit. In the morning the crew boarded the aircraft to reposition it to the terminal for passenger boarding. It is understood that prior to moving off they asked the ground engineer 'clear to go.' It would appear that the engineer took this to mean 'was the aircraft serviceable' and applied in the affirmative. Shortly after this the aircraft began to taxy forward. Unfortunately, the nose wheel chocks were still in place and a GPU was still positioned just to the right of its nose. The aircraft jumped the chocks and impacted the GPU sustaining substantial damage. The accident happened in daylight (0830L) and in good visibility.

12. Date of Loss : 4/26/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : DC-8

Year of Build : 1967

Operator : Emery Worldwide Airlines

Registration : N8076U

Accident Location : Nashville International Airport, Nashville, Tennessee, USA

Service : DNC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 18

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the approach to Nashville, when the undercarriage was selected down, the left main undercarriage would not extend. The approach was broken off and the aircraft took up a holding pattern to use up fuel before returning to Nashville for an emergency landing. It is reported that on April 25th., immediately prior to the accident flight, the aircraft's left main undercarriage hydraulic system had been worked on and a 'flow restrictor' replaced. The part number for this component should be either 4776708-5503 or -5503A. Although the new component had apparently been tagged as the correct part, 4776708-5503A, this number does not appear on the part itself and an initial inspection suggests that it is a 'one way check valve' rather than the required 'restrictor valve.'

13. Date of Loss : 5/10/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : MD-80

Year of Build : 1989

Operator : Spanair

Registration : EC-FXI

Accident Location : Liverpool International Airport, Liverpool, United Kingdom

Service : INP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 11

Crew on Board : 6

Crew Dead : 0

Pax on Board : 45

Pax Dead : 0

Following an apparently normal approach to Runway 27 at Liverpool, the aircraft's right main undercarriage failed on touchdown. The aircraft remained on the runway and came to rest some 1,600m. from its point of touchdown. An emergency evacuation was then carried out. The accident happened in daylight (1332L). The aircraft was operating a flight (JKK3203) from Palma. The subsequent investigation showed that the main undercarriage strut cylinder had fractured below the attachment trunnions, allowing the wheels/ axle assembly to separate. The failure apparently originated from a fatigue crack (approx 3.5mm long by 1.1mm deep) on the forward outer surface of the cylinder. The location and overall size of the crack is said to appear to be similar to that which caused the undercarriage failure on MD83 G-DEVR (28 April 1995 local time) and also generally similar to the undercarriage failure on MD82 B-2135 (27 April 1997).

14. Date of Loss : 5/13/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A300

Year of Build : 1992

Operator : Air Afrique

Registration : TU-TAG

Accident Location : Jan Smuts International Airport, Johannesburg, South Africa

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 2

Crew on Board : 0

Crew Dead : 0

Pax on Board : 77

Pax Dead : 0

Following an ILS approach to Runway 03R at Johannesburg, the aircraft suffered a tail strike on touchdown. The accident happened in daylight (0738L) and in 'good weather'. Wind 040deg/4kt. The aircraft was operating a flight from Abidjan via Brazzaville.

15. Date of Loss : 5/17/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A300

Year of Build : 1998

Operator : Thai Airways International

Registration : HS-TAX

Accident Location : Bangkok International Airport, Bangkok, Thailand

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 1

Crew on Board : 0

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the landing roll on Runway 21L at Bangkok, the aircraft veered off the right side of the runway and ran along on the grass beside the runway for some distance. The aircraft was eventually brought to a stop on Taxiway S and then taxied to its stand. The accident happened in daylight (1800L) but in poor weather associated with local thunderstorm activity. Wind, 180deg./15kt. and visibility 500 to 700m. The aircraft was operating a flight from Kathmandu, Nepal.

16. Date of Loss : 5/17/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A300

Year of Build : 1998

Operator : Thai Airways International

Registration : HS-TAZ

Accident Location : Bangkok International Airport, Bangkok, Thailand

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 1

Crew on Board : 0

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the final stage of the approach to Runway 21R, being flown by the co-pilot, a higher than normal sink rate reportedly developed and the aircraft touched down hard and bounced. The pilot took over control but, during the recovery, the aircraft suffered a tail strike. The landing was completed safely and the aircraft taxied to the gate for normal passenger disembarkation. The accident happened in darkness (about 0500L) and in 'good' weather; wind 190deg./9kt. The aircraft was operating a service (TG627) from Osaka, Japan.

17. Date of Loss : 6/2/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 747

Year of Build : 1991
Operator : Lufthansa
Registration : D-ABTH
Accident Location : Dulles International Airport, Washington, D.C, USA
Service : ISP
Phase of Flight : GND
Classification : Substantial Damage
Loss % : 3
Crew on Board : 18
Crew Dead : 0
Pax on Board : 355
Pax Dead : 0

On push back from its stand, the 747's tail cone area was struck by the right wing tip of a United Airlines Boeing 777, which had begun to taxi behind it. The 777 apparently received only minor damage. It is reported that the 747 had been cleared to push back by ramp control. The accident happened in daylight (1830L). The Lufthansa aircraft was operating a flight to Frankfurt.

18. Date of Loss : 6/10/2001

Aircraft Manufacturer : Embraer
Aircraft Type : ERJ-145
Year of Build : 2000
Operator : Sichuan Airlines
Registration : B-3040
Accident Location : Capital Airport, Beijing, China
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 14
Crew on Board : 5
Crew Dead : 0
Pax on Board : 45
Pax Dead : 0

The aircraft was reportedly high on the approach to Runway 18L at Beijing and landed 'long and fast.' During the landing roll the pilot was unable to stop the aircraft before the end of the runway and, in order to avoid overrunning, apparently attempted to steer it off to one side. However during this manoeuvre the aircraft's left main undercarriage failed and collapsed. The accident happened in daylight (1108L) and in VMC. Runway 18L at Beijing is 12,467ft. long. Wind, light and variable. The aircraft was operating a flight from Chengdu.

19. Date of Loss : 6/27/2001

Aircraft Manufacturer : Boeing
Aircraft Type : 747
Year of Build : 1975
Operator : Hydro Air Cargo
Registration : ZS-OOS
Accident Location : Ostend Airport, Ostend, Belgium
Service : INC
Phase of Flight : TOF
Classification : Substantial Damage
Loss % : 9
Crew on Board : 4
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

During the take-off roll at Ostend, as the aircraft accelerated through about 150kt, the crew noted a large seagull pass close by the cockpit. Immediately after this the No: 3 engine began to surge. The pilot elected to abort the take-off and brought the aircraft to a safe stop before taxiing clear of the runway. The subsequent inspection determined that the No:3 engine had ingested a 6lb. seagull. Apart from internal damage to the engine it would appear that pieces from the engine's fan blades escaped and caused airframe damage including penetrating the wing/body fairing.

20. Date of Loss : 7/6/2001

Aircraft Manufacturer : Lockheed
Aircraft Type : L-1011 TriStar
Year of Build : 1972
Operator : Air Transat
Registration : C-FTNA
Accident Location : in flight, 60nm. North of Lyon, France
Service : INP
Phase of Flight : CLB
Classification : Substantial Damage
Loss % : 50
Crew on Board : 14
Crew Dead : 0
Pax on Board : 196
Pax Dead : 0

While climbing through FL170, en route from Lyon to Berlin, the aircraft encountered a severe hail storm and sustained substantial damage. The pilot subsequently elected to return to Lyon where a safe landing was made.

21. Date of Loss : 7/17/2001

Aircraft Manufacturer : Fokker
Aircraft Type : F.28
Year of Build : 1984
Operator : TAME Ecuador
Registration : HC-BMD/FAE220
Accident Location : Tulcan Airport, Tulcan, Ecuador
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 27
Crew on Board : 6
Crew Dead : 0
Pax on Board : 70
Pax Dead : 0

On landing at Tulcan, shortly after touchdown, the aircraft began to veer to the left. The crew attempted to correct this but without success and the aircraft eventually ran off the left side of the runway. After leaving the runway the aircraft's nose and left main undercarriage failed and broke away and it came to rest against the airport perimeter fence. The accident happened in daylight (1300L) and in 'normal' weather. The aircraft was operating a flight from Quito to Cali, Colombia via Tulcan. It is understood that, marks on the runway show that, the aircraft's left main wheels were not turning from early in the landing roll.

22. Date of Loss : 7/19/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 707

Year of Build : 1967

Operator : Beta Cargo

Registration : PP-BSE

Accident Location : Guarulhos International Airport, Sao Paulo, Brazil

Service : DNC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 15

Crew on Board : 3

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

The aircraft is reported to have landed on Runway 27L at Guarulhos International Airport, Sao Paulo with its nose undercarriage retracted. The accident happened in darkness (0218L). The aircraft was operating a flight from Salvador.

23. Date of Loss : 7/21/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : MD-80

Year of Build : 1991

Operator : SAS

Registration : LN-RMT

Accident Location : in flight, Helsinki, Finland

Service : ISP

Phase of Flight : DES

Classification : Substantial Damage

Loss % : 17

Crew on Board : 6

Crew Dead : 0

Pax on Board : 57

Pax Dead : 0

While descending through about FL240 inbound to Helsinki, the aircraft encountered a severe hail storm and sustained substantial damage. The flight continued to Helsinki where a safe landing was made sometime later. The aircraft was operating a flight from Stockholm.

24. Date of Loss : 8/4/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (JT8D)

Year of Build : 1979

Operator : Canada 3000 Airlines

Registration : C-FRYG

Accident Location : in flight, (near) Cayo Largo del Sur, Cuba

Service : INP

Phase of Flight : CLB

Classification : Substantial Damage

Loss % : 15

Crew on Board : 4

Crew Dead : 0

Pax on Board : 107

Pax Dead : 0

It is reported that, shortly after take-off from Cayo Largo, as the aircraft was climbing through FL190, the oil pressure indication for the No. 2 engine began to 'flicker'. This was followed by a loss of oil pressure. The crew shut down the engine and elected to divert to Fort Lauderdale. However, sometime later, while the aircraft was holding to use up fuel, it became evident that there was a fire on the No. 2 engine. Both fire bottles were discharged but failed to extinguish the fire. Therefore, the crew decided to make an immediate, overweight, landing. During the subsequent landing at Fort Lauderdale two tyres reportedly burst but the aircraft was brought to a safe stop on the runway where an emergency evacuation was carried out. The AFS extinguished the engine fire. It is believed that a loss of oil from the gearbox resulted in overheating and a fire fed by the residual oil. The fire damaged the engine QEC, cowls, fairings etc.

25. Date of Loss : 8/19/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (NG)

Year of Build : 1999

Operator : Hamburg International

Registration : D-AHIA

Accident Location : Ataturk Airport, Istanbul, Turkey

Service : INP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 3

Crew on Board : 6

Crew Dead : 0

Pax on Board : 135

Pax Dead : 0

Following a reportedly normal ILS approach and touchdown on (Runway 24?) at Istanbul, during the landing roll the aircraft did not slow as expected and overran the end of the runway onto the stopway. However, gravel and larger stones on the surface of the stopway caused damage to its right engine, engine cowls at thrust reversers. The accident happened in daylight (1910L) but in poor weather with rain. It is reported that it had previously been dry for several weeks and that there had been recent heavy rain. Runway 24 has a concrete surface and is 2,300m long. The runway was wet with possible areas of standing water. The runway is also said to have been 'slippery' from rubber deposits. The aircraft was operating a flight from Hamburg.

26. Date of Loss : 8/24/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A330

Year of Build : 1999

Operator : Air Transat

Registration : C-GITS

Accident Location : Lajes Airport, Praia da Vitoria, Azores, Portugal

Service : INP

Phase of Flight : CRS

Classification : Substantial Damage

Loss % : 9

Crew on Board : 13

Crew Dead : 0

Pax on Board : 291

Pax Dead : 0

According to press reports, while en-route between Toronto and Lisbon the crew became aware of a fuel problem with a fuel imbalance between the right and left wings. At 0524UTC the crew reported fuel problems to ATC and advised that they were diverting to the Azores. The flight continued towards the Azores but by 0548UTC the crew had become concerned about the aircraft's fuel state and declared an emergency. 25min. later, at 0613UTC the right engine flamed out, apparently due to fuel exhaustion, followed, 13min. later (0626UTC), by the left engine. At this time, the aircraft was at FL340 some 85nm from Lajes. The RAT was deployed and the aircraft continued, unpowered, towards the airport. The flight was able to reach the airport and touched down hard and fast at 0646UTC, 20min after the second engine had been lost. Despite damage to the undercarriage, the aircraft was brought to a safe stop on the runway and an emergency evacuation carried out. The accident happened in darkness (touchdown was about 15min before dawn). It is understood that an initial inspection discovered that fuel had been leaking from a high volume/ low pressure fuel line in the right engine nacelle which it is believed may have chaffed against an adjacent hydraulic line. The right engine had apparently been changed four days earlier.

27. Date of Loss : 8/25/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A319

Year of Build : 1998

Operator : Eurowings

Registration : D-AKNH

Accident Location : Soellingen Airport, Karlsruhe/Baden Baden, Germany

Service : INP

Phase of Flight : TOF

Classification : Substantial Damage

Loss % : 4

Crew on Board : 0

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the take-off roll at Karlsruhe, large pieces of the runway surface apparently broke away and struck the aircraft's empennage and horizontal stabilizers. The take-off was completed safely and the aircraft climbed away. It would appear that the flight crew were not aware of the damage and continued with the flight to Monastir where a safe landing was made sometime later. It is understood that maintenance work had been carried out on the runway surface during the night prior to the aircraft's departure.

28. Date of Loss : 9/5/2001

Aircraft Manufacturer : BAE SYSTEMS (Avro)

Aircraft Type : RJ Avroliner

Year of Build : 1993

Operator : THY – Turkish Airlines

Registration : TC-THB

Accident Location : Ataturk Airport, Istanbul, Turkey

Service : DSP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 10

Crew on Board : 6

Crew Dead : 0

Pax on Board : 65

Pax Dead : 0

On departure from Istanbul, as the tug was being positioned to connect up for the pushback, it 'suddenly shot forward' and collided with the aircraft. The aircraft had its parking brakes on and sustained substantial damage in the impact. The aircraft was operating a service to Dalaman.

29. Date of Loss : 9/5/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 777

Year of Build : 1997

Operator : British Airways

Registration : G-VIIK

Accident Location : Denver International Airport, Denver, Colorado, USA

Service : ISP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 6

Crew on Board : 15

Crew Dead : 0

Pax on Board : 10

Pax Dead : 0

During turn around at Gate A37 at Denver, towards the start of refuelling, a fuel leak apparently developed in the vicinity of the hose/aircraft coupling and fuel sprayed out under pressure. A large fire developed and, despite being immediately attacked by hand-held extinguishers and the very quick response of the AFS, had engulfed the refuelling vehicle and done some damage to the aircraft before it was extinguished. Unfortunately, an employee of the refuelling company, ASIG, suffered extensive burns in the accident. The accident happened towards the end of passenger disembarkation following a flight from London (Gatwick) and a small number of passengers may still have been making their way out of the cabin or on the jetway when the fire started. The crew and any remaining passengers quickly evacuated the aircraft through the jetway.

30. Date of Loss : 9/6/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : DC-9

Year of Build : 1975

Operator : Aeropostal

Registration : YV-43C

Accident Location : Piarco International Airport, Port of Spain, Trinidad & Tobago

Service : ISP

Phase of Flight : GND

Classification : Substantial Damage

Loss % : 33

Crew on Board : 5

Crew Dead : 0

Pax on Board : 47

Pax Dead : 0

After landing on Runway 10 at Port of Spain, the pilot was instructed to make a 180deg. turn and backtrack the runway to Taxiway A1. At that time the aircraft had apparently come to a stop opposite the intersection with Taxiway A2 and the pilot elected to use part of the neck of the taxiway to make the turn. However, Taxiway A2 was closed due to work in progress and, during the turn, the aircraft's nose undercarriage ran into a shallow excavation on the taxiway and was torn off. At the time of the accident it was dark and the excavations on the taxiway were full of water following recent rain. The closure of Taxiway A2 had been NOTAMed but ATC apparently did not mention the work in progress when clearing the aircraft to make the 180deg. turn nor, it is claimed, was the work lighted or the taxiway closed off.

31. Date of Loss : 9/15/2001

Aircraft Manufacturer : Fokker

Aircraft Type : 100

Year of Build : 1994

Operator : TAM Linhas Aereas

Registration : PT-MRN

Accident Location : in flight, (near) Belo Horizonte, Brazil

Service : DNP

Phase of Flight : CRS

Classification : Substantial Damage

Loss % : 4

Crew on Board : 5

Crew Dead : 0

Pax on Board : 77

Pax Dead : 1

According to press reports while en route between Recife and Sao Paulo and in normal cruise flight, one of the aircraft's engines apparently suffered an uncontained failure. Debris from the engine apparently penetrated the cabin, killing one of the passengers and causing a loss of pressurization. The pilot carried out an emergency descent and diverted to Belo Horizonte where a safe landing was made sometime later.

32. Date of Loss : 11/1/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (CFMI)

Year of Build : 1999

Operator : Kenya Airways

Registration : 5Y-KQD

Accident Location : Jomo Kenyatta International Airport, Nairobi, Kenya

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 18

Crew on Board : 7

Crew Dead : 0

Pax on Board : 41

Pax Dead : 0

Following an ILS approach to Runway 06 at Nairobi, the aircraft touched down to the left of the runway centreline and then, apparently, continued further to the left. It subsequently ran off the left side of the runway some 250m. from its touchdown point and then continued, parallel to the runway, for some distance before being brought back. The aircraft was brought to a stop and an emergency evacuation was carried out. During the runway excursion, the aircraft's nose undercarriage struck a light fixture and, reportedly, both engines suffered ingestion. The accident happened in darkness (2040L). Weather, wind 080deg./10kt. and visibility 6,000m. in rain. The runway was wet. It is understood that the pilot has reported that the aircraft was struck by a gust of wind just on touchdown. The aircraft was operating a service from Entebbe.

33. Date of Loss : 11/3/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 727

Year of Build : 1967

Operator : Air Gemini

Registration : S9-BOE

Accident Location : Joaquin Kapango Airport, Cuito, Angola

Service : DNC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 50

Crew on Board : 3

Crew Dead : 0

Pax on Board : 6

Pax Dead : 0

Following a visual approach to Runway 26 at Cuito, towards the end of the landing roll, as the aircraft slowed through about 60kt., its nose undercarriage ran into an excavation on the runway and subsequently failed and collapsed rearwards. The aircraft came to rest on the runway. The accident happened in daylight but in rain. The surface of Runway 26 at Cuito is generally described as being in a poor condition but work to resurface it is being carried out and it is understood that it was an excavation associated with this work that the aircraft ran into. It is also understood that, at the time, Runway 26 had a 500m. displaced threshold and that this had been NOTAMed, however the aircraft's touchdown point on the runway is not known.

34. Date of Loss : 11/16/2001

Aircraft Manufacturer : Airbus Industrie

Aircraft Type : A321

Year of Build : 1997

Operator : Middle East Airlines

Registration : F-OHMP

Accident Location : Cairo International Airport, Cairo, Egypt

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 7

Crew on Board : 7

Crew Dead : 0

Pax on Board : 81

Pax Dead : 0

Following an ILS approach to Runway 05R at Cairo, on touchdown the aircraft suffered a hard tail strike sustaining substantial damage. The landing was completed safely and the aircraft was taxied to its gate for normal passenger disembarkation. It is reported that, as the aircraft descended through about 200ft on the approach, it 'ballooned up' and the pilot had to apply nose-down pitch to regain the glide path. Shortly after this, as the aircraft descended through about 100ft., it began to settle and the pilot apparently applied nose-up pitch to correct this. The accident happened in daylight (1250L). Wind 340deg./12kt. The aircraft was operating a flight from Beirut.

35. Date of Loss : 11/20/2001

Aircraft Manufacturer : Boeing (McDonnell-Douglas)

Aircraft Type : MD-11

Year of Build : 1994

Operator : EVA Air

Registration : B-16101

Accident Location : Chiang Kai Shek International Airport, Taipei, Taiwan

Service : ISP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 12

Crew on Board : 15

Crew Dead : 0

Pax on Board : 208

Pax Dead : 0

Following an apparently normal ILS approach to Runway 06 at Taipei, it would seem that a high rate of descent developed during the last 50ft. The aircraft touched down hard. The captain took over control from the co-pilot, who had been handling the aircraft and carried out a go-around. The aircraft flew a circuit before returning for a safe landing. The accident happened in daylight (1648L) and in fine, clear weather. The aircraft was operating a flight (BR316) from Brisbane, Australia.

36. Date of Loss : 12/17/2001

Aircraft Manufacturer : Boeing

Aircraft Type : 737 (CFMI)

Year of Build : 1990

Operator : Rio Sul

Registration : PT-SSI

Accident Location : Confins International Airport, Belo Horizonte, Brazil

Service : DSP

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 18

Crew on Board : 6

Crew Dead : 0

Pax on Board : 101

Pax Dead : 0

Following an ILS approach to Runway 16 at Confins International Airport, Belo Horizonte, the aircraft undershot, touching down about 70m. short of the runway threshold, just before the start of the stopway. The aircraft ran forward and its undercarriage struck the raised lip at the start of the stopway resulting in the left main undercarriage being torn away. The aircraft continued onto the runway and came to a rest about 1,800m. from its initial touchdown point. An emergency evacuation was carried out and a number of passengers sustained minor injuries. The accident happened in daylight but in poor weather with local thunderstorm activity. The aircraft had originally been scheduled to land at Pampulha Airport, Belo Horizonte but, on arrival, the captain had elected to divert to Confins International Airport, about 30km. away, due to bad weather at Pampulha

EASTERN-BUILT JETS OPERATIONAL HULL LOSS

1. Date of Loss : 5/17/2001

Aircraft Manufacturer : Yakovlev
Aircraft Type : Yak-40
Year of Build : 1977
Operator : Qeshm Airlines
Registration : EP-TQP
Accident Location : (near) Sari, Iran
Service : DNP
Phase of Flight :
Classification : Total Loss
Loss % : 100
Crew on Board : 5
Crew Dead : 5
Pax on Board : 25
Pax Dead : 25

The circumstances of the accident are unclear, however, it would seem that the aircraft was intended to take a party of government officials and MPs from Tehran to Gorgan on the occasion of the opening of a new airport at the town. However, on arrival, it was apparently unable to land due to poor visibility and the pilot elected to divert to Sari which is located about halfway between Gorgan and Tehran. The aircraft was apparently also unable to land at Sari due to bad weather and the pilot advised ATC that he was returning to Tehran. This was the last contact with the aircraft which was later found to have crashed in a mountainous area about 10sm South of Sari. The accident happened in daylight (0745L).

2. Date of Loss : 7/4/2001

Aircraft Manufacturer : Tupolev
Aircraft Type : Tu-154
Year of Build : 1986
Operator : Vladivostok Air
Registration : RA-85845
Accident Location : (near) Irkutsk, Russia
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 9
Crew Dead : 9
Pax on Board : 136
Pax Dead : 136

The aircraft was destroyed when it crashed while turning onto the base leg of the approach to Irkutsk. The wreckage appears to have been contained in a small area and it would seem that the aircraft impacted in a flat attitude. Last contact with the flight was when the pilot reported that they had the runway in sight. The accident happened at night (0210L) but in ‘normal’ weather. The aircraft was operating a service from Ekaterinburg.

3. Date of Loss : 7/14/2001

Aircraft Manufacturer : Ilyushin
Aircraft Type : Il-76
Year of Build : 1984
Operator : Russ Air Transport Company
Registration : RA-76588
Accident Location : Chkalovsky, (near) Moscow, Russia
Service : DNC
Phase of Flight : TOF
Classification : Total Loss
Loss % : 100
Crew on Board : 10
Crew Dead : 10
Pax on Board : 0
Pax Dead : 0

The aircraft was destroyed when it crashed shortly after take-off, coming down in woods about 1.5km. beyond the end of the runway. The aircraft impacted in a 50 to 60deg. nose down attitude and with a slight bank to the left. There was no distress call and the take-off roll and lift off had appeared normal. The accident happened in daylight (0853L). Weather; wind 200deg./1m. per sec., overcast ceiling and visibility 500 to 900m. in fog. The aircraft was operating a flight to Norilsk.

4. Date of Loss : 9/21/2001

Aircraft Manufacturer : Ilyushin
Aircraft Type : Il-86
Year of Build : 1985
Operator : Aeroflot Russian Airlines
Registration : RA-86074
Accident Location : Dubai International Airport, Dubai, United Arab Emirates
Service : ISP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 14
Crew Dead : 0
Pax on Board : 307
Pax Dead : 0

Following an ILS approach to Runway 30R at Dubai, flown manually by the co-pilot, the aircraft landed with its undercarriage retracted. The accident happened in darkness but in ‘normal’ weather. The aircraft was operating a flight from Moscow. It is believed that the crew forgot to lower the undercarriage. Additionally, it would appear that, at some time prior to touchdown, the cockpit warning system had been disarmed.

5. Date of Loss : 10/4/2001

Aircraft Manufacturer : Tupolev
Aircraft Type : Tu-154
Year of Build : 1990
Operator : Sibir Airlines
Registration : RA-85693

Accident Location : In Black Sea, 180km South of Sochi, Russia
Service : INP
Phase of Flight : CRS
Classification : Total Loss
Loss % : 100
Crew on Board : 12
Crew Dead : 12
Pax on Board : 66
Pax Dead : 66

The aircraft was destroyed when it went out of control and crashed into the waters of the Black Sea while en route from Tel Aviv, Israel to Novosibirsk, Russia. The aircraft had apparently been in normal cruise flight at 11,000 metres (about 36,000ft) when ATC heard the pilot 'cry out'. Contact was then lost. The pilot of another aircraft, flying at a lower altitude, is understood to have seen 'an explosion on the plane' above him. The aircraft then fell into the sea. It is believed that the aircraft was accidently brought down by an S200 SAM, which had been launched during exercises being conducted by Ukrainian defence forces.

EASTERN-BUILT JETS OPERATIONAL SUBSTANTIAL DAMAGE

1. Date of Loss : 4/18/2001

Aircraft Manufacturer : Ilyushin
Aircraft Type : Il-76
Year of Build : 1989
Operator : Yuzhnoe
Registration : UR-78821
Accident Location : Ostend Airport, Ostend, Belgium
Service : INC
Phase of Flight : TOF
Classification : Substantial Damage
Loss % : 0
Crew on Board : 8
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

During the take-off run on Runway 26 at Ostend, at about V1, there was reportedly a 'fire warning' on one of the aircraft's engines. The pilot elected to abort the take-off but the aircraft was not stopped before the end of the runway and overran. After leaving the runway the aircraft's nose undercarriage dug in and collapsed.

2. Date of Loss : 9/5/2001

Aircraft Manufacturer : Tupolev
Aircraft Type : Tu-154
Year of Build : 1993
Operator : Uzbekistan Airways
Registration : UK-85776
Accident Location : Ufa Airport, Ufa, Russia
Service : ISP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 0
Crew on Board : 10
Crew Dead : 0
Pax on Board : 106
Pax Dead : 0

On departure from Ufa, when the undercarriage was selected up, the right main undercarriage did not retract. The crew elected to dump fuel and return to Ufa. During the subsequent landing the right main undercarriage collapsed.

3. Date of Loss : 10/21/2001

Aircraft Manufacturer : Yakovlev
Aircraft Type : Yak-40
Year of Build : 1974
Operator : Kyrghyzstan Airlines
Registration : EX-87470
Accident Location : Osh Airport, Osh, Kyrgyzstan
Service : DSP
Phase of Flight : TOF

Classification : Substantial Damage

Loss % : 0

Crew on Board : 5

Crew Dead : 0

Pax on Board : 33

Pax Dead : 0

During the take-off roll, the aircraft reportedly would not rotate and the pilot elected to abort the take-off. The aircraft was not stopped before the end of the runway and overran, eventually coming to rest in a ditch.

WESTERN-BUILT TURBOPROPS OPERATIONAL HULL LOSS

1. Date of Loss : 2/4/2001

Aircraft Manufacturer : Bombardier (Shorts)

Aircraft Type : 360

Year of Build : 1984

Operator : Aer Arann Express

Registration : EI-BPD

Accident Location : City Airport, Sheffield, United Kingdom

Service : ISP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 71

Crew on Board : 3

Crew Dead : 0

Pax on Board : 25

Pax Dead : 0

Following an apparently normal ILS/DME approach to Runway 28 at Sheffield, as the commander, who was the handling pilot, commenced the landing flare, the aircraft's rate of descent increased significantly and it subsequently touched down hard in a left wing low attitude. The aircraft then bounced and came down nosewheel first. The landing roll was completed but, as the aircraft slowed, it began to veer towards the left, apparently due to the collapse of the left main undercarriage, which had been damaged in the touchdown. The aircraft ran off the left side of the runway and ground looped before coming to rest at the side of the runway about 700m. from its touchdown point. The accident happened in darkness (1921L). Weather, wind, variable at 2kt., visibility 4,000m. in rain, clouds, few at 500ft. and broken at 1,600ft. The aircraft was operating a flight from Dublin. The AAIB's analysis showed that the flight had been conducted in a 'thoroughly professional manner in accordance with the operator's normal procedures' until the final stages of the approach. The flight crew believed that, during the landing flare, the power levers had been in the flight idle position and neither were aware of any unusual control inputs. However, CVR/FDR data shows that, three seconds before touchdown, the propeller blade angle changed from the flight range to the ground range. The aircraft subsequently lost speed and descended rapidly. No faults could be found with the aircraft systems – the propeller control rigging and the operation of the flight idle baulk were correct. Selection of ground fine pitch requires the pilot to firstly release the flight idle baulk and then lift and pull the propeller levers further back. This combined action rapidly becomes a programmed motor skill in the routine of daily operations. The AAIB therefore believes that it is possible that the handling pilot unintentionally selected the propellers into the ground fine position while still in the air without realizing it.

2. Date of Loss : 2/10/2001

Aircraft Manufacturer : A.S.T.A. (GAF)

Aircraft Type : Nomad

Year of Build : 1978

Operator : Gum Air

Registration : PZ-TBP

Accident Location : (near) Jakobkondre, Suriname

Service : DNP

Phase of Flight : APP

Classification : Total Loss

Loss % : 100

Crew on Board : 1

Crew Dead : 1

Pax on Board : 9

Pax Dead : 9

The aircraft was destroyed when it apparently flew into the side of a hill during the approach to Jakobkondre. The point of impact was said to be about two miles from the town. The accident happened in daylight. The aircraft was operating a flight from Paramaribo.

3. Date of Loss : 2/27/2001

Aircraft Manufacturer : Bombardier (Shorts)

Aircraft Type : 360

Year of Build : 1987

Operator : Loganair

Registration : G-BNMT

Accident Location : Firth of Forth, (near) Granton, Scotland, United Kingdom

Service : DNC

Phase of Flight : CLB

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 0

Pax Dead : 0

Shortly after take-off from Runway 06 at Edinburgh, the pilot broadcast a Mayday and reported that 'both engines had flamed out.' Shortly after this he advised that he was going to ditch. The pilot appears to have attempted a forced landing on the foreshore of the Firth of Forth but the aircraft apparently impacted hard in a nose down attitude about 100m. off shore and was destroyed. The take-off and initial climb had appeared normal and power was reduced on the engines to 'climb power' as the aircraft climbed through 1,200ft. At 2,200ft. amsl. the aircraft's anti-icing systems were selected on. Three seconds later the torque on each engine reduced rapidly to zero. The interval between the failure of the two engines was so very short (about 0.37sec.) that it is thought likely to have resulted from a common event. The accident happened at 1731L in clear weather. The aircraft was operating a mail flight to Belfast. It had arrived at Edinburgh in the early hours of the morning and been parked on Stand 31 on a heading of 034deg. M. During most of the night while the aircraft was on the ground a strong NE wind was blowing with light to moderate snow. Engine blanks had not been fitted and it is thought probable that snow had accumulated in the engine air intake systems. This snow may not have cleared during the day after it stopped snowing nor during the engine start up and taxy. One possibility under investigation is that the mechanism which operates the anti-icing separator vanes in the engine air intake trunking may have interacted in some way with residual ice, snow or slush causing the engine power loss.

4. Date of Loss : 3/17/2001

Aircraft Manufacturer : Raytheon

Aircraft Type : 1900

Year of Build : 1991

Operator : SAL Express

Registration : S9-CAE

Accident Location : (near) Lubango, Angola

Service : DNP

Phase of Flight : APP

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 15

Pax Dead : 14

The aircraft was destroyed when it impacted high ground while descending for an approach to Runway 10 at Lubango. The point of impact was at about the 6,500ft. level (about 700 – 750ft. above the airfield elevation) on a low saddle between two 8,000ft. high hills some 10nm. to the North of the airfield. Approaching from the North, the ground rises steeply up to the saddle. The location is understood to be on the normal VFR approach path for a landing on Runway 10. The aircraft impacted at high speed. On arrival at Lubango, the pilot contacted ATC at 0819 and reported being 30nm. from the airfield at FL200, 'just starting descent.' ATC advised the flight that the runway in use was Runway 10. Four minutes later, at 0823, ATC attempted to pass weather information to the flight but received no reply. The surviving passenger reported that the flight had appeared to be normal up to the point of impact. The accident happened in daylight. Weather, wind 120deg/6kt., visibility 10km., cloud, 1/8 at 7,500m., 1/8 at 3,500m. and 2/8 at 600m. but increasing to 5/8 at 600m. on the high ground surrounding the airport. Airfield elevation is 5,778ft. There is understood to be an NDB at Lubango but the VOR there is apparently unserviceable. The aircraft was operating a flight from Luanda.

5. Date of Loss : 3/24/2001

Aircraft Manufacturer : Bombardier (de Havilland)

Aircraft Type : DHC-6 Twin Otter

Year of Build : 1969

Operator : Air Caraibes

Registration : F-OGES

Accident Location : (near) St.Barthelemy Airport, St.Barthelemy, Guadeloupe

Service : ISP

Phase of Flight : APP

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 17

Pax Dead : 17

During the final stage of what has been described as a 'normal' approach to Runway 10 at St.Barthelemy, shortly after crossing the shoreline, the aircraft was seen to go into a steep left turn. It then rapidly lost height and crashed into a house between the towns of Public and Corossol. The point of impact was on the Western slope of the Col de la Tourmente about 600m. from the runway threshold and to the left of the extended centre line. The accident happened in daylight (1630L) and in fine weather. The aircraft was operating a flight (TX1501) from St.Maarten. It is understood that an initial inspection of the aircraft's engines and propellers has shown that both engines were operating and that both propellers were within their normal range at impact.

6. Date of Loss : 6/14/2001

Aircraft Manufacturer : Bombardier (de Havilland)
Aircraft Type : Dash 8
Year of Build : 1990
Operator : Wideroe's Flyveselskap
Registration : LN-WIS
Accident Location : Batsfjord Airport, Batsfjord, Norway
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 62
Crew on Board : 3
Crew Dead : 0
Pax on Board : 24
Pax Dead : 0

During a LOC/DME approach to Runway 21 at Batsfjord, being flown by the co-pilot, the aircraft was, reportedly, levelled off at 375ft., at which height it was said to be 'in and out of the bottom of the cloud.' The decision was taken to continue with the approach but at 1nm. the pilot apparently elected to take over for the landing. During the last part of the approach, a high sink rate developed and the aircraft touched down hard causing its right main undercarriage to fail. The aircraft ground looped and came to rest part way off the runway. The accident happened in daylight (1610L) but in poor weather, apparently at or close to the landing minima. Wind 060deg./9kt., visibility 1,000m. and cloud base (400ft.?)

7. Date of Loss : 6/15/2001

Aircraft Manufacturer : Transall
Aircraft Type : C-160
Year of Build : 1985
Operator : Manunggal Air
Registration : PK-VTP
Accident Location : Sentani Airport, Jayapura, Irian Jaya, Indonesia
Service : DNC
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 0
Pax on Board : 16
Pax Dead : 1

On departure from Jayapura en route to Wamena, as the aircraft climbed through about 4,000ft., its No.2 engine is said to have developed a control problem and its LP RPM apparently could not be reduced below 14,200 (?). The pilot subsequently elected to return to Jayapura and carried out a normal approach to Runway 30. However, during the landing, when ground idle was selected, the No.2 engine apparently did not respond. Directional control was lost and the aircraft ran off the left side of the runway. It subsequently ran across a drainage ditch and struck a number of palm trees before eventually coming to rest at a point 72m to the left of the runway and 1,050m. from the landing threshold. The accident happened in daylight (about 1430L). Weather was said not to be a factor.

8. Date of Loss : 6/18/2001

Aircraft Manufacturer : ATR
Aircraft Type : ATR 42
Year of Build : 1987
Operator : Israir
Registration : 4X-ATK
Accident Location : Ben Gurion International Airport, Tel Aviv, Israel
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 36
Crew on Board : 3
Crew Dead : 0
Pax on Board : 39
Pax Dead : 0

The aircraft's right main undercarriage failed to extend when it was selected down on approach and the landing was made with it retracted. It is believed that the undercarriage up-lock mechanism failed to unlock.

9. Date of Loss : 6/25/2001

Aircraft Manufacturer : Embraer
Aircraft Type : EMB-110 Bandeirante
Year of Build : 1980
Operator : Avtex Air Services Pty Ltd
Registration : VH-OZG
Accident Location : Cootamundra Airport, Cootamundra, New South Wales, Australia
Service : DNP
Phase of Flight : CRS
Classification : Total Loss
Loss % : 100
Crew on Board : 1
Crew Dead : 0
Pax on Board : 9
Pax Dead : 0

While en route between Sydney and Griffith and in normal cruise flight at 10,000ft. about 60 to 70 miles Northeast of Young, the aircraft's right generator tripped off line. The pilot reset the generator normally but about 5 to 10min later the generator tripped again and the fire warning came on for the right engine. The pilot shut down the engine and used the engine fire extinguisher to put the fire out. He subsequently elected to make a precautionary landing and diverted, initially, towards Young. Shortly after this the fire warning on the right engine came on again. The pilot isolated the right electrical system while continuing towards Young. Meanwhile smoke had begun to enter the cabin. On arrival at Young, the pilot was unable to land due to poor visibility there and he elected to continue towards Cootamundra, which was about 9min flying time away, but with the intention of carrying out a landing at any clear area en route. In the event, the only area clear of fog was the airfield at Cootamundra and an approach was commenced. During the approach the smoke entering the cabin became worse. The aircraft touched down safely although the tyre on the right wheel had failed due to heat damage, but, during the landing roll, the nose and left main undercarriage collapsed. The aircraft slid forward for about 400m. before it ground looped and came to rest at the edge of the runway. Pilot and passengers evacuated the aircraft safely and the local AFS put out the fire on the right engine. The cause of the fire has yet to be determined but it appears to have started in the accessories section of the engine.

10. Date of Loss : 7/24/2001

Aircraft Manufacturer : BAE SYSTEMS (BAC)
Aircraft Type : Viscount
Year of Build : 1957
Operator : Transtel
Registration : 3D-OHM
Accident Location : N'Djamena Airport, N'Djamena, Chad
Service : Ferry
Phase of Flight : TOF
Classification : Total Loss
Loss % : 100
Crew on Board : 2
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

It is reported that during the take-off roll on Runway 23 at N'Djamena, at around VR, directional control was lost and the aircraft began to veer to one side. The pilot elected to abort the take-off but failed to regain control and the aircraft ran off the left side of the runway onto rough, scrub covered ground. Its undercarriage did not collapse and it was eventually brought to a safe stop after a ground run of some 800m. However, during the runway excursion three of the aircraft's propellers were destroyed and the No: 1 and No: 3 engines damaged, apparently rendering it uneconomical to repair. The accident happened in daylight and in 'normal' weather. Wind 180deg/15kt. The crew are understood to have attributed the loss of directional control to 'crosswinds'. The aircraft was positioning to Lome, Togo.

11. Date of Loss : 8/29/2001

Aircraft Manufacturer : CASA
Aircraft Type : CN-235
Year of Build : 1990
Operator : Binter Mediterraneo
Registration : EC-FBC
Accident Location : Pablo Ruiz Picasso Airport, Malaga, Spain
Service : DSP
Phase of Flight : APP
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 1
Pax on Board : 44
Pax Dead : 3

During the final approach to Runway 32 at Malaga the aircraft seems to have developed a problem with its left engine. The engine was shut down and the propeller feathered but, meanwhile, the aircraft's rate of descent appears to have increased and it undershot. The aircraft touched down hard on open ground and then ran forward until it struck the low embanked side of the N340 Highway about 150 to 200m short of the runway threshold. The accident happened in daylight and in good weather. The aircraft was operating a flight from Melilla.

12. Date of Loss : 9/6/2001

Aircraft Manufacturer : Saab
Aircraft Type : 340
Year of Build : 1990
Operator : Aerolitoral
Registration : XA-ACK
Accident Location : Los Dos Hermanos Ranch, (near) Tijuana, Mexico
Service : DSP
Phase of Flight : DES
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 0
Pax on Board : 29
Pax Dead : 0

The aircraft reportedly lost power on both engines while descending inbound to Tijuana and was substantially damaged in the subsequent forced landing on farm land some 15 miles from the town. The accident happened in daylight and in good weather – CAVOK. The aircraft was operating a flight from Ciudad Juarez. (Fuel exhaustion?)

13. Date of Loss : 10/11/2001

Aircraft Manufacturer : Fairchild (Swearingen)
Aircraft Type : Metro
Year of Build : 1978
Operator : Perimeter Airlines
Registration : C-GYPA
Accident Location : Shamattawa Airport, Shamattawa, Manitoba, Canada
Service : DNP
Phase of Flight : GOA
Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 1

Pax Dead : 0

The aircraft was operating a medivac flight to collect a patient from Shamattawa. It was seen to carry out an approach to Runway 01 at the airport but then started a go-around. Shortly after this the aircraft crashed in scrub about 1.6km. to the North of the airport. The accident happened in darkness (2332L).

14. Date of Loss : 11/27/2001

Aircraft Manufacturer : Fairchild (Swearingen)

Aircraft Type : Metro

Year of Build : 1977

Operator : Aerocassa Servicios Aereos SA

Registration : LV-WSD

Accident Location : Comandante Espora Airport, Bahia Blanca, Argentina

Service : DNC

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

After a normal approach and touchdown on Runway 16L at Bahia Blanca, directional control was lost towards the end of the landing roll and the aircraft ran off the right side of the runway onto soft ground. After leaving the runway, the aircraft's nose undercarriage dug in and collapsed rearwards. The accident happened in daylight (0500L) and in normal weather. The aircraft was operating a cargo flight from Buenos Aires.

15. Date of Loss : 11/30/2001

Aircraft Manufacturer : BAE SYSTEMS (Jetstream)

Aircraft Type : Jetstream 31/S31

Year of Build : 1984

Operator : European Executive Express

Registration : SE-LGA

Accident Location : Geiteryggen Airport, Skien, Norway

Service : DSP

Phase of Flight : LDG

Classification : Total Loss

Loss % : 100

Crew on Board : 3

Crew Dead : 0

Pax on Board : 10

Pax Dead : 0

Following a LOC/DME approach to Runway 19 at Skien, the aircraft appears to have touched down hard in a left wing low attitude and the left propeller struck the runway. The aircraft veered to the left and ran off the side of the runway. It continued for some 350m. before impacting a steep embankment. The accident happened in darkness (1830L).

16. Date of Loss : 12/6/2001

Aircraft Manufacturer : Convair

Aircraft Type : CVY 580

Year of Build : 1967

Operator : Trans Air Link

Registration : N582HG

Accident Location : Sunny Isles Beach FL

Service : Ferry

Phase of Flight : CRS

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

The aircraft was operating a short positioning flight from Hollywood International Airport, Fort Lauderdale to Opa Locka, which is located about 10 miles further South. After take-off from Runway 09L at Fort Lauderdale, the aircraft climbed to a height of 2,000ft. and continued on a heading of 100deg. out, over the sea. About 1min. after crossing the shore line the flight was given a heading of 270deg. back towards the coast but, shortly after this, the crew noticed a change in engine noise. The co-pilot checked the RPM and fuel gauges and noted that the indication for the right engine RPM was fluctuating and no longer in the 'green.' The right fuel gauge was also fluctuating, dropping to zero before returning to the original reading. At that time the left fuel and RPM indications appeared to be normal. The crew decided to shut down the right engine and then began to cross feed fuel from the right fuel tank to the left. The flight continued towards Opa Locka but then the RPM indication for the left engine began to fluctuate. Power was lost on the left engine and the crew therefore decided to turn back towards the sea in order to ditch. After crossing the coast the pilot made a right turn to fly parallel to the beach. He subsequently carried out a forced landing in the sea just off the beach at Sunny Isles, which is a few miles due East of Opa Locka. The crew were able to escape without serious injury and were later rescued. The aircraft was later driven onto the beach by the waves and destroyed. The aircraft was apparently airborne for about seven minutes. The accident happened in darkness (2258L) but in VMC.

Prior to departure from Fort Lauderdale, the co-pilot checked the fuel in each tank using the MFLIs (Magnetic Fuel Level Indicators) and noted a total of about 2,200 lb. He then checked the fuel gauges, which indicated about 200 lb. more fuel. He estimated that the flight to Opa Locka would require 1,900 lb of fuel.

WESTERN-BUILT TURBOPROPS OPERATIONAL SUBSTANTIAL DAMAGE

1. Date of Loss : 1/15/2001

Aircraft Manufacturer : Bombardier (de Havilland)
Aircraft Type : Dash 8
Year of Build : 1997
Operator : UNI Air
Registration : B-15235
Accident Location : Shang-Yi Airport, Kinmen, Taiwan
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 43
Crew on Board : 4
Crew Dead : 0
Pax on Board : 23
Pax Dead : 0

On landing on Runway 06 at Kinmen, the aircraft apparently touched down hard causing both main undercarriages to fail and collapse. The aircraft remained on the runway and came to rest after a ground slide of several hundred metres. The accident happened in daylight (1120L). Weather, wind 040deg./15kt. gusting to 25kt., visibility 7km. and broken cloud at 3,500ft. The aircraft was operating a flight from Tainan.

2. Date of Loss : 1/18/2001

Aircraft Manufacturer : Fokker
Aircraft Type : 50
Year of Build : 1993
Operator : Air Nostrum
Registration : EC-GRZ
Accident Location : Barajas Airport, Madrid, Spain
Service : DSP
Phase of Flight : GND
Classification : Substantial Damage
Loss % : 11
Crew on Board : 0
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

During turn around, some minor maintenance work was being carried out in the cockpit, which apparently required the undercarriage selector lever to be moved to the 'up' position. Prior to moving the lever the undercarriage safety pins were put into position. Sometime later, but while the engineers were still working, the flight crew boarded the aircraft. The co-pilot then decided to carryout a walk round inspection during which he noted that the safety pins were in place. He reportedly removed the pins. Shortly after this the undercarriage retracted.

3. Date of Loss : 1/18/2001

Aircraft Manufacturer : Bombardier (de Havilland)
Aircraft Type : DHC-6 Twin Otter
Year of Build : 1966
Operator : GT Air
Registration : PK-LTZ
Accident Location : Enarotali Airport, Enarotali, Irian Jaya, Indonesia
Service : DNP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 13
Crew on Board : 2
Crew Dead : 0
Pax on Board : 3
Pax Dead : 0

During the landing roll at Enarotali, reportedly, the crew were unable to obtain reverse thrust and, during heavy wheel braking, directional control was lost. The aircraft veered to the right and then back, 'sharply' to the left. During attempts to regain control the aircraft's right wing tip struck the ground sustaining substantial damage. The aircraft was eventually brought to a halt on the left edge of the runway some 150m. before its end. The accident happened in daylight and apparently in normal weather. The aircraft was operating a mixed passenger/cargo flight from Nabire. It is reported that ground testing of the reverse thrust failed to discover any problems with the system.

4. Date of Loss : 2/10/2001

Aircraft Manufacturer : Raytheon
Aircraft Type : 1900
Year of Build : 1994
Operator : Great Lakes Airlines
Registration : N97UX
Accident Location : O'Hare International Airport, Chicago, Illinois, USA
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 14
Crew on Board : 2
Crew Dead : 0
Pax on Board : 15
Pax Dead : 0

The aircraft was used to operate the Springfield – Chicago sector of a flight, which had originated at Lafayette. A change of aircraft was made at Springfield in order to position it to a maintenance facility to rectify a number of MEL items including 'Flap System inoperative' and 'GPWS Modes 1-4 inoperative.' Before departure the crew performed a preflight inspection and a systems check during a ground run. They subsequently determined the aircraft to be 'airworthy' and accepted the passengers for the flight to Chicago. After a routine flight, on arrival at Chicago, the aircraft was cleared for an approach to Runway 04R. During the approach the crew used the Abnormal Procedures : Flaps Up Landing Checklist due to the flap system being inoperative and, on short final, apparently carried out the Final Checklist. The approach was continued, however, on touchdown there was a bang and 'loud scratching noises.' As the aircraft was coming to rest, the co-pilot commented that he thought the undercarriage had collapsed. At that point the captain noticed that the undercarriage was in the 'up' position.

5. Date of Loss : 3/2/2001

Aircraft Manufacturer : ATR
Aircraft Type : ATR 42
Year of Build : 1989
Operator : Royal Air Maroc
Registration : CN-CDV
Accident Location : Mohammed V International Airport, Casablanca, Morocco
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 18
Crew on Board : 4
Crew Dead : 0
Pax on Board : 30
Pax Dead : 0

The aircraft's nose undercarriage failed and collapsed following a reported hard landing. The accident happened in daylight but in reduced visibility due to fog.

6. Date of Loss : 5/29/2001

Aircraft Manufacturer : Fairchild (Swearingen)
Aircraft Type : Metro
Year of Build : 1989
Operator : OLT – Ostfriesische Lufttransport
Registration : D-COLB
Accident Location : Lahti Airport, Lahti, Finland
Service : INP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 20
Crew on Board : 2
Crew Dead : 0
Pax on Board : 7
Pax Dead : 0

The aircraft was substantially damaged in a hard landing.

7. Date of Loss : 6/5/2001

Aircraft Manufacturer : Fokker
Aircraft Type : F.27
Year of Build : 1983
Operator : Channel Express
Registration : G-CEXF
Accident Location : in flight, (near) St. Helier, Jersey, United Kingdom
Service : DNC
Phase of Flight : CLB
Classification : Substantial Damage
Loss % : 43
Crew on Board : 3
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

The aircraft reportedly suffered an uncontained engine failure and fire shortly after take-off from Jersey. The fire was extinguished and the aircraft returned to Jersey where it landed safely. The aircraft was operating a service to Bournemouth.

8. Date of Loss : 9/14/2001

Aircraft Manufacturer : Raytheon
Aircraft Type : 1900
Year of Build : 1984
Operator : Skylink Express
Registration : C-GSKC
Accident Location : St.Johns International Airport, St.Johns, Newfoundland, Canada
Service : DNC
Phase of Flight : TOF
Classification : Substantial Damage
Loss % : 88
Crew on Board : 2
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

Following an apparently normal take-off roll and rotation on Runway 11 at St.Johns, after getting airborne, the crew felt that the aircraft had entered a higher than normal nose-up attitude. The aircraft climbed to a height of between 150 and 200ft. at which point the crew elected to abort the take-off and land on the remaining length of the runway. They reduced power and lowered the nose, however, the aircraft then descended rapidly and touched down very hard. The accident happened in darkness (2130L) and in poor weather. Wind 112deg./25kt., gusting to 35kt., visibility 0.5 miles in rain and fog and a low cloud base. The initial investigation found that the aircraft was loaded within limits and that the elevator trim was set to two divisions nose-up (out of six). No faults were found with the aircraft's systems. (Dark, no external visual reference)

9. Date of Loss : 10/16/2001

Aircraft Manufacturer : Embraer
Aircraft Type : emb-120
Year of Build : 1989
Operator : Alaska Central
Registration : N120AX
Accident Location :
Service : DNC
Phase of Flight : APP
Classification : Substantial Damage
Loss % : 0
Crew on Board : 2
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

Following a LOC/DME back course approach to Runway 36 at Bethel, the aircraft undershot, impacting the ground about 3.5 miles short of the runway. The accident happened in darkness (2130L) and in IMC. Wind 060deg./22kt., gusting to 28kt., visibility 1 mile in mist and snow and cloud, 800ft. broken and 3,500ft. overcast. The aircraft was operating a flight from Anchorage.

10. Date of Loss : 11/22/2001

Aircraft Manufacturer : Bombardier (de Havilland)
Aircraft Type : Dash 8
Year of Build : 1994
Operator : Wideroe's Flyveselskap
Registration : LN-WIG
Accident Location : Bringeland Airport, Forde, Norway
Service : DSP
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 27
Crew on Board : 3
Crew Dead : 0
Pax on Board : 14
Pax Dead : 0

Following a VOR/DME approach, during the landing flare, the aircraft's rate of descent increased and it touched down very hard. sustaining substantial damage. The approach had been flown with a tailwind component and it is believed that this had suddenly increased as the aircraft entered the flare. The aircraft was operating a flight from Oslo.

11. Date of Loss : 12/2/2001

Aircraft Manufacturer : Fairchild/Dornier
Aircraft Type : 328
Year of Build : 1994
Operator : OLT – Ostfriesische Lufttransport
Registration : D-CATS
Accident Location : Bremen Airport, Bremen, Germany
Service : Ferry
Phase of Flight : LDG
Classification : Substantial Damage
Loss % : 90
Crew on Board : 2
Crew Dead : 0
Pax on Board : 0
Pax Dead : 0

After a normal approach and touchdown, towards the end of the landing roll, following cancellation of reverse thrust at about 60kt., directional control was lost. The aircraft veered off the side of the runway and came to rest with its left main undercarriage collapsed. It would appear that the undercarriage failed in overload as the result of the side forces on it following the loss of control. The aircraft was positioning from Braunschweig.

EASTERN-BUILT TURBOPROPS OPERATIONAL HULL LOSS

1. Date of Loss : 1/23/2001

Aircraft Manufacturer : Let
Aircraft Type : L-410 Turbolet
Year of Build : 1985
Operator : Air Eagle
Registration : 9L-LCG
Accident Location : (near) Maiduguri, Nigeria
Service : DNP
Phase of Flight : CRS
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 0
Pax on Board : 15
Pax Dead : 0

Reports of the circumstances of the accident are confused, however, it would seem that, while the flight was enroute from Jos to Maiduguri, the visibility at Maiduguri had deteriorated significantly. When the pilot first contacted Maiduguri ATC at a position about 13nm. from the town, he was reportedly told that conditions were below the landing minima and advised to divert. He reportedly replied that he did not have enough fuel to divert. Some reports suggest that the flight then held for some time in the Maiduguri area and also that there may have been communication problems but this has not been confirmed. It is apparently generally assumed that, with fuel running low, the pilot eventually elected to carryout a forced landing on farm land some 12km. from Maiduguri. The accident happened in darkness (2230L) and in reduced visibility in sand haze. The aircraft had been chartered by ThisDay newspaper for a 'meet the nation' tour.

2. Date of Loss : 8/23/2001

Aircraft Manufacturer : WSK-PZL Mielec
Aircraft Type : An-28
Year of Build : 1989
Operator : Agefreco Air
Registration : 3C-LLA
Accident Location : (near) Bukavu, Congo (Democratic Republic)
Service : DNP
Phase of Flight : TOF
Classification : Total Loss
Loss % : 100
Crew on Board : 2
Crew Dead : 2
Pax on Board : 9
Pax Dead : 5

The aircraft was operating a flight from Kama to Bukavu, a distance of about 225km. Reportedly, about 8 min. after take-off from Kama, one of the aircraft's engines failed. The pilot subsequently elected to continue to Bukavu rather than returning to Kama or diverting to another, nearby strip. However, as the flight neared its destination it appears to have suddenly lost height ('plunged'] and crashed into trees. The point of impact is said to be about 12 miles from Bukavu. The accident happened in daylight and in 'normal weather'.

3. Date of Loss : 9/12/2001

Aircraft Manufacturer : Let
Aircraft Type : L-410 Turbolet
Year of Build : 1989
Operator : Aeroferinco
Registration : XA-ACM
Accident Location : (near) Chichen Itza, Mexico
Service : DNP
Phase of Flight : TOF
Classification : Total Loss
Loss % : 100
Crew on Board : 2
Crew Dead : 2
Pax on Board : 17
Pax Dead : 17

Following an apparently normal take-off and initial climb from Chichen Itza, the pilot reported reaching 1,500ft and then commenced a turn towards the east as expected. However this turn continued, the aircraft lost height and crashed, impacting the ground at a point about 4sm NE of the airport. The accident happened in daylight (1625L) and apparently in 'normal' weather. The aircraft was operating a flight to Cozumel.

4. Date of Loss : 9/18/2001

Aircraft Manufacturer : Let
Aircraft Type : L-410 Turbolet
Year of Build : 1986
Operator : Atlantic Airlines
Registration : TG-CFE
Accident Location : La Aurora Airport, Guatemala City, Guatemala
Service : INP
Phase of Flight : TOF
Classification : Total Loss
Loss % : 100
Crew on Board : 2
Crew Dead : 1
Pax on Board : 11
Pax Dead : 8

The aircraft was destroyed when it lost height and pancaked onto the ground shortly after getting airbone from Runway 01 at Guatemala City. The aircraft came to rest on the grass just to the left of the runway, between taxiways X and Y, about 550m short of the departure end. The accident happened in daylight (0730L) and apparently in normal weather. Wind 030deg/6kt. The aircraft was operating a flight to San Pedro Sula, Honduras.

5. Date of Loss : 11/19/2001

Aircraft Manufacturer : Ilyushin
Aircraft Type : Il-18
Year of Build : 1962
Operator : IRS Aero
Registration : RA-75840
Accident Location : (near) Kalyazina, Russia
Service : DNP
Phase of Flight : CRS
Classification : Total Loss
Loss % : 100
Crew on Board : 9
Crew Dead : 9
Pax on Board : 18
Pax Dead : 18

The aircraft was destroyed when it apparently went out of control and crashed while en route from Khatanga to Moscow. The point of impact was in a wooded area about 20km. from Kalyazina, some 160km. North of Moscow. Prior to the accident the aircraft had appeared to be in normal cruise flight at 7,800m. There was no distress call. The accident happened in darkness (2119L).

6. Date of Loss : 11/23/2001

Aircraft Manufacturer : WSK-PZL Mielec
Aircraft Type : An-28
Year of Build : 1986
Operator : Enimex
Registration : ES-NOV
Accident Location : Palade, Hiiumaa Island, Estonia
Service : DSP
Phase of Flight : LDG
Classification : Total Loss
Loss % : 100
Crew on Board : 3
Crew Dead : 0
Pax on Board : 14
Pax Dead : 2

The aircraft was destroyed when it lost height and crashed during the final stage of an NDB approach to Runway 32 at Kardla. The aircraft came down on flooded ground about 2km. short of the runway threshold. The accident happened in darkness (1835L) and in poor weather. Wind 020deg./22kt., visibility 10km. in rain, cloud overcast at 900ft., humidity 100% and temp. and dew point -0C. The aircraft was operating a scheduled service (on behalf of ELK?) from Tallinn.

7. Date of Loss : 11/27/2001

Aircraft Manufacturer : Let
Aircraft Type : L-410 Turbolet
Year of Build : 1985
Operator : Aeroferinco
Registration : XA-SYJ
Accident Location : (near) Playa del Carmen, Mexico
Service : Ferry
Phase of Flight : CRS
Classification : Total Loss
Loss % : 100

Crew on Board : 2

Crew Dead : 0

Pax on Board : 2

Pax Dead : 0

During a short positioning flight from Cozumel to Playa del Carmen, the aircraft reportedly suffered a complete loss of engine power. The crew subsequently carried out a ditching in the sea off Playa del Carmen. All four occupants were rescued without injury but the aircraft was lost. The accident happened in daylight (1545L) and in VMC.

8. Date of Loss : 12/14/2001

Aircraft Manufacturer : Let

Aircraft Type : L-410 Turbolet

Year of Build : 1973

Operator : Eagle Air

Registration : 5X-CNF

Accident Location : Geti, Congo

Service : DNP

Phase of Flight : CRS

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 4

Pax Dead : 4

The aircraft was operating a flight from Bunia to Beni but failed to arrive. It was later found to have crashed in an area of high ground near the town of Geti about 25 miles SSE of Bunia. The accident happened in daylight but, reportedly, in poor weather.

9. Date of Loss : 12/16/2001

Aircraft Manufacturer : Let

Aircraft Type : L-410 Turbolet

Year of Build : 1986

Operator : Heliandes

Registration : HK-4175X

Accident Location : Cerro El Silencio, (near) Medellin, Colombia

Service : DNP

Phase of Flight : CLB

Classification : Total Loss

Loss % : 100

Crew on Board : 2

Crew Dead : 2

Pax on Board : 14

Pax Dead : 14

The aircraft was destroyed when it apparently flew into the side of a hill shortly after take-off from Enrique Olaya Herrera Airport, Medellin. The point of impact was at the 7,800ft level some eleven miles South of the airport. The accident happened in daylight (1021L) but in poor weather with reduced visibility in heavy rain and 'strong turbulence.' There was said to be an overcast cloud base at 8,000ft. The aircraft was operating a flight to Quibdo.

EASTERN-BUILT TURBOPROPS OPERATIONAL SUBSTANTIAL DAMAGE

1. Date of Loss : 6/15/2001

Aircraft Manufacturer : Ilyushin

Aircraft Type : Il-18

Year of Build : 1967

Operator : Air Cess

Registration : 3C-KKL

Accident Location : King Abdulaziz International Airport, Jeddah, Saudi Arabia

Service : INP

Phase of Flight : TOF

Classification : Substantial Damage

Loss % : 0

Crew on Board : 5

Crew Dead : 0

Pax on Board : 110

Pax Dead : 0

During the take-off roll, one of the aircraft's tyres burst. The take-off was aborted but, it is understood that, a fire broke out on the undercarriage and caused some damage before it could be put out. The aircraft was operating a flight to Mogadishu.

2. Date of Loss : 6/22/2001

Aircraft Manufacturer : Antonov

Aircraft Type : An-32

Year of Build : 1986

Operator : Valan

Registration : ER-AET

Accident Location : Lodja Airport, Lodja, Congo (Democratic Republic)

Service : INC

Phase of Flight : TOF

Classification : Substantial Damage

Loss % : 12

Crew on Board : 4

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

During the take-off roll at Lodja, as the aircraft accelerated through about 160kmph, the pilot saw two children running towards the runway. He immediately elected to abort the take-off. The aircraft was not brought to a halt before the end of the runway and it overran onto soft ground where its nose wheel dug in and collapsed. The aircraft came to rest about 30m. beyond the end of the runway. The accident happened in daylight and in good weather – CAVOK. The runway at Lodja is 1,800m. long. The aircraft was operating a flight to Kigali, Rwanda.

3. Date of Loss : 7/10/2001

Aircraft Manufacturer : Antonov

Aircraft Type : An-12

Year of Build : 1962

Operator : Air Sofia

Registration : LZ-SFK

Accident Location : Exeter Airport, Exeter, United Kingdom

Service : INC

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 0

Crew on Board : 8

Crew Dead : 0

Pax on Board : 1

Pax Dead : 0

Following an ILS approach to Runway 26 at Exeter, the aircraft touched down hard and bounced. During the second touchdown, the right main undercarriage collapsed. The aircraft veered to the right and ran off the side of the runway. The accident happened in daylight (1326L) but in poor weather. Wind, 250deg. variable between 220 and 280deg./ 11kt., visibility 5km in rain showers and cloud, few at 800ft., scattered at 1,600ft and broken at 2,500ft. The aircraft was operating a flight from Casablanca.

The approach was flown by the co-pilot, who was under training, with the actual landing to be performed by the captain. The approach was stabilised at a speed of 270kmph and at about 800ft. the crew saw the approach lights, however, due to the heavy rain and despite the action of the wipers, forward visibility was poor and the approach was therefore continued on instruments down to the decision height (200ft.). Meanwhile, in order to stay on the glide slope power had been reduced below the 45% torque normally required. At the decision height, the approach was continued visually with a touchdown aiming point close to the runway threshold. At about 50ft. agl the captain took over control to complete the landing as planned, however, at that point, the aircraft's nose pitched up unexpectedly. The captain discovered that the aircraft had a marked nose up trim, which required a large force to overcome in order to adjust to the correct landing attitude. He then closed the throttles and the aircraft settled onto the runway.

The captain assessed the cause of the accident as an abrupt change in wind direction and speed after crossing the threshold. Additionally a breakdown in the co-ordination between the commander and co-pilot had occurred allowing the aircraft to become trimmed nose up so markedly. He also considered that the 3.5deg glide path combined with his aiming for a point before the ILS touchdown zone might also have added to the aircraft's high rate of descent.

4. Date of Loss : 10/16/2001

Aircraft Manufacturer : Antonov

Aircraft Type : An-12

Year of Build : 1962

Operator : Air Bridge

Registration : ER-ADT

Accident Location : Henderson International Airport, Honiara, Solomon Islands

Service : Ferry

Phase of Flight : LDG

Classification : Substantial Damage

Loss % : 0

Crew on Board : 6

Crew Dead : 0

Pax on Board : 0

Pax Dead : 0

Apparently, during the final stage of a non-precision approach to Runway 24 at Honiara, the aircraft undershot and briefly struck the surface of the sea, tearing off the right main undercarriage. Control was maintained and the aircraft touched down safely on the runway. However, during the landing roll, as speed decreased, the aircraft began to settle on its right side and its No.4 propeller struck the runway. The aircraft veered off the right side of the runway, across a ditch and came to rest after a ground slide of some 300m. The accident happened in daylight (1830L) but in poor weather with heavy rain showers and turbulence. The aircraft, which was operating on behalf of Pacific Air Express, was positioning back to Honiara after having taken cargo to Nauru.

APPENDIX F — TABLES

WESTERN-BUILT JETS

Figure F.1

Type	Sectors 1958-81	1982-91	1992-2001	Total	Losses 1958-81	1982-91	1992-2001	Total	Fleet end 2001
GROUP 1									
Comet	823,900	0	0	823,900	11	0	0	11	0
B707/720	15,351,400	1,681,100	474,700	17,507,200	66	29	27	122	87
DC8	9,017,700	1,922,600	1,392,400	12,332,700	39	11	15	65	217
SE210	5,670,900	545,900	44,400	6,261,200	35	9	3	47	9
880/990	1,577,300	12,700	0	1,590,000	12	0	0	12	0
B727	34,348,300	26,958,600	13,861,100	75,168,000	34	22	23	79	1062
Trident	1,374,300	321,600	7,000	1,702,900	4	5	0	9	0
VC 10	526,800	0	0	526,800	3	0	0	3	0
Tot Grp 1	**68,690,600**	**31,442,500**	**15,779,600**	**115,912,700**	**204**	**76**	**68**	**348**	**1,375**
GROUP 2									
BAC111	5,319,900	2,363,600	838,100	8,521,600	12	5	6	23	86
DC9	28,193,500	18,692,500	12,552,500	59,438,500	35	20	24	79	612
B737 (JT8D)	14,133,900	22,359,500	17,114,500	53,607,900	10	33	28	71	767
F28	1,972,300	3,792,600	2,949,200	8,714,100	14	10	10	34	165
B747	2,888,500	4,990,800	3,977,300	11,856,600	6	8	10	24	475
Tot Grp 2	**52,508,100**	**52,199,000**	**37,431,600**	**142,138,700**	**77**	**76**	**78**	**231**	**2,105**
GROUP 3									
DC10	2,352,800	3,502,700	2,341,000	8,196,500	8	6	7	21	303
L1011	1,569,400	2,422,400	1,309,700	5,301,500	2	1	1	4	119
A300	622,100	3,146,000	2,056,600	5,824,700	0	3	6	9	160
Mercure	144,600	234,900	42,500	422,000	0	0	0	0	0
VFW614	52,300	0	800	53,100	0	0	0	0	2
Concorde	23,900	33,800	26,100	83,800	0	0	1	1	12
MD80	83,500	7,907,000	19,501,400	27,491,900	1	3	8	12	1127
Tot Grp 3	**4,848,600**	**17,246,800**	**25,278,100**	**47,373,500**	**11**	**13**	**23**	**47**	**1,723**

Type	Sectors 1958-81	1982-91	1992-2001	Total	Losses 1958-81	1982-91	1992-2001	Total	Fleet end 2001
GROUP 4									
B757	0	2,121,000	9,472,800	11,593,800	0	1	4	5	955
A300-600	0	443,300	2,482,100	2,925,400	0	0	4	4	257
A310	0	1,135,800	2,187,400	3,323,200	0	0	6	6	218
Bae 146/RJ	0	1,472,400	4,886,800	6,359,200	0	1	5	6	365
B717	0	0	211,000	211,000	0	0	0	0	91
B737CFMI	0	6,451,800	33,154,300	39,606,100	0	4	12	16	1931
B737NG	0	0	2,748,500	2,748,500	0	0	0	0	948
B744	0	168,000	2,742,200	2,910,200	0	0	3	3	557
B767	0	2,348,600	7,038,500	9,387,100	0	1	2	3	824
Do 328J	0	0	169,600	169,600	0	0	0	0	79
F100	0	273,800	5,113,700	5,387,500	0	0	4	4	270
A320	0	490,600	9,436,100	9,926,700	0	2	6	8	996
MD11	0	14600	1,073,400	1,088,000	0	0	5	5	188
CRJ	0	0	3,952,700	3,952,700	0	0	1	1	592
A340	0	0	637,400	637,400	0	0	0	0	203
A330	0	0	719,800	719,800	0	0	0	0	206
A321	0	0	1,342,200	1,342,200	0	0	0	0	232
A319	0	0	1,525,500	1,525,500	0	0	0	0	421
B777	0	0	1,075,800	1,075,800	0	0	0	0	378
FK70	0	0	476,500	476,500	0	0	0	0	43
MD90	0	0	833,900	833,900	0	0	1	1	109
EMB135	0	0	244,800	244,800	0	0	0	0	100
EMB140	0	0	7,600	7,600	0	0	0	0	19
EMB145	0	0	1,536,200	1,536,200	0	0	1	1	395
Total Gp 4	**0**	**14,919,900**	**93,068,800**	**107,988,700**	**0**	**9**	**54**	**63**	**10377**
Grand total	**126,047,300**	**115,808,200**	**171,558,100**	**413,413,600**	**292**	**174**	**223**	**689**	**15,580**

Figure F.2

Year	Hours, million	Sectors, million	Fleet size (k)	Passenger Fatalities
58	0.008	0.003	0.012	**0**
59	0.204	0.083	0.143	**1**
60	0.817	0.343	0.392	**113**
61	1.465	0.664	0.588	**256**
62	1.998	0.964	0.741	**508**
63	2.318	1.166	0.831	**348**
64	2.770	1.370	1.025	**137**
65	3.436	1.803	1.303	**249**
66	4.460	2.478	1.682	**452**
67	5.784	3.387	2.182	**296**
68	7.495	4.739	2.858	**353**
69	9.066	6.132	3.388	**529**
70	9.797	6.848	3.678	**512**
71	10.192	7.146	3.891	**332**
72	10.709	7.468	4.092	**937**
73	11.118	7.810	4.315	**795**
74	11.058	8.040	4.540	**1091**
75	11.307	8.343	4.771	**418**
76	11.829	8.661	4.925	**476**
77	12.395	8.987	5.045	**848**
78	13.124	9.407	5.222	**663**
79	13.795	9.867	5.548	**881**
80	13.902	10.149	5.852	**666**
81	13.636	10.190	6.107	**356**
82	13.729	9.496	6.200	**551**
83	14.084	9.657	6.356	**755**
84	15.280	10.410	6.469	**2**
85	16.185	10.991	6.750	**1169**
86	17.418	11.531	7.106	**313**
87	18.639	12.106	7.469	**449**
88	19.735	12.562	7.922	**378**
89	20.350	12.656	8.311	**753**
90	21.961	13.321	8.909	**254**
91	21.988	13.081	9.334	**627**
92	23.767	13.718	9.945	**735**
93	24.989	14.269	10.450	**424**
94	26.593	15.098	10.953	**665**
95	28.412	15.852	11.367	**383**
96	30.154	16.635	11.776	**1189**
97	31.797	17.373	12.296	**637**
98	33.170	17.991	12.970	**768**
99	35.282	18.957	13.764	**299**
2000	37.492	19.936	14.676	**729**
2001	37.000	20.000	15.580	**380**

Note: *2001 flight hour and flights figures have been reduced to reflect impact post Sept 11. This reduction has not been applied to the figures for individual aircraft types so totals struck by adding up the by type figures will be higher than appears here.*

Figure F.3

ACCIDENT COSTS ($M) ADJUSTED TO 2001 VALUES					
Year	**Hull Losses**	**Major Accidents**	**Passenger Liabilities**	**Minor Liabilities**	**Acts of Violence**
1991	209	131	176	172	
1992	334	127	310	176	1
1993	433	295	133	175	2
1994	479	187	847	184	7
1995	213	205	347	207	0
1996	354	132	1196	224	52
1997	396	208	305	232	4
1998	563	327	778	225	6
1999	679	330	589	225	0
2000	654	230	699	225	2
2001	270	166	432	225	4531
Total:	**4584**	**2338**	**5812**	**2270**	**4605**

Western built Jet Airliners (All losses include acts of violence, non-operational losses and some losses suffered by non-airline operators). Passenger liability figures may include contribution from “products”.

WESTERN-BUILT TURBOPROPS

Figure F.4

GROUP A										
Type	1950-81 AC Years	1982-91 AC Years	1992-01 AC Years	End 2001 Fleet size	1950-01 A/C Years	1950-81 Losses	1982-91 Losses	1992-01 Losses	2001 Losses	All Losses
Aero Spacelines Guppy	18.5	28.4	0	0	46.9	0	0	0	0	0
BAe (AW) Argosy	210.0	53.4	0	0	263.4	2	1	0	0	3
BAe (Bristol) Britania	876.9	63.9	5.8	0	946.6	10	0	0	0	10
BAe (Vickers) Vanguard	634.0	93.5	11.3	0	738.8	3	2	0	0	5
BAe (Vickers) Viscount	6381.6	616.1	130.9	5	7128.6	93	8	6	1	107
Canadair CL-44	505.2	133.4	56.9	5	695.5	13	2	0	0	15
DHC Dash 8 400	0	0	44.6	54	44.6	0	0	0	0	0
Lockheed Hercules	534.0	646.2	684.2	55	1864.4	10	7	3	0	20
Lockheed L-188 Electra	2930.1	861.2	559.2	44	4350.5	25	10	3	0	38
Shorts Belfast	15.8	50.0	24.8	2	90.6	0	0	0	0	0
Transall C 160	40.2	78.6	55.3	6	174.1	0	0	1	1	1
Totals	**12146.3**	**2624.7**	**1573**	**171**	**16344**	**156**	**30**	**13**	**2**	**199**

GROUP B										
Type	1950-81 AC Years	1982-91 AC Years	1992-01 AC Years	End 2001 Fleet size	1950-01 A/C Years	1950-81 Losses	1982-91 Losses	1992-01 Losses	2001 Losses	All Losses
ATR 72	0	43.0	1678.7	263	1721.7	0	0	3	0	3
BAe (HS) 748	1865.6	1502.3	1179.4	110	4547.3	29	18	12	0	59
BAe ATP	0	72.5	517.6	55	590.1	0	0	2	0	2
DHC 5 Buffalo						0	1	0	0	1
DHC Dash 7	78.6	901.2	719.3	62	1699.1	0	2	1	0	3
DHC Dash 8 300	0	74.5	1166.6	174	1241.1	0	0	1	0	1
Fairchild F-27	1313.7	452.5	312.8	21	2079.0	21	5	0	0	26
Fairchild FH-227	860.4	517.2	308.0	23	1685.6	9	5	5	0	19
Fokker 50	0	266.6	1707.4	172	1974.0	0	0	1	0	1
Fokker F-27	4571.6	3239.6	2571.5	217	10382.7	46	26	21	0	93
GD Convair 540/580/600/640	2528.6	1427.7	1142.8	103	5099.1	14	8	4	1	26
HP Dart Herald	613.1	206.3	77.0	1	896.4	7	3	0	0	10
NAMC YS-11	1719.4	1115.6	691.0	47	3526.0	12	3	3	0	18
Saab 2000	0	0	292.5	54	292.5	0	0	0	0	0
Totals	**13551.0**	**9819.0**	**12364.6**	**1302**	**35734.6**	**138**	**71**	**53**	**1**	**262**

GROUP C										
Type	1950-81 AC Years	1982-91 AC Years	1992-01 AC Years	End 2001 Fleet size	1950-01 A/C Years	1950-81 Losses	1982-91 Losses	1992-01 Losses	2001 Losses	All Losses
Aerospatiale (Nord) 262/298	550.5	254.0	135.4	12	939.9	7	0	1	0	8
ATR42	0	645.3	2786.9	318	3432.2	0	1	7	1	8
CASA/IPTN CN235	0	48.7	240.4	23	289.1	0	0	2	1	2
DHC Dash 8 100/200	0	685.4	2953.3	356	3638.7	0	2	2	1	4
Dornier 328	0	0	504.5	94	504.5	0	0	1	0	1
EMB120 Brasilia	0	634.9	2828.4	303	3463.3	0	4	5	0	9
Gulfstream 1	130.1	372.8	472.5	32	975.4	0	4	6	0	10
Jetstream 41	0	0	624.4	93	624.4	0	0	2	0	2
Saab 340	0	828.2	3736.6	421	4564.8	0	1	6	1	7
Shorts 330	161.0	775.7	444.9	32	1381.6	1	2	4	0	7
Shorts 360	0	896.3	1195.5	108	2091.8	0	4	4	2	8
Totals	**841.6**	**5141.3**	**15922.8**	**1792**	**21905.7**	**8**	**18**	**40**	**6**	**66**
GROUP D										
Type	1950-81 AC Years	1982-91 AC Years	1992-01 AC Years	End 2001 Fleet size	1950-01 A/C Years	1950-81 Losses	1982-91 Losses	1992-01 Losses	2001 Losses	All Losses
ASTA (GAF) Nomad	122.6	322.4	193.6	13	638.6	3	4	7	1	14
Beech 1300	0	25.3	84.3	10	109.6	0	0	0	0	0
Beech 99	1629.9	1631.4	1353.8	131	4615.1	16	10	7	0	33
Beech Commuter 1900	0	681.2	3743.4	472	4424.6	0	2	11	1	13
CASA 212	101.2	1017.6	861.0	72	1979.8	0	10	7	0	17
DHC-6 Twin Otter	4285.4	4989.1	4346.5	387	13621.0	49	52	46	1	147
Dornier 228	0	623.7	1210.1	117	1833.8	0	4	11	0	15
Embraer EMB 110 Bandeirante	520.3	2303.9	2134.3	189	4958.5	8	23	18	1	49
Fairchild Metro/Expediter	539.5	3251.2	4143.0	405	7933.7	4	23	26	2	53
IAI Arava	30.9	93.5	62.7	6	187.1	0	0	0	0	0
HP Jetstream	150.9	94.3	33.8	2	279.0	2	0	0	0	2
Jetstream 31	0	1212.3	2667.7	211	3880.0	0	5	7	1	12
Saunders ST27	72.0	54.0	0	0	126.0	0	0	0	0	0
Shorts Skyvan	428.3	342.8	345.6	32	1116.7	8	4	8	0	20
Totals	**7881.0**	**16642.7**	**21179.8**	**2047**	**45703.5**	**90**	**137**	**148**	**7**	**375**
TOTAL	**34419.9**	**34227.7**	**51040.2**	**5312**	**119687.8**	**392**	**256**	**254**	**16**	**902**

TURBOPROP HULL LOSSES

Figure F.5

Year	Op. HL	Test/Training/ Other	Violence (Op.)	Ground	Violence (Other/Ground)	Non Airline	Total
52						1	1
53							
54		1				1	2
55							
56	1	2			1		4
57	3					2	5
58	6	2	1			2	11
59	8	2					10
60	10	1					11
61	8						8
62	8	2				1	11
63	6	1				1	8
64	10		1				11
65	13	3					16
66	9						9
67	15	4			2	3	24
68	18	1		1	1	4	25
69	21	4				3	28
70	29	4	1	1		3	38
71	16	6	2	2	1		27
72	30	3		1			34
73	18	6				1	25
74	14	3		5	1	2	25
75	21	1		2		4	28
76	21		1		1	3	26
77	25	2		3		2	32
78	18	7	1	1	1	1	29
79	28	5	1	1		3	38
80	16	2		2		3	23
81	20	2	1	1		4	28
82	22	3		4		1	30
83	21	1		3		1	26
84	20	5		2	1	1	29
85	23	1		1	1	2	28
86	19	1	2	1	1	1	25
87	29	4	2	1		3	39
88	35	4		1		6	46
89	34	2	2	2	1	5	46

Year	Op. HL	Test/Training/ Other	Violence (Op.)	Ground	Violence (Other/Ground)	Non Airline	Total
90	28	2	2		1	7	40
91	25	2	5	3		3	38
92	21	5		2		4	32
93	28	3		1		4	36
94	24	1	1		1	2	29
95	27	5			2		34
96	25	6		1		1	33
97	36	1		2		1	40
98	27	1	1	2	2	4	37
99	30	1	1	2	3	3	40
2000	20			2	2	5	29
2001	16	1		1		5	23
TOTAL	**902**	**113**	**25**	**51**	**23**	**103**	**1217**